9-27-2018

Young Children's Use of Mobile Technology: Impacts on Self-Regulation and Aggression

Amy Wei-Yan Tran
University of Windsor

Young Children's Use of Mobile Technology: Impacts on Self-Regulation and Aggression

By

Amy W. Y. Tran

A Thesis
Submitted to the Faculty of Graduate Studies
through the Department of Psychology
in Partial Fulfillment of the Requirements
for the Degree of Master of Arts at the
University of Windsor

Windsor, Ontario, Canada

2018

Young Children's Use of Mobile Technology: Impacts on Self-Regulation and Aggression

By

Amy W. Y. Tran

APPROVED BY:

_____

D. Kane
Faculty of Nursing

_____

K. Babb
Department of Psychology

_____

R. Menna, Advisor
Department of Psychology

September 18, 2018

AUTHOR'S DECLARATION OF ORIGINALITY

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication.

I certify that, to the best of my knowledge, my thesis does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that I have included copyrighted material that surpasses the bounds of fair dealing within the meaning of the Canada Copyright Act, I certify that I have obtained a written permission from the copyright owner to include such material in my thesis.

I declare that this is a true copy of my thesis, including any final revisions, as approved by my thesis committee and the Graduate Studies office, and that this thesis has not been submitted for a higher degree to any other University or Institution.

ABSTRACT

The present study tested the displacement hypothesis, which proposed that mobile technology use disrupts important daily activities and social interactions that are important for the development of young children's self-regulation skills (Gentile et al., 2012). As a result of this displacement, children are more likely to become dysregulated and aggressive. Participants were 174 caregivers (n = 157 mothers) who reported on their children aged 2 to 5 years old (n = 100 male). All participants completed self-report questionnaires assessing their own technology use, interference in the parent-child relationship due to mobile technology, and the use of mobile technology as a parenting tool. Caregivers also reported on their children's use of mobile technology, participation in the environment, self-regulation, aggressive behaviour, and temperament. A subset of 15 caregivers (n = 14 mothers) also answered open-ended interview questions about their attitudes, perceptions, and experiences regarding mobile technology use in the family. The analyses revealed that mobile technology use by both caregivers and children negatively impacted young children's self-regulation and aggressive behaviour. Greater use of mobile technology was found to displace daily activities and social interactions, leading to greater dysregulation and aggression. Results also demonstrated that greater use of mobile technology as parenting tools mediated the relation between greater mobile technology use and children's aggressive behaviour. A thematic analysis of caregivers' interviews revealed that caregivers have many strategies to monitor their children's media activity, concerns about the negative impacts of mobile technology, and tensions about using these devices in the family. The novelty of these findings address gaps in the literature by identifying various ways in which mobile technology can interfere with young children's daily lives in a way that is detrimental for the development of their self-regulation and aggressive behaviour.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to my research advisor, Dr. Rosanne Menna, for her support and guidance throughout this research project. I truly enjoyed our conversations about how mobile technology continues to shape the world around us. Thank you for these conversations, which reinforced my excitement and confidence in pursuing this project.

My appreciation also goes to my committee members, Dr. Babb and Dr. Kane, whose suggestions helped refine this project. A special thank you goes to Chelsea Reaume, whose time listening and transcribing caregiver interviews helped captured the illustrative quotes used in the present study.

Thank you to all the caregivers who participated in the study, caregivers who commented on their appreciation for this project, and friends and family who shared countless personal stories about young children using mobile technology. It was during these times when the hours dedicated to this project were seen as a grateful opportunity to contribute to a growing area of research.

Finally, thank you to my family. Thank you for your patience, understanding, unconditional love, and for reminding me to reduce my computer screen time to spend time with those I love.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

Introduction

In 1994, International Business Machines (IBM) introduced the very first smartphone with the release of the IBM Simon (Aamoth, 2014). It was not until 2007, however, when Apple unveiled their version of the smartphone, that these technologies became a ubiquitous part of everyday modern life. Shortly after, Apple released their version of the tablet, which accelerated the pace at which people adopted these mobile technologies. By 2011, 38% of children, age 8 and younger, have used a smartphone or tablet in their lifetime (Rideout, 2013). Two years later, in 2013, mobile technology use by young children increased to 72% (Rideout, 2013).

In 2016, the American Academy of Pediatrics' Council on Communications and Media revised their guidelines of recommendations for young children's digital media use. The recommendations are: (1) children under 18 months old are encouraged to avoid the use of screen-media, unless they are using technology to video chat; (2) caregivers of children 18-to-24 months of age, who want to introduce digital media to their children, are encouraged to choose high-quality programming and media (e.g., PBS; (3) children between 2 to 5 years old should be limited to only one hour of screen time per day (of high-quality programming and media); and (4) across all ages, caregivers should help children understand what they are viewing and how to apply what they learn with digital media to the real world (American Academy of Pediatrics, 2016). Despite these recommendations, Kabali and colleagues (2015) reported that in a sample of 350 American children under the age of 4, almost all of them have used mobile technology, with the majority of children starting before the age of 1. Furthermore, three-fourths of these children owned their own mobile device. While caregivers are encouraged to choose educational programs, the majority of high-quality programs offered on mobile technologies are not

supported by empirical evidence (Hirsh-Pasek, Zosh, Golinkoff, Gray, Robb, Kaufman, & 2015). Thus, the burden to evaluate the quality of more than 80,000 "educational" apps ends up falling on caregivers.

Evidently, smartphones and tablets are an ever-present part of daily Western life. These devices likely have an impact on parenting practices, family dynamics, and healthy child development, but research is lagging behind the rapid adoption of these technologies by young children (Kabali et al., 2015; Radesky, Schumacher, & Zuckerman, 2015). The portable nature of these devices reinforce their pervasive use, and preliminary evidence has suggested that mobile technology disrupts important social interactions and children's participation in activities (e.g., creative play, neighborhood outings, mealtime; Radesky, Miller, et al., 2015; Radesky, Silverstein, et al., 2014). Activities, such as unstructured play, are considered major sources of learning, as well as opportunities for children to interact with caregivers who play a large role in promoting more mature levels of self-regulation (Blair & Diamond, 2008; Elias & Berk, 2002). Displacement of these activities may therefore result in lost opportunities for children to develop self-regulation and potentially lead to poor self-regulation and aggressive behaviour.

With the potential for such an alarming consequence, research is urgently needed to inform caregivers and pediatric guidelines. Yet, with the relatively recent introduction of mobile technology, there is a paucity of research to support these speculations. This study aims to examine how mobile technology affects children's participation in daily activities, as well as their self-regulation, and aggression.

CHAPTER II

Review of Literature

Self-Regulation

The development of self-regulation is a dynamic process that encompasses the ability to comply with directions (*compliance*), control internal impulses (*inhibition*), regulate emotions and behaviour (*social-emotional regulation*), and engage in self-directed learning (*effortful control*; Kopp, 1982). When children are between the ages of 0 to 5 years, they undergo a critical period of development. This is a period during which the brain undergoes maturation (Chugani, 1998), secure relationships are established (Ainsworth, 1989), and language is rapidly acquired (Johnson & Newport, 1989). In addition to these processes, the development of self-regulation is also a hallmark of this childhood period (Bronson, 2000; Flavell, 1977) when the development of foundational regulatory skills emerge during the first five years of life (Blair 2002).

Various theories of self-regulation may differ by emphasizing the importance of language (e.g., Luria, 1959), reward and punishment (e.g., Skinner, 1974, 1938), the child's observations (Bandura, 1977), or the social environment (e.g., Piaget, 1952; Vygotsky, 1978, 1962); however, one unanimous aspect across all of these theories is that self-regulation emerges out of social interactions with caregivers during the early years of life (Grolnick & Farkas, 2002). Keeping with this theme, current literature continues to support the claim that self-regulation, between the years of 2 and 5, is best developed within the context of hands-on exploration and caregiver-child interactions (American Academy of Pediatrics, 2016; Grolnick & Farkas, 2002).

Vygotsky. Cognitive-developmental theorist, Lev Vygotsky (1978, 1962), highlighted the role of social interaction during child development. Vygotsky postulated that the development of self-regulation can be better understood if it is traced back to caregiver-child

social interactions (Vygotsky, 1978). Adults provide the assistance of "other-regulation," by making directive statements that help guide a child through a task, while allowing them to adjust their behaviour to match what is being said by the caregiver.

Through the progression of four main levels, as children's self-regulative capacities increase, regulative assistance formerly provided by caregivers are no longer needed, and children can now carry out tasks in the absence of their caregivers (Vygotsky, 1978). During the first level, without the capacity for language, the child does not understand that the caregiver's speech is related to the child's activity. In level two, the child begins to realize that the caregiver's utterances are connected to their task and learn to comply with the directive statements. Emergence of self-directed control occurs in level three, when the child can carry out some basic functioning without an adult specifying the steps to follow. Here, the caregiver provides reassurance that the child's behaviour is appropriate and re-directs him or her when not appropriate. The absence of sensitive caregiver practices may inhibit the acquisition of more sophisticated phases of self-regulation and lead to developmentally inappropriate behaviour later in life (Kopp, 1982; Stats, Juffers, & van IJzendoorn, 2002). Finally, the child experiences a shift from other-regulation to self-regulation in level four. Children can now carry out tasks completely by themselves and the development of self-regulation is considered to be internalized (Bronson, 2000; Vygotsky, 1978).

Kopp. Kopp (1982) offers a more contemporary view of self-regulation. Influenced by the work of Vygotsky (1978; 1962), Kopp's developmental model of self-regulation shares many similarities by taking a developmental perspective, while highlighting the role of caregiving practices. When children are capable of following their caregiver's expectations without external monitors, self-regulation is considered to have emerged (Kopp, 1982). Prior to reaching this

milestone, children undergo a series of qualitative changes in their behaviour that signal successive adaptations of cognitive, emotional, and physiological requisites necessary for more advanced features of self-regulation (Kopp, 1982). This process is largely influenced by an interactional process through which children are socialized by others, particularly their caregivers, and a shift from external sources of control to self-directed control is observed (Kopp, 1982).

During the first three months of life, termed the *Neurophysiological Modulation* phase, children display organized patterns of adaptive responses, such as thumb-sucking, that help regulate their arousal states (Kopp 1982). According to Kopp (1982), caregivers aid in their children's control by establishing social interactions and routines, such as defining the environmental features of day and night to reinforce children's sleep and wake cycles. This leads to the period of *Sensorimotor Modulation*, which is characterized by the voluntary engagement with objects and signaling for caregiver attention during the first year of life (3 to 9+ months). During this phase, infants are largely dependent on stimulation from objects and caregivers' responsivity and sensitivity to help facilitate sensorimotor acts (e.g., reaching and grasping for an object). Once children can differentiate the actions of others from themselves, the *Control* phase, which spans across the 12- to 18-month period, emerges. During this period, more advanced cognitive abilities of this age permit greater exploration of the environment and use of language that is monitored by caregivers. Caregivers direct behaviour, highlight the consequences of children's actions, and help draw attention to socially appropriate acts. The social exchanges between child and caregiver help facilitate self-monitoring and control, and eventually children begin to demonstrate awareness of social task demands by showing compliance. Kopp (1982) considers compliance to be the first resemblance to self-regulation. Compliance has also been

recognized as a landmark in the development of self-regulation by other theorists, who have related it to the quality of infant-caregiver relationships (e.g., Luria 1959; Stayton, Hogan, & Ainsworth, 1971).

Despite impressive regulatory developments made within the first two years of life, children in the *Control* phase continue to lack internally-generated mechanisms of control and still rely on their caregivers. Thus, the more social interactions children are afforded to learn about the effects of their own behaviour, the more sophisticated their ability will be to regulate their own acts in accordance with social norms (Kopp, 1982). This shift from external controls of behaviour to internal control is typically seen during the third year of life and constitute the final phase of *Self-Regulation*. Essentially, during this phase, children have internalized socially sanctioned rules of behaviour and act in compliance with these norms in the absence of their caregivers (Kopp, 1982).

Throughout the review of the self-regulation literature, studies may make reference to executive functioning, impulse control, self-control, and attention. These discrepancies speak to the differences in operational definition. Effective self-regulation relies on a collection of higher order cognitive processes that constitute a board spectrum of attentional, emotional, and behavioural responses, collectively called executive functions (Skogan et al., 2016). Examples of these functions include, attention, planning, and impulse control (Barkley, 1997; Seguin & Zelazo, 2005; Skogan et al., 2016). Therefore, the terms executive functions, impulse control, self-control, and attention will be referenced in the literature to guide the review of the present study's focus on self-regulation, but will not be used interchangeably.

Aggression

During the preschool years, children learn to inhibit aggressive impulses (Tremblay et al., 2004). Whereas proactive aggression constitutes one's planned behaviours to achieve a goal, reactive aggression captures one's aggressive responses to a trigger (Dodge & Coie, 1987). Congruous with the frustration-aggression hypothesis (Berkowitz, 1978; Dollard, Miller, Doob, Mowrer, & Sears, 1939), reactive aggression can manifest through poor control of one's emotions and impulses. One study aimed to establish the link between reactive aggression and self-regulation by observing boys at risk for substance abuse (Giancola, Moss, Martin, Kirisci, & Tarter, 1996). Using a series of executive functioning tasks, lower executive function scores predicted reactive aggression in youth two years later. Similar associations across studies with younger children have also been observed. In one study, the executive functions of 83 boys (M = 10.00) were measured using laboratory tasks (e.g., Stroop Task, Tower of Hanoi). Deficits in self-control and planning were related to reactive aggression (Ellis, Weiss, & Lochman, 2009). These findings are also consistent with studies using self-report measures of aggression (White, Jarrett, & Ollendick, 2013) and younger preschool-aged samples (Raaijmakers et al., 2008). Thus, research suggests that the development of self-regulation is associated with children's aggressive behaviours. Specifically, children with poor self-regulation tend to display more physical aggression (Cummings, Davies, & Campbell, 2000; Achenbach, 1991), exhibit more externalizing and internalizing problems, and are at a higher risk for conduct problems (e.g., Card & Little, 2006; Hughes, White, Sharpen, & Dunn, 2000). On the other hand, successful development of self-regulation is related to a lower risk of externalizing problems (Eisenberg, Spinrad, & Eggum, 2010; Rodriguez, Ayduk, Aber, & Mischel, 2005).

Participation in Everyday Activities

Keeping with the social origins of children's emerging self-regulation, activities of everyday life can enhance child development. Children require opportunities that introduce concrete social interactions with adults and other capable peers to learn to internalize social expectations, learn about their own capabilities, and to develop self-regulation (Dunst, Bruder, Trivette, Raab, & McLean, 2001; Flores, 2011). Consequently, young children's engagement in everyday activities generate experiences for children to practice emerging skills and competencies, such as self-regulation (Dunst, Hamby, Trivette, Raab, & Bruder, 2002; Florez, 2011; Gallimore, Weisner, Kaufman, & Bernheimer, 1989).

The home, community, and early childhood programs (e.g., school, daycare) are settings that offer a rich array of teaching and learning activities (Bronfenbrenner, 1979, 1992; Dunst et al., 2002; Lave, 1988; Lave & Wenger, 1991). The term *activity setting* (Farver, 1999) describes contexts that offer situated learning opportunities, which is a type of learning that takes place during naturally-occurring real life experiences (Lave & Wenger, 1991). A confirmatory factor analysis identified 22 unique categories of activity settings that constitute sources of children's learning opportunities in the family and community life (Dunst, Hamby, Trivette, Raab, & Bruder, 2000). Family activities settings included a mix of people who afford numerous learning opportunities for children (Axelsson, Granlund, & Wilder, 2013; Dunst et al., 2000). Examples of these activities include: participating in adult activities (e.g., family chores, gardening), socializing with other adults and children, and children's interest-based abilities (e.g., play and entertainment). In the community, activity settings bring children in contact with others (e.g., running errands with a caregiver) and engage them in new settings (e.g., dance class, going to the

library) that provide situated learning opportunities (Dunst et al., 2000). In both of these settings, all the activities bring children in contact with caregivers, adults, or other children (Dunst et al., 2000) in the family, community, and early childhood programs to make up the foundation of children's learning and development.

To illustrate the impact of children's development enhancing activities, a longitudinal intervention study with 63 preschool children and their parents aimed to increase children's participation in activity settings over a period of 16 weeks (Dunst, Bruder, Trivette, Hamby et al., 2001). Toward the end of the intervention, more frequent participation in activity settings with more developmentally enhancing characteristics (e.g., sharing toys, helping with chores) was related to higher positive affect, positive cognitive styles (e.g., attention span, goal directedness, endurance), and social responsiveness in children (Dunst, Bruder, Triette, Hamby et al., 2001).

Important precursors to maturing self-regulation, such as language and compliance, can also be facilitated through participating in activity settings. Language development, specifically the use of private speech, is a clear indicator that children are beginning to internalize socially sanctioned strategies to regulate their own thoughts and behaviour (Alarcón-Rubio, Sánchez-Medina, & Prieto-Garćia, 2014). A research synthesis of children's participation found that engaging in virtually every activity (e.g., parent-child play, family mealtime, weekend outings) in the family and community settings was related to better language and literacy outcomes (Dunst, Valentine, Raab, & Hamby, 2013). Likewise, language intervention models centered around increasing children's activities led to improved child communication and language skills (Dunst et al., 2013). Children's engagement in activity settings have also been associated with more perceived control over parenting, parenting competence, parent well-being, and more

importantly, parent's judgments about their child's progress (Dunst, Bruder, Trivette, & Hamby, 2006). These outcomes ultimately contribute to more responsive caregiver-child interactions and are related to increased child compliance to caregivers (Feldman & Klein, 2003).

An intervention study aimed at increasing children's participation in activities also helped parents practice scaffolding and responsive teaching methods (Dunst, Bruder, Trivette, Hamby et al., 2001). Parents created activity schedules to increase their children's involvement in the activity settings and were taught how to respond to children's behaviour (i.e. high responsiveness and more incidental teaching) in a manner that facilitated further engagement and enjoyment by the child while in the activity. Parents who adopted these responsive strategies during children's activities saw improvements in their child's affect and positive child behavioral style scores (e.g., vocal behaviour, excitement, persistence, affective responsiveness; Dunst, Bruder, Trivette, Hamby, et al., 2001). In a similar vein, a different study found that mothers who were supportive of their toddler's own ability to regulate emotions, as opposed to taking over responsibility for regulating their children's emotions, had less distressed toddlers when the toddlers were required to regulate independently (Grolnick, Kurowski, & Gurland, 1999). Conversely, other studies have found that employing unsupportive strategies, such as using distraction, giving into children's wishes, demanding compliance, or exerting too much other-regulation can lead to lower task performance and self-regulation later in life (Spinrad, Stifter, Donelan-McCall, & Turner, 2004; Winsler, Diaz, McCarthy, Atencio, & Chabay, 1999).

Overall, a review of the research demonstrates that greater participation in everyday activities can lead to more opportunities for scaffolding, promoting parental and child well-being, increasing compliance to caregivers, and nurturing literacy skills (Dunst et al., 2013; Dunst et al., 2006; Dunst et al., 2001; Feldman & Klein, 2003). These characteristics are

considered precursors and facilitators of self-regulation. Thus, engaging in activities within the home, community, and daycare provide opportunities for children to translate their experiences into information used to regulate their thoughts, emotions, and behaviours (Blair & Diamond, 2008).

Theoretical Explanations of Digital Media and Attention

Focusing on the importance of children's activities within the home, community, and daycare settings is not complete without examining the broader physical context of the child. The physical characteristics of environments have large behavioural influences over adults, children, and ultimately child development. Stated by Bronfenbrenner, himself, beyond the people present in the child's environment, "the physical and symbolic features of the setting invite, permit, or inhibit engagement in …more complex interaction with an activity in the immediate environment (Bronfenbrenner, 1993, p.11)." In fact, the environment may have qualities that supersede the influence of socialization (Wach, 1990, 1979). Hence, one would expect that the presence of digital media in a child's environment will influence the amount of time that young children spend using digital media (screen time) in lieu of other activities, such as socializing with others.

Gentile, Swing, Lim, and Khoo (2012) proposed three possible hypotheses to describe the associations between digital media and attention problems, such as difficulties sustaining and allocating attention. As stated earlier, self-regulation is a multi-faceted construct that includes the ability to sustain attention and inhibit impulses (Barkley, 1997). Thus, the following theoretical explanations of digital media and attention problems also extend to the present study of self-regulation.

Attraction hypothesis. Temperamental or difficult children may have pre-existing attention problems that stimulate their attraction to digital media. The exciting appeal of digital

media, such as adrenaline inducing games or games rewarding players with digital forms of reinforcers, may be difficult to resist for children with poor self-control. Alternatively, frustration with children's temperamental or difficult behaviour may also result in parents turning to digital media to regulate or calm their children. For instance, children rated as being more fussy were put in front of a television (Hyde, O'Callaghan, Bor, Williams, & Najam, 2012) or handed a mobile device (Radesky, Peacock-Chambers, et al., 2016) more often than non-temperamental children. Thus, it is not clear whether digital media is causing poor self-regulation or already fussy children are seeking out, or being given these technologies.

Some research has attempted to tease apart this bidirectional relation. For example, a prospective longitudinal study of over 7,000 children found that poor self-regulation at nine months of age was related to greater television consumption at age 2 (Radesky, Silverstein et al., 2014), providing some preliminary evidence for the attraction hypothesis. Despite the unclear causality of this relation, parents' reliance on technology to occupy children may distract children from learning to regulate themselves and further contribute to poor self-regulation (Radesky, Schumacher, et al., 2015; Radesky, Silverstein et al., 2014).

Excitement hypothesis. A second possible explanation is that digital media may make other activities appear less interesting. Many television shows and video games have exciting and attention-grabbing features that attract and reinforce engagement with these technologies. For example, features such as sound effects and flickering lights trigger an orienting response (Kubey & Csikszentmihalyi, 2002). These features are in stark contrast to other activities, such as board games or school work. Over time, as children continue to engage with media, the exciting content is thought to change their desired or expected level of stimulation. As a result,

focusing on other activities will become more difficult and preference for digital media will be further reinforced.

Displacement hypothesis. A third hypothesis is that the time devoted to using digital media requires sacrificing time that could otherwise be devoted to more productive activities that facilitate the development of self-regulation. Logically, less time devoted to media lends to more time devoted to other activities. If, however, deficits in self-regulation are simply a result of displacing other activities, then the total time spent with digital media should influence poor self-regulation, irrespective of the content (e.g., violent media) being accessed. If the contrast between exciting media content versus the non-stimulating activities of daily life predict poor self-regulation (excitement hypothesis), then one would expect that differences in media content (e.g., violence) would predict greater self-regulation problems. There is evidence to support both of these claims. Although violent television is the most strongly related to children's attention problems (compared to non-violent and educational television), the difference between violent and non-violent content is not statistically significant (Zimmerman & Christakis, 2007). Similarly, the total time spent watching television, rather than the specific content itself, has been found to be related to children's externalizing problems later in life (Verlinden, Timelier, & Hudziak., 2012). Hence, these two explanations do not appear to be mutually exclusive.

Technoference. As explained by the displacement hypothesis, preoccupation with mobile technology can reduce the frequency of developmentally important activities, but even brief interferences from technology can displace or reduce parent-child interactions during daily routines that are also important for maturing self-regulation. In other words, children may still be engaging in activity settings, but the time spent using mobile technology interferes with the quality of parent-child interactions during these activities. McDaniel and Coyne (2016a) first

introduced the concept of "technoference" as the "interruptions in interpersonal interactions or time spent together that occur due to digital and mobile devices." Technoference can apply to any interpersonal relationship (e.g., co-parents, parent-child) and interruptions can range from blatantly engaging with a device during face-to-face conversations, interruptions during routines (e.g., bedtime), to checking a device mid-interaction when receiving a notification (McDaniel & Coyne, 2016a).

McDaniel and Coyne (2016a) first used the term to describe these intrusions within romantic relationships. In a study of 143 woman in heterosexual relationships (married or cohabitating), participants reported their experiences with technoference, conflict over technology use, life and relationship satisfaction, and depression. Women who reported higher accounts of technoference with their partners also reported greater conflict over technology, and thus, lower life and relationship satisfaction, as well as more depressive symptomatology (McDaniel & Coyne, 2016a). Since then, technoference has been extended to examine technologies' interference during co-parenting experiences of young children. Yielding similar results, 203 mothers of children, age 3 or younger, reported on their perceptions of technoference within co-parenting interactions, technoference across parenting domains, and co-parenting quality. Caregivers who reported more technoference (use by the mother, partner, or child) also perceived their co-parenting quality to be lower, and reported lower relationship satisfaction, as well as more depressive symptoms (McDaniel & Coyne, 2016b). Drawing from these results, technoference likely increases discoordination in relationships, leading to frustration and alterations in the quality of parenting (McDaniel & Coyne, 2016b).

More recently, McDaniel and Radesky (2017) examined technoference within parent-child relationships and found preliminary support for the displacement hypothesis in explaining

children's behavioural outcomes. By exploring the self-reported perceptions of technoference of 183 mother-father dyads with children under the age of 5, the authors found that greater problematic technology use by parents was related to more technoference in the mother-child relationship, and in turn, predicted greater externalizing and internalizing behaviours in children (McDaniel & Radesky, 2017). Interestingly, although greater technoference was related to poor perceptions of co-parenting, depressive symptoms, and parenting stress, as reported by fathers, greater technoference was not related to children's developmental outcomes in the father-child relationship (McDaniel & Radesky, 2017). Evidently, interruptions due to technology during daily life not only displace important activities, but also displace fundamental interactions in mother-child relationships that can set the stage for lower parenting quality, and thus increased risk for self-regulation and aggressive problems.

Displacement

Given the importance of children's activities and interpersonal interactions in maturing self-regulation, the present study aimed to find support for the displacement hypothesis. An important distinction worth highlighting is the difference between displacement and technoference. Despite its conceptual similarities, technoference is an extension, but different than displacement. Whereas displacement is generally concerned with how preoccupations with technology displace other activities, technoference focuses more specifically on how technology displaces the quality of interpersonal interactions during these activities (McDaniel & Coyne, 2016b). Considering that the majority of children's daily routines and well-being are dependent on the responsiveness and interactions of their caregivers, examining how mobile technology interferes with the quality of parent-child interactions is vitally important. Thus, aside from children's disengagement with activities due to their technology use, how technology influences

the harmony of parent-child interactions was also an important consideration for emerging self-regulation in this study.

Although studies have theorized about the displacement hypothesis (e.g., Gentile et al., 2011; Inoue, Yorifuji, Kato, Sanada, Doi, & Kawachi, 2016; Kostyrka-Allchorne, Cooper, & Simpson, 2017) to the author's knowledge, no known studies have formally tested it in relation to children's self-regulation and aggression. The following section will review studies examining the displacing effect of digital media on children's activities.

Television and video games. Concern over the displacing effect of television and video games has been raised for decades. Early studies testing the displacing effect of digital media between 10 communities with and without television found that television watching by children leads to less playtime (Maccoby, 1951; Schramma, Lyle, & Parker, 1961). Similarly, a decrease in children's imaginative play after the introduction of television to Canada was also found (Harrison & Williams, 1986). More recently, a study of over 1,000 children, age 12 and younger revealed that time spent watching television, irrespective of co-watching with parents or siblings, was related to less time socializing with family members (Vanderwater, Bickham, & Lee, 2006). Furthermore, time spent with homework and creative play, especially in children younger than 5, was reduced (Vanderwater et al., 2006). Scaffolding opportunities in the form of teaching children shapes, letters, and days of the week also decreased in the presence of television and video games (Tomopoulos et al., 2007b).

To examine displacement longitudinally, the introduction of television to South Africa in 1976 provided a unique opportunity to test the hypothesis across the span of eight years with approximately 1,900 children in 5th to 12th grade (Mutz, Roberts, & van Vuuren, 1993). Each year, children reported the amount of time spent participating in hobbies, clubs, and

extracurricular activities, playing sports, doing homework, listening to the radio, watching movies, and reading. By examining time spent devoted to each of these activities before and after the introduction of television, decrements in all activities were identified, especially for watching movies, listening to the radio, reading, playing sports, and participating in hobbies (Mutz et al., 1993). Television watching at the expense of movie watching and radio listening was most evident, especially during the first year of television's introduction (Mutz et al., 1993). This pattern was attributed to the novelty of television's introduction. Yet, decreases in television viewing in subsequent years did not bring other activities back to their original level of frequency (Mutz et al., 1993) because the television was thought to replace other forms of technology, such as radio listening and attending the movie theatre (Mutz et al., 1993).

While there is more evidence to support digital media's displacing effect, the literature is disorganized and inconsistent (Lee & Kuo, 2002), especially when different media platforms are examined. For example, a Canadian study with 2113 adolescents found that using the Internet or playing video games displaced television watching, as well as the time spent being physically active, socializing, and reading (Mannell, Zuzanek, & Aronson, 2005). On the other hand, when Internet use in secondary school students was examined in Singapore, television use decreased, but newspaper reading, radio listening, and socializing with friends actually increased (Lee & Kuo, 2002). Similarly, in Norway, associations between media usage and displacement of activities were marginal at best, with the exception of playing sports (Endestad, Heim, Kaare, Torgersen, & Brandtzaeg, 2011). The numerous avenues to instantly access the radio and social media through the Internet, compared to television watching, may offer a plausible explanation for these findings. Thus, it appears as though the activities that are displaced vary depending on the type of media platform being examined (e.g., television or Internet).

Studies that are not explicitly focused on activity displacement, but instead extend the hypothesis by examining television and video gaming's impact on caregiver-child interactions (technoference) seem to find consistent results: screens distract parents and children from engaging with each other (Raman et al., 2017). Despite marketing claims that infant-oriented media are designed to give caregivers and children time to interact with each other, empirical evidence does not support this claim (Garrison & Christakis, 2005). Educational content, let alone non-educational content, does not increase dyadic interactions, but actually reduces verbal interactions between parents and children (Christakis et al., 2009; Mendelsohn, et al., 2008). For example, in one study, 329 children aged 2 to 48 months wore a digital language processor around the home. Recording of human and television audio revealed that child utterances, adult word counts, and conversational turns between child and caregiver were reduced in the presence of a television (Christakis et al., 2009).

Even the presence of background television has detrimental effects on caregiver-child interactions. In a laboratory study of 51 dyads of parents and children under the age of 3, the quantity and quality of parent-child interactions was observed in the presence of background television (Krikorian, Pempek, Murphy, Schmidt, & Anderson, 2009). Parents talked to their children less often, were less actively involved in their children's object play (or not interacting at all), and children's social interactions decreased, compared to dyads interacting without television in the room (Krikorian et al., 2009). Similarly, an interpretive study of social negotiations with three boys and three girls in kindergarten found that children spent limited time interacting with each other around the presence of video games, even when video games were being played in the background. The children spent the majority of the day playing, talking, and thinking about video games, as well as watching others play video games or being distracted

from other activities not related to video gaming (Bacigalupa, 2005). This preoccupation with video games resulted in rushed, disconnected, and defective social interactions.

Mobile technology. As the field remains in its infancy, some preliminary research on shared parent-child experiences using tablets has been explored. For example, parents in a structured laboratory setting reported positive experiences scaffolding their children's use of touchscreens (Wood et al., 2016). They were observed providing support to their children by interacting with the touchscreens themselves, using verbal and nonverbal exchanges, and providing emotional support (Wood et al., 2016). Yet, scaffolding or joint-engagement is rarely observed outside of the laboratory (Radesky, Dimitir, & Christakis 2016). In fact, it is common to see caregivers hand their children mobile technology rather than using them together (Radesky, Dimitri, et al., 2016). The interactive aspects of electronic toys do not simultaneously engage children and caregivers (Radesky, Dimitri, et al., 2016; see Bus, Takacs, & Kegel, 2015). For instance, in a controlled experimental study, 26 parent-child dyads of children, aged 10 to 16 months, were observed playing for 15 minutes in their home. Parent-child communication was observed while playing with an electronic toy (e.g., talking farm, baby cell phone), traditional toy, and books. Playing with electronic toys lead to fewer child initiated words, adult words, conversational turns, and parental responsiveness to child utterances compared to play with traditional toys or books (Sosa, 2015).

With the relatively recent introduction of smartphones and tablets, little empirical evidence regarding these technologies displacing effect is known. Yet, of the studies that have examined smartphones and tablets along with other media platforms (e.g., television), the research continues to point to evidence suggesting that technology use distracts parent-child dyads from interacting with each other (McDaniel & Coyne, 2016b; McDaniel & Radesky,

2017). For example, greater problematic mobile technology use by parents (e.g., unable to resist urges to check devices), was associated with greater technoference in the parent-child relationship and disruptions across numerous parenting domains, such as mealtime and bedtime (McDaniel & Radesky, 2017).

So far, no known studies have exclusively examined mobile technologies displacing effect on children's activities, but three known studies have begun to explore how parental use of mobile technology disrupts parent-child interactions (technoference). Radesky and colleagues (2014) observed 45 caregivers eating with their children at fast food restaurants. Observations revealed that caregivers were highly absorbed in their mobile devices, rather than paying attention to their child, resulting in decreased responsiveness, fewer conversations with the children, and harsh responding to children's bids for attention (Radesky, Kistin, et al., 2014).

Observations made at a playground setting also point to the same conclusions. In one study examining mothers' technology use at a playground, mothers who were preoccupied with their mobile devices were not only notably less responsiveness to child bids for attention (compared to mothers not using their phone), but an alarming 56 percent (n = 18) of mothers outright ignored their children by not speaking or looking away from their phones (Hiniker et al., 2015).

Moreover, reduced parental responsiveness was replicated in a laboratory setting where parent-child dyads tried new foods together. Mothers who spontaneously used their mobile devices were unaware of their child's social cues, resulting in decreased verbal and nonverbal interactions (Radesky, Miller, et al., 2015).

Alarmingly, despite several studies documenting reduced parental responsiveness, parents continue to believe that their preoccupation with mobile devices do not hinder their

ability to respond to children's request (Hiniker et al., 2015).Thus, the potential for mobile technology to have a pronounced effect on parental responsiveness is immediately concerning for the quality of child-rearing practices that children are receiving and how technoference might influence young children's self-regulation and aggression.

In regard to children's own use of mobile technology, there is a lack of research examining how mobile technology use by children may influence their own responsiveness to daily routines and interpersonal interactions. Initial evidence suggests that children at-risk for social-emotional difficulties simultaneously access digital media (e.g., television, tablets) during a majority of their daily activities (Raman et al., 2017), but mobile technology itself (excluding other forms of digital media) has not been explored as a displacer of activities.

Taken together, mobile technology has been shown to alter parental responsiveness and may change how children spend their time by choosing these devices over developmentally appropriate activities. Undoubtedly, the ease at which these portable devices can disrupt important activities and parent-child interactions calls attention to the need for further research into mobile technology's impact on child development. Anecdotally, one would expect that a portable device would have an even greater displacing effect on children's social activities and interpersonal relationships than television, video games, and computers because the small size and portability of these devices create opportunities for them to be used in new settings and situations where older and larger technologies could not have been used. But with such a paucity of empirical evidence to support this claim, further research is required.

Technology, Self-Regulation and Aggression

Research on the impact of mobile technology on children's self-regulation and aggression is relatively limited. Therefore, in the following section literature examining the impact of

television and video gaming on children's self-regulation and aggression were reviewed to guide the present study's research questions.

Television and video games.

Self-regulation. Numerous studies have established the link between young children's television watching and video game playing on subsequent self-regulatory problems (e.g., Levin & Waite, 2000; Swing, Gentile, Anderson & Walsh, 2010). For example, significant associations between television viewing before age 3 and subsequent regulation problems at age 7 were found after controlling for all other confounds (e.g., parental emotional support; Christakis, Zimmerman, DiGuiseppe, & McCarty, 2004). Another study of 170, 2- to 5-year-old children found a relationship between more television viewing and greater inattentiveness and hyperactivity (Miller et al., 2007). In one study, the specific content of television exposure and children's subsequent attention problems were examined (Zimmerman & Christakis, 2007). Families of over 3,000 children completed time diaries of children's exposure to violent, non-violent, or educational television content. Whereas television viewing of educational content at age 3 was not associated with subsequent attention problems, five years later, violent and nonviolent content was found to be related to poor attention (Zimmerman & Christakis, 2007).

A systematic review of 76 studies, suggests that children's television viewing disrupted play and the quality and quantity of child-parent interactions, leading to lower executive functioning (Kostyrka-Allchorne et al., 2017). Alternatively, the effort required to encode rapidly presented events on television may also exhaust children's executive functioning resources (Lillard & Peterson, 2011). For example, children watching fast-paced television performed worse on tasks of executive functioning compared to children watching an educational show or assigned to a drawing task (Lillard & Peterson, 2011).

Not only are the effects of television watching and video gaming on self-regulation immediate, there is evidence that they are also sustained well into later childhood and adolescence. Longitudinal studies demonstrated that viewing television and playing video games during childhood were associated with subsequent attention problems later in life. In a longitudinal study following more than 32,000 children, daily television viewing and video game playing was examined at age 3, 4, and 5 years. Longer time spent watching television was associated with a higher risk of later dysregulation across all three time points. Interestingly, children who played one hour or less of video games per day at age 3 had a lower likelihood of self-regulation problems compared to children who did not play video games. However, up to three hours of video game playing on the weekends was related to a lower probability of self-regulatory problems at 5 years old (Inoue et al., 2016). The finding that playing video games may be protective for self-regulation, coincide with some authors who believe that certain types of video games may help facilitate executive functioning (Staiano & Calvert, 2011). Or, these specific children may simply be allowed to play several hours of video games only during the weekend, but spend their time engaging in more developmentally enriching activities during the weekday. Nevertheless, the study found that three or more hours of video game playing, especially during school days, was related to problematic self-regulation. As a result, the authors concluded that extensive use of video games can take away from developmentally important activities and is an overall risk factor for self-regulation and attention problems later in life (Gentile et al., 2011; Inoue et al., 2016). Taken in tandem, the influences of childhood television viewing and video games on attention problems have been frequently replicated and subsequent self-regulation problems have been shown to remain prevalent well into adolescence (Landhuis, Poulton, Welch, & Hacox, 2007).

Aggression. Decades of strong evidence support the notion that children's exposure to violent media content is related to aggressive behaviour. Children are prone to imitating violent behaviour observed on screens and become aroused from the frightening and fast-paced content (American Academy of Pediatrics, 2016). The more time that children spend watching television and video games, the higher their risk for violent and aggressive behaviour (e.g., physical fights, quarrels; Kelishadi et al., 2014).

The link between the short and long-term effects of violent television on aggression in children has garnered a great deal of research in the past several decades (see Bushman & Huesmann, 2001). Anderson and Bushman (2001) sought to extend these findings by examining the effects of violent video gaming on aggression by conducting a meta-analysis of 35 studies examining aggressive tendencies in more than four thousand participants (46% under 18-years-old). Violent video games was associated with increased aggressive behaviour ($r_+ = .19$), aggressive cognition ($r_+ = .27$), aggressive affect (e.g., frustration; $r_+ = .18$), physiological arousal (blood pressure and heart rate; $r_+ = .22$), and decreased prosocial behaviour ($r_+ = -.16$), irrespective of gender, age, and experiment type (experimental or non-experimental studies). Thus, these findings suggest that exposure to violent video games leads to temporary aggression in laboratory settings (experimental studies), as well as aggressive behaviours in daily life (non-experimental studies). More recently, a meta-analytical review of 50 studies, including those published in both Eastern and Western Countries, as well as longitudinal studies, found further evidence that aggression increases due to violent video games across experimental ($r_+ = .21$) cross-sectional ($r_+ = .20$) and longitudinal studies ($r_+ = .20$; Anderson et al., 2010).

Some evidence suggests that time spent accessing screen media is not related to aggression, but rather violent or inappropriate content is to blame, (Conner-Burrow, McKelvey,

& Fussel, 2011); however, other studies have found that time spent using screen media, irrespective of the content being accessed, is related to aggressive behaviour. For example, Bushman and Anderson (2002) hypothesized that violent media engenders aggressive behaviours because exposure to violent content primes aggressive thoughts, feelings, and behaviours. Thus, if violent content is the sole mechanism driving aggressive behaviour, then exposure to non-violent media should not influence aggressive behaviours. Correspondingly, one study found that preschool children watching more age inappropriate videos or movies (rated PG-13 or R-rated) also exhibited higher levels of hyperactivity, aggression, and lower social skills, but time spent watching television in general did not predict these behaviours (Conner-Burrow et al., 2011).

Yet, numerous studies have also demonstrated that aggressive behaviours can manifest, irrespective of exposure to violent or non-violent content. For instance, the magnitude of video gaming's effect on aggressive behaviour in the meta-analysis conducted by Anderson and Bushman (2001) remained significant, regardless of whether studies examined time spent playing violent video games, having a preference for violent video games, or simply playing video games in general. Similarly, a population study of over 3,000 children in the Netherlands, found that television content being watched at 24 months of age did not influence externalizing problems at 36 months, but rather prolonged habits of more television watching predicted externalizing problems (Verlinden et al., 2012). Time spent watching television however, coupled with inappropriate content likely exacerbates aggression in children. For instance, in a study examining television content consumed by preschool children under the age of 2, more television watching predicted aggressive and externalizing problems a year later, especially if children were accessing non-educational content (Tomopoulos et al., 2007a). Thereby, although the evidence is inconclusive, both the time spent watching television and playing video games, as

well as the exposure to inappropriate content appear to be important contributors to aggressive behavior in children.

Mobile technology.

Self-regulation. Literature examining children's use of mobile technology in relation to self-regulation is limited. In one study of 144 parents, Radesky and colleagues (2016) examined whether parents' frustration with their children's (aged 15 to 36 months) difficult behaviour led to the use of mobile devices as a behaviour regulation tool to calm children down. Parents reported their children's social-emotional development (internalizing, externalizing, and attention problems) using the Baby or Preschool Pediatric Symptom Checklist, the likelihood of using mobile devices across several parenting domains (e.g., to keep them quiet, while in public, to get chores finished), and perceived control over their children's behaviour. Children with greater social-emotional difficulties (score of ≥ 9) were given mobile devices more frequently as a calming tool and to maintain peace and quiet in the household (no other parenting domains reached significance) compared to less difficult children (Radesky, Peacock-Chambers, et al., 2016). In a similar fashion, a study of 210 typically developing 12- to 36-month-old children found that children at risk for social-emotional difficulties (e.g., self-regulation, compliance, communication) go through a large portion of their daily routines (e.g., breakfast, playtime, bedtime, etc.) in the presence of digital media (television, smartphones, tablets; Raman et al., 2017) compared to children not at risk for these delays. Whereas these studies point to a potential link between mobile technology use and self-regulatory problems in young children, none of these studies examined self-regulation and mobile technology, specifically. Moreover, in line with the attraction hypothesis (Gentile et al., 2012) it is unclear whether mobile technology use is causing regulatory problems or parents are using mobile technology as a means to occupy

already fussy children (Radesky, Silverstein, et al., 2014). Nonetheless, relying on this parenting strategy may distract children from learning to regulate themselves and further sustain self-regulatory problems in already difficult children (Radesky, Peacock-Chambers, et al., 2016; Radesky, Silverstein, et al., 2014). In sum, despite the little research available, the literature seems to suggest that an association between children's mobile technology use and self-regulation does exist and more research is required to replicate and extend these findings.

Aggression. Research examining the relationship between aggression and mobile technology use is also lacking. Previous studies strongly suggest that digital media and aggression are related, but no known research has explored aggressive behaviour and children's use of mobile technology specifically. Although this relation is unclear, by drawing from the television and video game literature, similar findings are expected.

Use of mobile technology may increase children's aggressive behaviour in three ways. First because the exposure to violent media through television or video games is related with more aggression, it would be expected that accessing inappropriate content through mobile technologies would also be associated with aggressive behaviour in children. This is in line with the excitement hypothesis. Of greater concern, caregivers have noted that the portable nature of these devices are more difficult to monitor (Radesky, Eisenberg, et al., 2016) and instantly accessible content means that children can access inappropriate content anytime and anywhere outside the control of their caregivers (Radesky & Christakis, 2016). Second, in line with the displacement hypothesis, the amount of time spent using mobile technology will take away from time with developmentally enriching activities that offer better opportunities to foster self-regulation, leading to greater deficits in self-regulation. Third, granted that poor self-regulatory skills can manifest as aggressive behaviours, one may expect that as increased use of mobile

technology contributes to poor self-regulation, aggressive behaviours will also increase. These speculations however, have yet to be established in the literature and therefore warrant further exploration in the present study.

Caregiver Attitudes

Given that caregivers are responsible for creating an environment rich in stimulating activities that promote self-regulation, examining caregiver attitudes towards using mobile technology is imperative. Young children are largely dependent on their caregivers and lack the autonomy to initiate mobile technology use themselves, so much of the burden surrounding limit setting falls on caregivers. Yet, contrary to the common view that caregivers attempt to moderate children's pervasive use of media, caregivers' own use of technology, as well as the norms surrounding technology use established at home, largely influence children's screen time (Wartella, Rideout, Lauricella, & Connell, 2014). For instance, children growing up in homes characterized by caregivers who spent more time engaged in screens, enjoy using digital media as a family activity, hold more favorable views towards media, and are more likely to use technology as a behaviour regulation tool, spent an average of two-and-a-half hours more using digital media than children with caregivers holding more conservative attitudes toward media use (conservative attitude average digital media use, M = 4 hours, 29 minutes; Wartella et al., 2014). Not surprisingly, caregiver media habits are strongly related to children's screen time (Jago et al., 2012) and not only distract parents and children from interacting with each other, but also reinforce children's level of usage when using these devices to regulate children's behaviour or to occupy children (Radesky, Peacock-Chambers, et al., 2016). Using mobile technology as the principal way to calm children down may be detrimental to later social-emotional development

because opportunities for children to learn how to regulate themselves are compromised (Radesky, Schumacher, & Zuckerman, 2015).

Yet, with the paucity of research concerning mobile technology's influence on child development, it is difficult for families to make informed decisions about mobile media use. Some caregivers prefer an early introduction of these devices to their children (Wood et al., 2016), whereas others express worrying about the potential for any negative effects on children's development (Bentley, Turner, & Jago, 2016; Radesky, Eisenberg, et al., 2016). Meanwhile, some caregivers felt inclined to permit the use of mobile technology for fear that their children may be missing out on educational benefits, but worried about displacing quality family time (Radesky, Eisenberg, et al., 2016). Other caregivers expressed concern over the tension between using mobile technology as a behaviour regulation tool (e.g., to calm upset children) or as a convenient means to occupy their children during chores (Radesky, Eisenberg, et al., 2016; Rideout, 2013). Without sufficient research, what these tensions and worries convey is that more research regarding the use of mobile technologies' impact on child development is urgently needed.

The Present Study

The main purpose of the present study was to extend the digital media literature by looking exclusively at the impact of mobile technology use on children's daily routines (activity settings and parent-child interactions), self-regulation, and aggression. More specifically, although some researchers have referenced the displacement hypothesis in studies of mobile technology, it has not been empirically tested in relation to self-regulation. Clearly, the use of mobile technology impacts activities and interpersonal interactions, but how does this displacement influence children's self-regulation and aggression? To date, only one known study

has examined the displacement hypothesis by establishing links between technoference and children's internalizing and externalizing behaviours. In a study of 183 parents, McDaniel & Radesky (2017) found that greater problematic parental technology use (as reported by both mothers and fathers) was associated with greater technoference, and in turn, related to greater externalizing (e.g., hyperactive, temper tantrums) and internalizing (e.g. whining, sulking) problems in children, aged 1 to 5 years old. When examining the effect of parental mobile technology use alone, the results held, suggesting that technoference by mobile technology is a large contributor to children's developmental outcomes (McDaniel & Radesky, 2017).

The current study aimed to extend the results of McDaniel and Radesky's (2017) study by addressing the following gaps. First, the previous study focused solely on parents' use of technology. Whereas parental screen time can undoubtedly influence their responsiveness to parent-child interactions, children's own preoccupation with technology may also interfere with their responsiveness to interpersonal interactions and other healthy activities (e.g., outdoor play, educational activities). The current study examined both parent and child screen time. Second, whereas the previous study examined the link between problematic technology use (unable to resist urges to use technology) and technoference, the current study focused on screen time more broadly (without differentiating between problematic use). Doing so may shed light onto the potential for leisurely use of mobile technology to have substantial impacts on children's development. Third, whereas the focus on technoference is an important one, it is not clear how mobile technology is related to the frequency of children's participation in other important activities. The present study not only examined technoference in the parent-child relationship, but also explored how mobile technology was related to children's participation with daily activities. Fourth, technoference was measured in terms of how many times electronic devices

(television, video games, tablets, etc.) interrupted a conversation or activity while engaging with a child, but no activities in particular were specified. The current study explored the frequency of technoference occurring across several specific parenting domains (e.g., mealtime, indoor play, dining out). Finally, whereas the previous study examined technoference's impact on children's internalizing and externalizing behaviours, the current study focused more specifically on children's self-regulation and aggression. Taken in tandem, the aim of the present study was to explore the displacement hypothesis by establishing preliminary links between young children's mobile technology use, participation in daily (activity settings and parent-child interactions), self-regulation, and aggression. The specific objectives and hypothesis were as follows:

Objective one. Although the link between television and video games, poor self-regulation, and higher aggression is supported by research (e.g., Anderson & Bushman, 2001), little is known about mobile technology. The first study objective was to examine whether mobile technology use is related to poor self-regulation and aggressive behaviour in young children.

(1a). Greater child screen time will predict poor self-regulation and higher levels of aggression.

(1b). Greater caregiver screen time will predict poor self-regulation and higher levels of aggression in children.

Objective two. It is apparent that higher consumption of media by young children, as well as caregivers, is related to fewer social interactions and displacement of developmentally important activities (e.g. Mannell et al., 2005). Given the importance of engagement and participation in activity settings for developing children (Bronfenbrenner, 1997; Dunst et al., 2002), limiting these activities is especially alarming. Furthermore, the portable and flexible

nature of mobile technologies may allow children to access these devices with greater ease. Thus, the displacing effect of mobile technology may be more pronounced than other forms of media. The second study objective was to explore the displacing effect of mobile technology; that is, is there a relationship between children's disruption of daily activities and use of mobile technology?

(2a). Greater caregiver and child screen time will predict lower frequency of children's participation across activity settings.

(2b). Greater caregiver and child screen time will predict greater technoference in the parent-child relationship across parenting domains.

Objective three. The third study objective was to test the displacement hypothesis by establishing preliminary links between mobile technology, children's participation in their environment, self-regulation, and aggression in young children. Because participating in daily activities constitutes numerous opportunities for building children's emerging self-regulation, mobile technology's disruption of these activities may lead to poor regulation. In other words, children's self-regulation problems not only occur through the increased use of mobile technology, but also through missed opportunities that facilitate emerging self-regulation skills. Therefore, a third objective was to explore whether mobile technology affects children's frequency of participating in activities and thus, their self-regulation and aggression.

(3a). Lower frequency of activities will predict poor self-regulation and higher levels of aggression in children.

(3b). Greater technoference will predict poor self-regulation and higher levels of aggression in children.

(3c). The relation between child screen time, and self-regulation and aggression will be mediated by children's engagement with their environment (both displacement of activities and technoference).

Objective four. The fourth study objective was to better understand caregiver attitudes towards mobile technology use in the family. Caregivers are the gateways to children's mobile technology use. They create the media ecology that children grow up in, their own use of mobile devices displaces interactions with children, and they initiate device use to occupy their children on a daily basis. Exploring how the use of mobile technology as a parenting tool may be sustaining self-regulatory and aggressive behaviours was particularly important in light of this common parenting strategy.

(4a). The relation between child screen time, and the variables of self-regulation and aggression will be mediated by the use of mobile technology as a parenting tool.

Further, acquiring a more nuanced understanding about caregiver attitudes towards mobile technology and the impact these devices have on family dynamics and caregiver-child relationships is important. Through interviews, a qualitative component of the study gathered further information about these topics to support, explain, and add to the findings of the present study. Specifically, drawing from previous research (Radesky, Eisenberg, et al., 2016), the present study explored:

a) Whether caregivers had any concerns about how mobile technology may impact young children who use them
b) Whether caregivers express any stress regarding limit setting and rules

c) Whether caregiver express any tension about their attitudes towards children using mobile technology and permitting or limiting the use of these devices

CHAPTER III

Methods

Quantitative Component of Study

Participants

Participants were 174 caregivers. The majority of participants were female (n = 157; 90.2%), whereas most children were boys (n = 100). Participants ranged from 19 to 48-years-old (M = 32.93; SD = 5.38) and children ranged in age from 2 to 5 years (M = 3.42; SD = 1.02). Caregivers (74.1%) and children (71.3%) were primarily Caucasian and came from two-parent homes (72.4%). Approximately half of the caregivers graduated from College or University. Approximately half of the sample were upper middle class (50 %; income ranging from $81K to over $250K). In terms of the technology landscape in participants' homes, almost all caregivers reported having a smartphone (96.6%) or tablet (85.6%) in their household. Specifically, all caregivers reported personally owning a smartphone (100%), while a majority reported also personally owning a tablet (61.5%). Only a few children personally owned a cell phone or smartphone (5.3%), but more children personally owned a tablet (37.9%). Participant demographic characteristics and technology ownership are presented in Table 1 and Table 2.

The sample size was determined on the basis of detecting a relation between the predictor variable and the outcome variable with a medium effect size, $\alpha = .05$, $\beta = .20$, for a hierarchical multiple regression requiring seven predictors. Using Tabachnick and Fidell (2013)'s simple formula, $N > 50 + 8m$ (m = number of independent variables) with four independent variables and an estimate of three (television, video games, and computers) covariates, the regression analyses with the largest number of predictors required approximately 106 participants. A power analysis was conducted using G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) to confirm

the recommended minimum sample size. In order to detect a medium effect size ($f^2 = .15$) for a hierarchical multiple regression with a power of .80 and seven predictors, 103 participants were required. The sample in the present study exceeded this number.

Table 1

Participant Characteristics (N = 174)

		N	%
Caregiver Gender (*N* = 171)			
	Female	157	90.2
	Male	14	8
	Missing	3	1.8
Child Gender (*N* = 174)			
	Female	74	42.5
	Male	100	57.7
Caregiver Ethnic Background (*N* = 174)			
	Caucasian	129	74.1
	South Asian	12	6.9
	East Asian	7	4
	African Canadian	5	2.9
	Caribbean	4	2.3
	Hispanic	4	2.3
	Native Canadian	2	1.1
	Biracial or Multiracial	10	5.7
	Other	1	0.6
Child Ethnic Background (*N* = 171)			
	Caucasian	124	71.3
	South Asian	11	6.3
	East Asian	4	2.3
	African Canadian	6	3.4
	Caribbean	2	1.1
	Hispanic	2	1.1
	Native Canadian	1	0.6
	Biracial or Multiracial	21	12.1
Marital Status (*N* = 174)			
	Married	126	72.4
	Divorced	2	1.1
	Separated	10	5.7
	Living Together	21	12.1
	Single	15	8.6

Table 1 Continued

		N	%
Maternal Education (*N* = 174)			
	Graduated High School	11	6.3
	Some College or University	22	12.6
	Graduate College or University	99	56.9
	Graduate or Professional School	42	24.1
Paternal Education (*N* = 169)			
	Some High School (Grade 10 or 11)	7	4
	Graduated High School	22	12.6
	Some College or University	28	16.1
	Graduate College or University	80	46
	Graduate or Professional School	31	17.8
	Other	1	0.6
Household Income (*N* =174)			
	Under $30K	18	10.3
	$30K to $45K	12	6.9
	$46K to $60K	12	6.9
	$61K to $80K	27	15.5
	$81K to $100K	27	15.5
	$101K to $150K	34	19.5
	$151K to $250K	25	14.4
	Over $250K	2	1.1
	Prefer not to answer	17	9.8

Table 2

Participant Technology Characteristics (N = 174)

Variable	Yes (%)	No (%)
Own in Household:		
Cable or Satellite TV	88 (50.6)	86 (49.4)
Connect TV to Internet	129 (74.1)	45 (25.9)
Laptop or desktop	164 (94.3)	10 (5.7)
High Speed Internet	169 (97.1)	5 (2.9)
Video game Console	98 (56.3)	76 (43.7)
Handheld Video Game Player	45 (25.9)	129 (74.1)
Digital Video Recorder (DVR)	45 (25.9)	129 (74.1)
DVD Player	97 (44.3)	77 (55.7)
Smartphone	168 (96.6)	6 (3.4)
E-Reader	45 (25.9)	129 (74.1)
iPod	30 (85.6)	144 (14.4)
Tablet	149 (85.6)	25 (14.4)
Caregiver Personally Owns:		
Cell phone (Smartphone)	174 (100)	0 (0)
iPod	12 (6.9)	162 (93.1)
Educational Game Player	11 (6.3)	163 (93.7)
Hand-Held Game Player	15 (8.6)	159 (91.4)
Tablet	107 (61.5)	67 (38.5)
Child Personally Owns:		
Cell phone	6 (3.4)	168 (96.6)
Cell phone (smartphone)	5 (2.9)	1 (0.6)
iPod	9 (5.2)	165 (94.8)
Educational Game Player	34 (19.5)	140 (80.5)
Hand-Held Game Player	10 (5.7)	164 (94.3)
Tablet	66 (37.9)	108 (62.1)
None of the above	76 (43.7)	98 (56.3)
In Child's Room:		
Television	22 (12.6)	152 (87.4)
Video Game Console	4 (2.3)	170 (97.7)

Table 2 Continued

Variable	Yes (%)	No (%)
DVD Player	9 (5.2)	165 (94.8)
Computer	5 (2.9)	169 (97.1)
Computer (Connected to Internet)	5 (2.9)	0 (0)
None of the above	149 (85.6)	25 (14.4)

Measures

Screening questionnaire. All participants completed a screening questionnaire to confirm eligibility for the study. Caregivers were asked whether they have a child between the age of 2 to 5 years old, if they were the primary caregiver for the child (spends the most time with child), and if they or their child had access to a smartphone or tablet. Participants were also asked whether their partner (e.g., spouse) had previously completed the study to ensure independence of informants. All participants were required to be fluent in English (reading and comprehension).

Background information. Caregivers were asked to complete a background information questionnaire. Questions related to the demographics of the caregiver (gender, marital status, level of education, and ethnicity) child's age, gender, and their family structure were included. Additionally, eight items adapted from Wartella and colleagues (2014) asked various questions about media ownership by families (e.g., how many television sets are in the household, whether the child owns their own media device). Option responses for question one (*Which of the following, if any, do you have in your household: Check all that apply*) and four to six (*Do you have your own: Check all that apply; Does your child have his/her own; Which of the following items, if any, are available in your child's room?)* were randomized.

Child screen time. At the time of the present study, there was no established parent report measure of child screen time using mobile technology. Global estimates are the most common method of measuring technology use and moderate correlations (.40) between global estimates of technology use and time diaries have been found (Anderson, Field, Collins, Lorch, & Nathan, 1985). Global estimates however, require asking caregivers to make retrospective estimates about their children's technology use over a 24-hour period, which likely yields

inaccurate answers (Vanderwater & Lee, 2009). Instead, the division of the day into three distinct periods (morning, afternoon, and evening) will provide a heuristic template to improve the accuracy of recall **(**Vanderwater & Lee, 2009). Following suit, four items from The Adult Involvement in Media Scale (AIM; Anderson, Gentile, & Buckley, 2007) were used to measure children's television and video game use, along with adapted versions to measure the use of computers, smartphones, and tablets. In order to exclusively examine mobile technology in the present study, measuring all screen-based media was necessary in order to control for these other devices. The ten items asked caregivers to report how many hours their child spent using screen-based media during the morning (*6am to afternoon*), afternoon (*afternoon to 6pm*) and evening (*6pm to midnigh*t) on a typical weekday and weekend. Total screen time for each device was calculated by using a weighted average of screen time by multiplying the total daily hours for a typical weekday by 5, multiplying the total daily hours for a typical weekend by 2, and summing together the weekday and weekend hours. To calculate the total amount of *mobile* technology use by children (MT-Child) the weighted averages of total smartphone and tablet use were summed together.

Participation in activities. The Young Children's Participation and Environment Measure (YC-PEM; Khetani, Coster, Law, & Bedell, 2013) was used to measure the frequency of various activities at home (YC-PEM-Home), the community (YC-PEM-Community), and at school or daycare (YC-PEM-Daycare). This scale contains 27 items with 13 items measuring home activities (e.g., mealtime), 11 items measuring community activities (e.g., community attractions, classes or lessons), and three items measuring daycare or preschool activities (e.g., socializing with friends). Caregivers were asked to rate each activity by its frequency of occurrence over the last four months on an 8-point Likert-type scale from 0 (*Never*) to 8 (*Once*

or more each day). A total score for the frequency of activities was calculated using the average score of the items.

The *Level of Involvement*, *Desire for Change*, and *Environmental* subscales were excluded from the study since they were not relevant to the research questions. The *Level of Involvement* subscale asks caregivers to rate how involved they *perceive* their child to be during certain activities. *Desire for Change* is assessed by asking caregiver if they wish their child's level of participation would change and to describe three strategies that would promote change (if caregivers answered "yes" to the question). The *Environmental* subscale measures the impact of environmental features (e.g., physical layout, safety, weather) and resources (e.g., money, information, time) on children's participation in activities. The YC-PEM has good internal consistency, test-retest reliability, and construct validity (Khetani, Graham, Davies, Law, & Simeonsson, 2015). The YC-PEM shows good convergent validity with similar measures (Khetani, 2015), such as the Craig Hospital Inventory of Environmental Factors – Child and Parent Version (CHIEF-CP). In the present study, Cronbach's alpha across children's participation in overall activities, as well as activities in the home, community, and daycare setting ranged from .69 to .81 indicating acceptable to good internal consistency (YC-PEM-Home = .69).

Technoference. Perceived technoference in the parent-child relationship was measured using 14 items adapted from the Technology Interference in Parenting Scale (TIPS; McDaniel & Coyne, 2016b). The original measure (Technology Device Interference Scale; TDIS) was created to measure technoference across different types of digital media (e.g., tablets, television, video games, etc.) within romantic relationships (McDaniel & Coyne, 2016a). A principal component analysis revealed strong factor loadings across numerous media devices and one factor

accounting for 54% of the variance in technoference. McDaniel & Coyne, (2016b) adapted the TDIS to create the TIPS by simply changing the items that focused on romantic relationship to co-parenting relationships. They inquired about the amount of technoference in the participant's own and their partner's parenting across 14 different parenting domains (e.g., mealtime, playtime etc.). Parents were asked to think only about times when these domains occurred and report technoference during these occurrences. The wording of these instructions eliminated differences in the frequency of certain domains occurring in different families and allows for comparison across domains (McDaniel & Coyne, 2016b). The TDIS (α= .67) and TIPS (α = .90) both have demonstrated acceptable internal consistency. No other known studies have evaluated the psychometric properties of this new scale. The TIPS was further adapted to measure perceptions of technoference across different types of digital media within parent-child relationships (McDaniel & Radesky, 2017). Parents were asked: "On a typical day, about how many times do the following devices interrupt a conversation or activity you are engaged in with your child?" Following suit, the present study asked parents to report how many times mobile technology (smartphones or tablets) interrupted 14 different parenting domains with their child (). The order of the 14 items were randomized and rated from 0 (*Never*) to 8 (*10 or more times a day*), with higher scores representing more frequent technoference. Items were examined separately, as well as averaged together for a total technoference score. Cronbach's alpha in the present study for total technoference was .84 indicating good internal consistency.

Self-regulation. Considering executive function's integral role in self-regulation, executive functioning is considered to be central to the measurement of self-regulation in preschoolers (Denham, Warren-Khot, Bassett, Wyatt, & Perna, 2012). Despite considerable similarities between executive function and self-regulation, executive function has a greater

focus on cognition processes, such as the control of thoughts and actions, but does not emphasize the processing and regulation of emotions (Halle & Darling-Churchill, 2016). The Behaviour Rating Inventory of Executive Function – Preschool version (BRIEF-P; Gioia, Espy, & Isquith, 2002) was therefore used to measure children's self-regulation. The present study focused on using the *Inhibitory Self-Control Index* (ISCI), which is comprised of the *Inhibit* (impulse control) and *Emotional Control* subscale. The BRIEF-P is a 63-item parent-report measure for children aged 2 to 5-years-11- months. The measure yields five subscale scores (inhibit, shift, emotional control, working memory, and planning and organization), three index scores (inhibitory self-control, flexibility, and emergent metacognition), and one global executive composite. The BRIEF-P asked parents to rate their child's ability to modulate and inhibit actions, responses, emotions, and behaviours over the past six months on a scale of 1 *(Never*), 2 (*Sometimes*), or 3 (*Always*). Sample items from the BRIEF-P include "When instructed to clean up, puts things away in disorganized, random way" and "Becomes upset too easily." The BRIEF-P has demonstrated good internal consistency (all α= > .80) in a Canadian preschool sample (Duku & Vaillancourt, 2014), as well as good test-retest reliability (r = .65 to .94) by the developers. Excellent internal consistency has been documented for the ISCI specifically (α= .92; Skogan et al., 2016). A raw score for the ISCI was calculated by summing together the items from *Inhibit* and *Emotional Control* subscale and then normed based on the child's age and gender to derive t-scores for analyses. Cronbach's alpha in the present study was .92 indicating excellent internal consistency.

Emotion-regulation. The Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1995, 1997) is a 24-item parent report measure that assesses how frequently children display affective behaviours ranging from 1 (*Never*) to 4 (*Almost always*). The ERC was included to

examine how the ISCI and ERC correlate with each other. Factor analysis confirmed two subscales: *Emotion Regulation* (8 items*)* which captures aspects such as empathy and socially appropriate emotional displays, and *Lability-Negativity* (15 items) which is centered around emotional intensity, reactivity, anger dysregulation, and mood swings (Shields & Cicchetti, 1995; 1997). Higher scores on the *Lability-Negative* represent greater emotion dysregulation and negativity, whereas higher scores on the *Emotion Regulation* subscale reflect greater emotion regulation and positive expression of emotions. Both scales have demonstrated good construct, convergent, and discriminant validity (Shields & Cicchetti, 1997). The ERC has demonstrated acceptable psychometric properties with preschool samples as young as 2 years old (e.g., Liability-Negativity subscale reported with $\alpha = .77$ in a sample of 2-year-old preschoolers; Howse, Calksin, Anastopoulos, Keane, & Shelton, 2003). A review of the literature using the ERC with preschool children indicated that internal consistency for of the *Emotion Regulation* subscales tend to be lower in preschool children (e.g., $\alpha = .59$ - .66; Blandon, Calkins, Keane, & O'Brien, 2008) compared to school-aged children (e.g., ranging from .81 to .83; Jungmeen, Cicchetti, & Rogosch, 2013; Kim & Cicchetti, 2010). In the present study, Cronbach's alpha for the *Lability-Negative* and *Emotion Regulation* subscales were .82 and .64 respectively. Therefore, the ERC demonstrated acceptable to good internal consistency in the present study.

Aggression. Aggression will be measured using the *Aggressive Behaviour* subscale from the Child Behavior Checklist- Preschool Version (CBCL $1^{1/2}$ – 5; Achenbach & Rescorla, 2001). The CBCL $1^{1/2}$ – 5 is a 99-item measure yielding six subscales (emotionally reactive, depressed, somatic complains, withdrawn, attention problems, and aggressive behaviour) of which 19 items describe aggressive behaviours. Caregivers were asked to rate how true each item has been over the past two months from 0 (*Not true*), 1 *(Somewhat or sometimes true*), to 2 (*Very true*). The

CBCL $1^{1/2}$ – 5 has demonstrated good psychometric properties (Achenbach & Rescorla, 2001), including good discriminant validity, construct validity (e.g., Ha, Kim, Song, Kwak, & Eom, 2011; Pandolfi, Magyar, & Dill, 2009), and criterion validity (Muratori et al., 2011). Good psychometric properties have been documented with the CBCL $1^{1/2}$ – 5 across 23 diverse societies (Ivanova et al., 2010). Items from the *Aggressive Behaviour* subscale (CBCL $1^{1/2}$ – 5-AGG) were summed together and raw scores were converted into t-scores for analyses. Cronbach's alpha for the aggressive behaviour subscale in the present study was .89 indicating good internal consistency.

Temperament. A measure of temperament was included as a potential control variable. Developmentally salient differences in temperament emphasize the need for using different temperament measures when examining different age groups, especially between preschoolers (Prior, Oberklaid, & Northam, 1987). For this reason, two different measures were used to measure temperament. The Early Childhood Behaviour Questionnaire – Very Short Form (ECBQ; Putnam, Jacobs, Garstein, & Rothbart, 2010) and Children's Behaviour Questionnaire – Very Short Form (CBQ; Putnam & Rothbart, 2006) was used to measure temperament in children age 2 to 3 years, and 4 to 5 years, respectively. The ECBQ includes 36 items rated on a 7-point Likert-type scale ranging from 1 (*Never*) to 7 (*Always*). An option to select "does not apply" is also available. The CBQ measure also includes 36 items rated on a 7-point Likert-type scale ranging from 1 (*Extremely untrue*) to 7 (*Extremely true*), as well as a "does not apply" option. Both measures yield three factors: negative affect (ECBQ/CBQ-NA), surgency (similar to extraversion, high need for intensity and pleasure; ECBQ/CBQ-S), and effortful control (ECBQ/CBQ-EC). A new variable was created for each of the three composites by integrating sores from both the ECBQ and CBQ. For instance, a variable name *Combined Negative Affect*

was created by incorporating both the ECBQ-NA and CBQ-NA into one variable. Both scales demonstrate good construct validity, criterion validity, adequate internal consistency, and good longitudinal stability consistency (Putnam, Jacobs, Gartstein, & Rothbart, 2010). Cronbach's alpha for the ECBQ ranged from .65 to .84, while alpha coefficients for the CBQ ranged from .68 to .78 indicating acceptable to good internal consistency.

Caregiver screen time. The ten items created to measure child screen time were further adapted to measure caregiver screen time across television, video game, computer, smartphone, and tablet usage. Four items from The Adult Involvement in Media Scale (AIM; Anderson, Gentile, & Buckley, 2007) were used to measure television and video game use, along with adapted versions to measure computers, smartphones, and tablet use. The ten items asked caregivers to report how many hours they spend using screen-based media during the morning (*6am to afternoon*), afternoon (*afternoon to 6pm*) and evening (*6pm to midnigh*t) on a typical weekday and weekend. Total screen time for each device was calculated by using a weighted average of screen time by multiplying the total weekday hours by 5, multiplying the total weekend hours by 2, and summing together the weekday and weekend hours. To calculate the total amount of *mobile* technology use by caregivers (MT-Caregiver) the weighted averages of total smartphone and tablet use were summed together.

Parenting tool. At the time of the present study, there was no established measure to assess the use of technology as a parenting tool by caregivers. Therefore, seven items from Wartella and colleagues (2014) were adapted for the present study, along with one researcher-created item to measure the use of mobile technology as a parenting tool. These items asked caregivers to rate how likely they were to introduce mobile technology across eight various parenting situations (e.g., getting ready for bed) from 1 (*Disagree*) to 4 (*Agree*). Two additional

questions adapted from Wartella and colleagues (2014) asked caregivers to indicate how much they agree that mobile technology has made parenting easier. An open-ended question asked parents to indicate what other ways they use mobile technology with their children. Order of the 10 items were randomized and scores were summed together to create a total parenting tool score (PT), with higher scores indicating greater use of mobile technology as a parenting tool. In the present study, Cronbach's alpha was .80 indicating good internal consistency.

Social desirability and validity checks. The Social Desirability-17 (SDS-17; Stöber, 1999, 2001) contains 16 true or false items that were used to measure socially desirable response styles. The SDS-17 demonstrates good internal consistency, test-retest reliability (Tatman & Kreamer, 2014; Blake, Valdiserri, Neuendorf, & Nemeth, 2006), discriminant validity, and convergent validity (.52 to .85) with other measures of social desirability (Eysenck Personality Questionnaire-Lie Scale, Sets of Four Scale, Marlowe-Crowne Scale; Stöber, 2001). Additionally, five validity questions (e.g., "click option five if you are paying attention") were embedded across the measure. Cronbach's alpha for the present study was .74 indicating adequate internal consistency.

Procedure

Recruitment. A multi-method approach was used to recruit caregivers of children 2 to 5 years old. Throughout all recruitment methods, a snowball recruitment technique was employed in which participants were asked to share information about the study to eligible participants whom they think may be interested in participating.

Some recruitment occurred in-person at events hosted by organizations, such as community centers and mom-to-mom events. Interested participants were e-mailed a unique link to the online survey. Recruitment also took place in the community by posting flyers in public

areas and community centers (e.g., libraries, multi-cultural centers, daycares). Flyers included information about the study, eligibility criteria, and contact information of the researcher.

Various organizations who have contact with caregivers of children 2 to 5 years old were contacted and asked to assist with recruitment. Organizations were asked to distribute an electronic copy of the study's flyer, e-mail a brief description of the study, post information about the study on their website or social media platforms, post study flyers in their building, or tell people about the study.

The majority of recruitment occurred online. In particular, Facebook was the main platform used. A Facebook page dedicated to the study was created to host a brief description of the study's details and an electronic copy of the flyer. Organizations were contacted through private messages to ask for assistance with recruitment. They were encouraged to "share" the study's page or post the study's flyer on their own wall. Using a snowball technique, Facebook users were also encouraged to share the study's page within their own social networks.

Fraudulent responses. Given the concern over robots or participants who complete online studies for multiple incentives (Teitcher et al., 2015), multiple strategies were employed to prevent fraudsters from completing the survey. A unique link was generated for each participant to prevent fraudsters from completing the study numerous times. To further prevent robots from completing the study, a CAPTCHA (e.g., "Completely Automated Public Test to tell Computers and Humans Apart) was also added to the first page of the study.

All interested participants (excluding participants recruited in-person) emailed the researcher for a unique link to the online survey. All potential participants who emailed the researcher requesting a link to the study were asked several screening questions (e.g., where they

heard of the study, what eligibility characteristics are required, what the study is about, what city they live in) before a unique link was sent.

Emails that were received in close proximity to each other and who share similar characteristics regarding their email address or subject line were likely sent from an automated computer program and were flagged as suspicious. Other characteristics of suspect include similarities across multiple emails, matching IP addresses across participants, consistency of responses (e.g., birth year), and willingness to participate in follow-up interviews (Teitcher et al., 2015). Approximately five fraudulent participants were excluded from the study by displaying a combination of these suspicious characteristics.

The study's advertisements directed interested participants to contact the researcher for a unique link to the study by email. All participants were required to answer screening questions (mentioned above) before being sent a link as a layer of security against fraudulent responders or robots.

Once participants gained access to the link, a consent form was completed online which include stipulations that parents will not receive compensation for their participation if they do not meet eligibility requirements for the study, if they complete the survey in an atypically short amount of time, or if more than 80% of their responses are missing or invalid.

Participants were required to answer screening questions to assess their eligibility to continue the survey. Ineligible participants were redirected to a page where they were thanked and informed about their ineligibility to complete the study. Eligible participants continued on with the survey, where they were presented with instructions about how to answer the questionnaire. In each section, participants were instructed to answer the questions either thinking about themselves or thinking about their child. Caregivers who had multiple children

were instructed to answer the questions thinking only about their child between the age of 2 to 5. If they had more than one child between this age range, they were instructed to think about the oldest child who is between 2 to 5 years old while answering the questions.

Participants began the survey by answering demographic questions. The rest of the questionnaires were presented in counterbalanced order with the items from the SDS-17 and validity checks randomly dispersed throughout. Upon completion of the survey, participants were asked whether they would be interested in being contacted to participate in an optional interview to be scheduled at a later time. Finally, participants were prompted for their email address so they could receive compensation in the form of a $5 electronic gift card. Participants who indicated that they were interested in the additional interview component of the study were contacted by email to schedule a time for the interview.

Qualitative Component of Study

Participants

A diverse sample of interview participants was sought. Caregivers were primarily recruited based on the amount of caregiver and child screen time in an effort to capture variability of mobile technology use (high or low use of mobile technology). Child gender and age were subsequently considered, followed by caregiver gender and caregiver/child ethnicity. See Table 3 for selected demographic information.

A total of $N = 15$ participants completed an audio-recorded phone interview. The majority of participants were females ($n = 14$; 93.3%), whereas most children were boys ($n = 9$; 60%). Participants ranged in age from 29 to 44-years-old ($M = 34.57$; $SD = 4.59$) and children ranged in age from 2 to 5 years ($M = 3.67$; $SD = 1.05$). Caregivers (73.3%) and children (73.3%)

were primarily Caucasian and came from two parent homes (73.3%). All of the caregivers graduated from College or University. The sample was primarily upper middle class (66.6%).

Measures

Interview. Ten questions from a semi-structured interview adapted from Radesky, Eisenberg, and colleagues (2016), as well as Hiniker and colleagues (2015), were initially used to explore common themes of mobile technology use by caregivers and their children. According to Braun and Clark (2014), it is acceptable to revise and add additional interview questions as interviews are being conducted. Accordingly, as more interviews were conducted, participant's responses prompted follow-up questions relevant to the research questions and were therefore included as part of the standardized questions for subsequent participants. After the first two interviews, the following questions were added: *Do you use mobile technology with your child (e.g., joint games) and do you think these interactions are important?; Do you have any feelings associated with using your phone around your child?; and Do you have any concerns about young children's use of mobile technology?* After the third interview, the following questions were added: *How do you choose which apps your child is allowed to use?; Is your child allowed to download apps on their own?; What do you consider to be a good app?; What do you consider to be a bad app?* Interview questions were directed towards both caregiver and child use of mobile technology.

Procedure

All interviews were conducted by the researcher and took place over the phone. Consent was obtained through the phone after participants reviewed a copy of the consent form sent to them through e-mail. Qualitative data were obtained through (N = 15) phone interviews with caregivers. Specifically, caregivers were asked semi-structured interview questions centered around how these technologies may be affecting the parent-child dynamic, why caregivers

permit the use of these technologies with their children, and the rules they implement to monitor or limit technology use by their young children. All interviews were audio recorded using *Quicktime* and then later transcribed *verbatim*.

Table 3

Selected Demographic Characteristics of Caregivers who Provided Qualitative Data (N = 15)

		N
Caregiver Gender		
	Female	14
	Male	1
Child Gender		
	Female	6
	Male	9
Caregiver Age		
	29	1
	30	2
	31	1
	32	3
	33	1
	37	3
	40	2
	44	1
	Prefer not to answer	1
Child Age	2	3
	3	4
	4	5
	5	3
Caregiver Ethnic Background		
	Caucasian	11
	South Asian	1
	East Asian	2
	Prefer not to answer	1
Child Ethnic Background		
	Caucasian	11
	South Asian	1
	East Asian	2
Caregiver Education		
	Graduate/Professional School	6
	Graduated from College or University	9
Family Structure		
	Single Parent Home	4
	Dual Parent Home	11
Total Family Income		
	$46K to $60K	3
	$61K to $80K	1

Table 3 Continued

		N
	$81K to $100K	1
	$101K to $150K	5
	$151K to $250K	3
	Over $250K	1
	Prefer not to answer	1
Caregiver Mobile Screen Time		
	High (> *Mdn* = 5.87)	8
	Low (< *Mdn* = 5.87)	7
Child Mobile Screen Time		
	High (> *Mdn* = 1.00)	7
	Low (< *Mdn* = 1.00)	8

Transcription and Coding of Interviews. Audio recordings were transcribed verbatim using the transcription software *Quickscribe* by the principal researcher and a trained research assistant with a Bachelors degree in Psychology. Following transcription, the principal researcher reviewed all transcriptions while listening to audio-recording of interviews to ensure accuracy of transcription.

NVivo, version 12 (QSR International, 2014) was used to organize data extracts, examine the data, compile and organize codes, and identify themes. Coding of the transcript were guided by a thematic analysis approach, which is suitable for applied research (Braun & Clarke, 2014). The use of thematic analysis offers flexibility when organizing and identifying patterns within the qualitative data by allowing interpretation of the data with or without a theoretical basis (Braun & Clarke, 2014). Therefore, data were coding and interpreted by the principal researcher, as well as by drawing on previous research.

Qualitative analysis was conducted following Braun & Clarke's (2006) five steps to thematic analysis. During step one (familiarizing oneself with the data), the transcripts were read several times to facilitate familiarity with the data while potential ideas, codes, and themes were noted. During step two (generation of initial codes), interviews were coded using a complete coding method described by Clarke and Braun (2013), which allows for the generation of as many potential codes as possible that appear relevant to the research questions, application of multiple codes to the same response, and the flexibility to select, discard, or collate similar codes later in the analysis. For example, the code *Calming Tool* was initially identified in step one, but then upon further review of the qualitative responses, it became apparent that there were two additional and distinct reasons for which caregivers chose to use mobile technology as a parenting tool beyond keeping their children calm; therefore, rendering three distinct codes

(*Calming Tool*, *Rewarding Tool*, and *Distraction Tool*) that were eventually housed under the overarching subtheme *Wanting to Limit Time VS. Useful Parenting Tool.* Conversely, it is important that similar codes with overlapping concepts be merged into one code for parsimony in the next step. For instance, caregivers noted that children became unresponsive to their surroundings (e.g., not responding when being called) when using their mobile technology. Caregivers also expressed concerns about children not socializing with others. The similarities across these two codes, in which children become disengaged with their surrounding environment were collated into one code named *Child Disengagement with Environment.* While refining codes, criteria for the inclusion or exclusion of excerpts into each code was also established to determine whether excerpts fit well under each code. The interviews were read through and coded several times to ensure that codes generated in the latter part of the process were also applied to interviews reviewed earlier in the coding process. Once all possible codes were generated, the third step (searching for themes) requires housing similar codes together to identify potential themes. In the present study concerns about the negative effects that mobile technology may have on children, such as concerns about decreased physical activity, increased bids for attention, and modelling poor behaviour, appeared across numerous interviews. These concerns were housed under the same themed named *Negative Effects and Changes in Child.* While a main theme is characterized by one central organizing concept, it is acceptable to create sub-themes which capture notable specific aspects within a central organizing concept (to represent one or two overarching patterns within a theme). It is acceptable to create miscellaneous themes. In the fourth step (reviewing themes), a "thematic map" is constructed. Themes were reviewed to ensure that codes extracted for each theme revealed a consistent pattern and whether themes make conceptual sense in relation to the entire data set and research

questions. Additionally, themes were also reviewed to ensure they were distinct from different themes. Candidate themes that did not meet these goals were removed and their corresponding codes were re-housed into different themes if appropriate. Coded data were revisited to ensure extracts were placed in the appropriate themes and un-coded sections of the interviews were reviewed and coded if relevant. Once there were no more changes to be made, the "thematic" map was considered complete. During the fifth step (naming themes), codes and extracts within each theme were reviewed to help define and name themes (see Table 4 for a final list of themes, codes, and coding criteria). Definitions of each theme were created and reflect interpretations of the patterns in the data set. The sixth step requires generating a report of the themes and relating them back to the research question. Throughout the report of themes, the use of *[…]* signals when words have been removed from extracts. Words within brackets *[]* signal speech that was inferred given the context of the interview. Interviews were continued until thematic saturation was reached (Braun & Clarke, 2006).

Table 4

Final List of Themes, Codes, and Coding Criteria

Theme Code	Coding Criteria	Example
Negative Effects/Changes in Child	This theme captures the negative effects or changes in the children's behaviour due to the use of mobile technology.	
Bids for Attention (73.3%)	Caregivers describes increased bids for attention while the caregiver is occupied with mobile technology, but not when the caregiver is occupied with other activities not involving mobile technology (e.g., cooking).	"He demands […] my attention by acting out. Say I'm trying to do something […] I have to post it, take pictures, write up the description, he'll just keep bugging me for something." (Mother of 3-year-old boy)
Child Preoccupation (46.7%)	Caregiver notes that the child is persistently asking for mobile technology and expressed concerns about excessive use of technology or addiction to technology.	"I think if they are engaged with it for too long, at their age, it's not great for their development […] it could be too early to get addicted to technology or to mobile technology." (Mother of 4-year-old girl)

Table 4 Continued

Theme Code	Coding Criteria	Example
Temper Tantrums or Heightened Emotionality (73.3%)	Caregivers note that the child throws temper tantrums or displays greater negative emotionality (e.g., irritability, frustration) when mobile technology is limited, removed, or when the child experiences difficulties (e.g., during a game).	Using it too long creates temper tantrums when I have to turn it off […] I'd say a lot of the times her temper tantrums revolve around – she just wants to watch more." (Mother of 2-year-old girl)
Child Disengagement With Environment (66.7%)	Caregivers note that the child becomes unresponsive and disengaged to their environment (e.g., calling the child's name).	"They basically become withdrawn zombies […] they don't pay attention to what's going on." (Mother of 5-year-old boy)
Delayed Self-Regulation (26.7%)	Caregivers express concerns about mobile technology interfering with the child's development of self-regulation	"Most kids should have that ability [to self-regulate]. But as parents or the society, we actually didn't give them the opportunity to do that [because of mobile technology]." (Mother of 5-year-old girl)

Table 4 Continued

Theme Code	Coding Criteria	Example
Delayed Social Skills (33.3%)	Caregivers express concerns about mobile technology interfering with the child's development of social skills	"They're losing a lot of their social aspect if they're sitting in front of an iPad all day long. They don't know how to play on their own and they don't know how to socialize." (Mother of 2-year-old girl)
Model Poor Behaviour (86.7%)	Caregivers express concerns about the child modelling behaviour learned from mobile media (e.g., aggressive behaviour, use of profanity) or modelling other children and adult's excessive use of mobile technology.	"[A bad app is] anything with swearing, violence, just rude things. I mean they're sponges, so they monkey see monkey do at this age." (Mother of 4-year-old boy)
Physical Health Issues (40%)	Caregivers express concerns regarding an array of negative physical health effects (e.g., decreased physical activity, eye and neck strain, etc.)	"I'm more cautious now about the posture […] if they're sitting up I always try to tell them, remind them to raise the iPad so it's eye level." (Mother of 5-year-old boy)
Caregiver Strategies	This theme captures the different strategies caregivers incorporate to regulate their children's use of mobile technology.	

Table 4 Continued

Theme Code	Coding Criteria	Example
Within Arm's Reach (86.7%)	Caregivers note engaging in technology with their children, keeping the sound of the technologies on so caregivers can hear, or keeping their children within arm's reach so that they can see or hear what their children are doing on these technologies.	"We're never too far from it, so keeping an eye on it […] over her shoulder […] I guess you could hear, even if we're not starting at it [mobile technology]." (Mother of 3-year-old girl)
Childlock (73.3%)	Caregivers describe using software features to regulate what their children have access to (e.g., use a child lock feature).	"We have programs with child block on it […]so that we decided what can be watched and what can be accessed." (Mother of 3-year-old girl)
Regulated Apps (66.7%)	Caregivers note only giving their children access to regulated apps (e.g., YouTube kids, Netflix kids).	"I'll put on Netflix, and she knows how to touch things on Netflix. So it's just the kid's version so everything's pretty much appropriate." (Mother of 2-year-old girl)
Caregiver Testing (53.3%)	Caregivers download apps for their children and test the apps before allowing children to use them.	"I first download it [the app] myself and try to use it first. Or decide on whether she can use it or not." (Mother of 4-year-old girl)

Table 4 Continued

Theme Code	Coding Criteria	Example
Tense Caregiver Attitudes	This theme captures tensions between the advantages or disadvantages of using or limiting caregiver and child access to mobile technology	
Wanting to limiting time VS. Educational benefits/Technology literacy (86.7%)	Caregivers expression tension over wanting to limit their children's use of mobile technology but recognizing the educational and technological benefits of using mobile technology (e.g., learning foundational academic skills like colors and letters or learning how to use the operating software on mobile technology).	"I want to be careful with what he does [on mobile technology] so it's less mind-numbing, him just watching and actually him getting something out of it so that we can talk about it afterwards, so that it becomes more meaningful." (Mother of 2-year-old boy)
Needing to use mobile technology VS. Negative feelings for not prioritizing child needs (73.3%)	Caregivers express tension over needing to use their mobile technology but experiencing negative feelings for not prioritizing their child.	"I guess I feel almost like, torn […] I'm trying to get something done, but then I want to pay attention to her." (Mother of 2-year-old girl)
Frustrated Feelings (26.7%)	Caregivers express feeling frustrated when using their mobile technology but recognizing the time taken away from their child.	"I did get frustrated when I was trying to work on taxes […] I feel frustrated sometimes if they're trying to get my attention." (Mother of 5-year-old boy)

Table 4 Continued

Theme Code	Coding Criteria	Example
Guilty Feelings (66.7%)	Caregivers express feeling guilty when using their mobile technology but recognizing the time taken away from from their child.	"Guilt for sure because I am not paying attention to him […]I don't like the fact that I'm on my phone." (Mother of 2-year-old boy)
Wanting to limit time VS. Useful Parenting Tool (100%)	Caregivers express tension over wanting to limit their children's use of mobile technology but recognizing the usefulness in using mobile technology as a parenting tool.	"I let him watch videos which are passive, so I don't love it, but it's kind of like sometimes you just have to entertain your kid in a situation" (Mother of 3-year-old boy)
Rewarding Tool (26.7%)	Caregiver note using mobile technology to reward their children's good or punish their children's bad behaviour.	"I allow him to use electronics as sort of a reward for taking the medication" (5-year-old boy; 3)
Calming Tool (60%)	Caregivers note using mobile technology to calm their children down when the child is irritated, dysregulated, or upset.	"Sometimes she's really tired or not feeling so well, it's a nice activity for her. It keeps her, you know, calmer." (Father of 3-year-old girl)

Table 4 Continued

Theme Code	Coding Criteria	Example
Distraction Tool (86.7)	Caregivers note using mobile technology to distract their children when caregivers are busy at home or in a public space (e.g., when caregiver is cooking, driving, in a waiting room).	"It's a distraction, it allows parents the time to get things done, take care of other siblings or do chores." (Mother of 5-year-old boy)
Other Codes		
Change in Caregiver Attention (86.6%)	Caregiver reported paying less attention to their children while they were using mobile technology.	"Um, possibly less. Because even though I try to multitask it just doesn't happen all the time." (Mother of 4-year-old boy)
Judgement of Other Parents (60%)	Caregivers expressing judging other caregiver who are using their phones around their children.	"If one's [caregiver] looking at their phone instead of attending to what their child's doing, or if their child is trying to get their attention […] and they're still looking at their phone, I think it's potentially harmful to the child." (2-year-old boy; Participant 9)

Table 4 Continued

Theme	Code	Coding Criteria	Example
Technology is a Normal Part of Life (40%)		Caregivers note that technology is a normal part of life and needs to be accepted and the use of technology by young children is acceptable and should not be stigmatized.	"There's a lot of negativity towards kids using technology. But it's not a bad thing, but people look at it […] a negative way most of the time" (Mother of 4-year-old boy)

CHAPTER IV

Results

Quantitative Analyses

Data Preparation

All descriptive and statistical analyses were conducted using Statistical Package for the Social Sciences, Version 25 (IBM, 2017). Prior to conducting any primary analyses, data were screened for participants who did not meet eligibility for the study or who failed to answer four out of five validity questions correctly. A total of 19 participants did not meet screening criteria, and an additional 6 failed to correctly answer all validity questions. The subsequent sample of N = 176 were examined for data entry errors, missing data, and outliers.

Missing data. Only one participant completed less than 80% of the questionnaire and was removed from the sample, leaving a sample of N = 175. Missing data were analyzed using a Missing Value Analysis (MVA) to reveal very little missing data. Across all participants and variables, only 1.12% of total data was absent. The MVA indicated that 38.98% of the variables and 32.57% of cases had some level of missing data. The only item missing more than 5% of data were regarding children's grade (9.0%); however, the missing data were attributed to poor item-structure since a *not applicable* option was not included and many caregivers of young children (age 2 to 3 years old) may not have responded to this item since their children are too young to be enrolled in school. Besides the item about children's level of education, the percentage of missing data across all variables in the data set ranged from 0% to 7.4% with the majority of variables missing only 0% to 0.6%. Little's MCAR test was conducted to determine whether the pattern of missing data were considered MCAR (Missing Completely at Random) or MAR (Missing at Random; Tabachnick & Fidell, 2013). Little's MCAR revealed that the data

were MCAR, X^2 (14969) = 8525.56, $p > .999$, suggesting that the pattern of missing data of any particular variable in the data set were unrelated to other variables in the data set.

When the pattern of missing data is determined to be MCAR, and missing data across each variable falls under 5% to 10%, the conditions for any imputation method is satisfied (Tabachnick & Fidell, 2013; Hair, Black, Babin, Anderson, & Tatham, 2010). Therefore, multiple-imputation, which is considered the most respectable method of dealing with missing data, was computed at the composite level with five iterations (Tabachnick & Fidell, 2013).

Outliers and Assumptions

A total of $N = 175$ participants were originally included in the dataset. Univariate outliers on the independent and dependent variables were examined by inspecting standardized residuals +/- 3.29 as potential outliers. The presence of outliers were further corroborated with a visual inspection of histogram, boxplots, and scatterplots. Outliers exceeding the acceptable value of +/- 3.29 were found on the following variables: children's participation in their home, daycare, and overall environment (YC-PEM-Home; YC-PEM Daycare; YC-PEM); children's use of technology across all platforms, caregiver's use of technology across all platforms, self-regulation (ISCI), aggression (CBCL $1^{1/2}$-5-AGG), and technoference (TIPS).

Assumptions of normality were assessed by reviewing the distribution of histograms, Q-plots, and boxplots, along with kurtosis and skewness values. Skewness values for aggression (CBCL $1^{1/2}$-5-AGG), as well as the use of technology across all platforms fell outside the acceptable range of -/+2, while kurtosis values for scales measuring children's participation in the home environment (YC-PEM-Home), effortful control (among children age 4 and 5; CBQ-EC), aggression (CBCL $1^{1/2}$-5-AGG), and the use of technology across all platforms fell outside the acceptable range of -/+3.

After screening for both outliers and non-normality across variables, outliers that were detected on variables *without* violations of normality (YC-PEM; YC-PEM-Daycare; ISCI; CBQ-EC; and TIPS) were winsorized in the interest of preserving sample size. After winsorizing, the assumptions of normality for these variables were met and all standardized residuals were within normal limits.

Regarding variables with both outliers and violations of normality, before deleting or modifying any cases, a fundamental decision is whether to handle outliers or violations of normality first (Tabachnick & Fidell, 2013). In order to make a decision, the number of outliers and severity of non-normality were inspected. Children's aggression (CBCL-$1^{1/2}$-5-AGG), participation in the home environment (YC-PEM-HOME), and effortful control (CBQ-EC) were threatened with few outliers and less drastic violations of normality; thus, deletion or modifications of these few outliers will would yield a normal distribution without requiring transformations to the data (Tabachnick & Fidell, 2013). After these aforementioned variables had been winsorized, the assumptions of normality were met and all standardized residuals were within normal limits.

All other scales measuring caregiver and child technology use (with the exception of *Caregiver Smartphone Use*) severely violated normality (maximum kurtosis and skewness values were 127.53 and 10.60, respectively; all positively skewed) and many outliers were identified. For these reasons, the transformation of variables prior to deleting or modifying scores is preferable since the likelihood of reducing outliers and producing normality increases after a transformation (Tabachnick & Fidell, 2013). Logarithmic transformations were applied to child and caregiver's use of technology across all platforms (except *Caregiver Smartphone Use*) to overcome skewness and bring them into compliance with normality prior to any data

modification. Since the smallest value across these variables were zero, a value of one was added to the logarithmic transformation as a constant (Tabachnick & Fidell, 2013). Transformations were undertaken prior to searching for any multivariate outliers because many statistics used to detect them are sensitive to failures of normality (Tabachnick & Fidell, 2013).

Univariate outliers and normality were assessed on the transformed variables. Following transformations, the skewness of *Child Tablet Use*, as well as *Caregiver Tablet Use* were reduced and outliers were eliminated. One outlier remained on *Child Television Use* and *Caregiver Television Use*, whereas two outliers remained on *Child Video Game Use*. These outliers were winsorized (exceeded residual cut-off of +/-3.29). Kurtosis values exceeding the acceptable limit (+/-3) were identified on *Child Smartphone Use*, *Child Computer Use*, *Child Video Game Use,* and *Child Computer* Use, as well as *Caregiver Video Game Use* and *Caregiver Computer Use.* Once outliers on these variables were winsorized, kurtosis values fell within acceptable limits. Thus, after winsorizing cases and applying transformation, no outliers or violations of normality were found on all measures of technology use with the exception of *Child Video Game Use, Child Computer Use, Caregiver Video Game Use*, and *Caregiver Computer Use.* These variables remained positively skewed after transformations and had limited variability since many caregivers reported no use of video games and computers for themselves or their child. These scales were dichotomized according to no use of video game or computers (assigned a 0) or some use of video game or computers (assigned a 1). All subsequent analyses including caregiver or child video game and computer use were analyzed using the dichotomized versions of these scales.

Multivariate outliers and influential data points were detected using a Leverage cut-off value of 0.167 at $p < .001$, and Cook's distance cut off-value of less than 1.00 (Tabachnick &

Fidell, 2013). Cook's distance across all cases fell under 1, while 1 case was identified as a multivariate outlier and therefore removed from the data set, leaving a remaining sample of N = 174 for analysis.

A scatterplot matrix between the residuals of all variables confirmed linear relationships between predictor and outcome variables thereby meeting the assumption of linearity. To assess the assumption of homoscedasticity, scatter plots of standardized residuals by standardized predicted values were examined for all primary analyses. The spread of the data within scatterplots across all primary analyses did not represent a funnel shape, suggesting that the assumption of homoscedasticity was met. The assumptions of multicollinearity and singularity were tested by examining the VIF and tolerance values. VIF values over 10 and tolerance values under 0.1 are considered problematic (Field, 2009). In the present sample, the assumption of multicollinearity was met, with VIF values ranging from 1.260 to 2.00 and tolerance values ranging from .501 to .793. Furthermore, a correlation matrix corroborated the absence of multicollinearity since no correlations approached or exceeded r = .90. Finally, the assumptions of independence of errors was tested using the Durbin-Watson statistic and met. The Durbin-Watson value across primary analyses fell within normal limits (between 1 and 3; Field, 2009) and ranged between 1.183 to 2.424.

Preliminary Quantitative Data Analyses

Descriptive statistics for all variables included in the primary analyses are presented in Table 5. In order to screen for potential covariates, study variables were examined in relation to pertinent demographic characteristics. Only the relations between demographic variables, and the main dependent variables of the primary analyses, technoference (TIPS), and the use of mobile technology as a parenting tool (PT) will be discussed. All other relations are displayed in Table

6. In terms of child characteristics, older children had significantly greater self-regulation deficits (ISCI) and caregivers reported significantly greater use of mobile technology as a parenting tool with boys. Independent samples t-test revealed that boys (n = 100; M = 20.87; SD = 5.47) were significantly more likely than girls (n = 74; M = 19.16; SD = 5.55) to use mobile technology when it was being used as a parenting tool ($t(172) = -2.02$, $p = .05$). Boys (M = 27. 63; SD = 5.67) were also significantly more likely than girls (M = 25.77; SD = 5.37) to display more emotion dysregulation ($t(172) = -2.18$, $p = .03$).

With respect to caregiver characteristics, caregivers who were younger and who had pursued less education experienced significantly greater technoference in the caregiver-child relationship. Lower caregiver education was also significantly related to greater use of mobile technology as a parenting tool. Finally, when considering family characteristics, family structure was dichotomized. Caregivers who reported being *Married*, *Living Together,* and *Remarried* were collapsed into one category representing two parent families (assigned a value of 1). Caregivers who reported being *Divorced*, *Separated,* and *None of the above* (all participants who selected this option reported being single) were collapsed into one category representing single parent families (assigned a value of 0). Caregivers from two-parent homes used significantly more technology as a parenting tool. Families with higher total annual incomes had children who participated in their environment (YC-PEM) significantly more and used less mobile technology as a parenting tool. Therefore, based on these relations, child age, child gender, caregiver age, caregiver education, family structure, and family income were included as controls in the subsequent analyses when the aforementioned variables were significantly related to the dependent variable being explored.

To further screen for potential covariates, relations between all study variables were examined with bivariate correlations and are presented in Table 7. Throughout the analyses, child and caregiver use of mobile technology (smartphones and tablets) may be referred to as child and caregiver's *mobile screen time* for brevity.

Only the relations between caregiver and child mobile screen time, potentially confounding variables, and the main dependent variables included in the primary analyses will be discussed. All other relations are presented in Table 7. First, greater child mobile screen time (MT-Child) was significantly related to greater caregiver mobile screen time (MT-Caregiver). Greater child and caregiver mobile screen time was significantly related to greater dysregulation (ISCI), aggression (CBCL $1^{1/2}$ – 5- AGG), technoference, and the use of mobile technology as a parenting tool. Greater use of mobile technology by caregivers was also significantly related to less participation in the environment by children (YC-PEM).

Second, when examining potentially confounding variables, lower social desirability (SDS-17) associated with significantly higher reports of aggressive behaviour. Greater negative affect (ECBQ/CBQ-NA) was significantly related to greater dysregulation, aggression, technoference and use of mobile technology as a parenting tool. Greater effortful control (ECBQ/CBQ-EC) was significantly related to less caregiver and child mobile screen time, dysregulation, aggression, technoference and the use of mobile technology as a parenting tool, but significantly related to greater participation in the environment.

Finally, with regards to other forms of technology use by children (television, video games, and computers), bivariate associations revealed that greater child mobile screen time was significantly associated with greater use of the television, video games, and computers. More time spent watching television was significantly related to less participation in the environment,

greater technoference, and greater use of mobile technology as a parenting tool (by caregivers). Meanwhile, greater use of video games was significantly related to greater dysregulation, technoference, and use of mobile technology as a parenting tool (by caregivers). Lastly, more time spent on the computer was significantly related to greater participation in the environment, but also greater use of mobile technology as a parenting tool (by caregivers). In terms of caregiver technology use, greater mobile screen time by caregivers was only significantly related to greater use of the television. More time spent watching television was significantly related to less participation in the environment, greater technoference, and greater use of mobile technology as a parenting tool. Meanwhile, more time spent on the computer significantly related to greater participation in the environment, but also greater use of mobile technology as a parenting tool. The time that caregivers spent playing video games was not related to any pertinent study variables. Drawing from these results, social desirability, negative affect, child use of the television, video games, and the computers, as well as caregiver use of television and computers were included as covariates in the subsequent analyses the aforementioned variables were significantly related to the dependent variable being explored.

Associations between the Emotion Regulation Checklist (ERC) and the Inhibitory Self-Control Index (ISCI) as measured by the BRIEF-P revealed that greater liability/negativity (ERC-LN; higher scores representing greater emotion dysregulation) was significantly related to greater dysregulation (ISCI), whereas greater emotion regulation (and positive expression of emotions; ERC-ER) was significantly related to lower dysregulation (ISCI). These patterns of result suggest that the Inhibitory Self-Control Index is a good indicator of self-dysregulation.

Table 5

Descriptive Statistics for Primary Study Variables (N = 174)

Variable	*M*	*SD*	*Min.*	*Max.*
MT-Child	.34	.27	0	9.12
MT-Caregiver	.77	.25	0	24.14
ISCI	52.14	10.91	43	87
CBCL $1^{1/2}$ – 5-AGG	53.51	5.49	50	72
YC-PEM	5.71	.65	3.78	7.44
Home	6.76	.61	5	7.85
Community	4.33	.93	2.09	7
Daycare	6.25	1.32	2	8
TIPS	2.35	.85	1	5.08
PT	20.14	5.55	10	36

Note. MT-Child = Total Child Mobile Screen Time; MT-Caregiver = Total Caregiver Mobile Screen Time; ISCI = Inhibitory Self Control Index (BRIEF-P); CBCL $1^{1/2}$ – 5-AGG = Child Behavior Checklist- Preschool Version Aggression Subscale; YC-PEM = Young Children's Participation and Environment Measure; TIPS = Technology Interference in Parenting Scale (Total Technoference); PT = Total Parenting Tool.

Table 6

Correlations between Demographics and Study Variables (N = 174)

	Child Age	Child Gender	Caregiver Age	Family Structure	Caregiver Education	Total Annual Income
ISCI	.18*	-.05	-.04	.06	-.13	-.10
CBCL $1^{1/2}$ – 5-AGG	-.04	-.10	-.02	.01	-.15	-.13
YC-PEM	.06	-.01	.04	-.09	.19*	.25**
YC-PEM-Home	.04	.03	-.08	-.00	.13	.19*
YC-PEM-Community	-.03	-.01	.04	.03	.08	.16*
YC-PEM-Daycare	.21**	-.02	.21**	-.10	.27**	.12
TIPS	.04	-.08	-.23**	-.09	-.30**	-.09
PT	.02	-.15*	-.15	-.16*	-.30**	-.21**
SDS-17	-.10	.10	-.01	-.03	-.03	-.07
ECBQ/CBQ-S	-.45**	-.06	-.14	-.07	-.07	-.06
ECBQ/CBQ-EC	.12	.04	.15*	.11	.23**	.10
ECBQ/CBQ-NA	.62**	-.00	.01	.07	-.10	-.16*
ERC-LN	.20**	-.16*	-.04	-.07	-.11	-.22**
ERC-ER	-.00	-.03	-.02	-.09	-.16*	-.11
MT-Child	-.06	-.05	-.08	-.11	-.18*	-.23**
TV-Child	-.19*	-.03	-.20**	-.08	-.17*	-.17*
Computer-Child	.08	-.03	.00	-.13	-.02	-.04
VideoGame-Child	.18*	-.09	-.03	-.14	-.14	-.17*
MT-Caregiver	-.17*	.04	-.23**	-.12	-.20**	-.16*
TV-Caregiver	-.19*	-.03	-.20**	-.08	-.17*	-.17*
Computer-Caregiver	.08	-.03	.00	-.13	-.02	-.04
VideoGame-Caregiver	.08	-.12	-.05	-.06	-.12	-.18*

Note. Inhibitory Self Control Index (BRIEF-P); CBCL $1^{1/2}$ – 5-AGG = Child Behavior Checklist- Preschool Version Aggression Subscale; YC-PEM = Young Children's Participation and Environment Measure; TIPS = Technology Interference in Parenting Scale (Total Technoference); PT = Total Parenting Tool; SDS-17 = Social Desirability Scale-17; ECBQ/CBQ-S = Early Child Behaviour Questionnaire/Child Behaviour Questionnaire-Surgency; ECBQ/CBQ-EC = Effortful Control; ECBQ/CBQ-NA = Negative Affect; ERC-LN = Emotion Regulation Checklist – Lability/Negativity; ERC - ER =Emotion Regulation Checklist – Emotion Regulation Scale; TV-Child = Child Television Use; Computer-Child; Child Computer Use; VideoGame-Child = Child Video game Use; TV-Caregiver = Caregiver Television Use; Computer-Caregiver = Caregiver Computer Use; VideoGame – Caregiver = Caregiver Video game Use.
*$p < .05$. ** $p < .01$

Table 7

Bivariate Correlations between Main Variables, Technology Use Variables, and Potential Confounding Variables (N = 174)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
1. MT-Child	-	.42**	.18*	.26**	-.10	-.11	-.04	-.09	.36**	.56**	-.02	.01	-.16*	.14	.26**	-.20**	.48**	.16*	.25**	.48**	.16*	.01
2. MT-Caregiver	-	-	.24**	.29**	-.20**	-.17*	-.11	-.23**	.23**	.32**	-.02	.09	-.15*	.06	.25**	-.24*	.40**	.15	.10	.40**	.15	.02
3. ISCI	-	-	-	.64**	-.25**	-.31**	-.13	-.11	.19*	.28**	-.12	-.07	-.38**	.39**	.76**	-.32**	.10	.04	.17*	.10	.04	.06
4. CBCL $1^{1/2}$-5-AGG	-	-	-	-	-.16*	-.24**	-.04	-.09	.25**	.34**	-.21**	.03	-.37**	.22**	.72**	-.43**	.11	.06	.14	.12	.06	.08
5. YC-PEM	-	-	-	-	-	.76**	.87**	.57**	-.16*	-.21**	-.04	-.00	.38**	-.03	-.21**	.26**	-.17*	.18*	.01	-.17*	.18*	.08
6. YC-PEM-Home	-	-	-	-	-	-	.41**	.23**	-.18*	-.33**	-.02	.05	.48**	-.07	-.23**	.40**	-.18*	.10	-.06	-.18*	.10	.04
7. YC-PEM-Community	-	-	-	-	-	-	-	.38**	-.05	-.03	-.04	-.02	.20**	-.01	-.11	.07	-.09	.19*	.04	-.09	.19*	.08
8. YC-PEM-Daycare	-	-	-	-	-	-	-	-	-.19*	-.16*	-.03	-.05	.16*	.08	-.05	.17*	-.11	.11	.05	-.11	.11	.05
9. TIPS	-	-	-	-	-	-	-	-	-	.51**	-.03	-.11	-.29**	.23**	.18*	-.22**	.22**	.13	.19*	.22**	.13	.06
10. PT	-	-	-	-	-	-	-	-	-	-	.01	.01	-.23**	.26**	.35**	-.19*	.32**	.17*	.32**	.32**	.17*	.03
11. SDS-17	-	-	-	-	-	-	-	-	-	-	-	.02	.13	-.06	-.18*	.13	-.02	.08	.02	-.02	.08	-.05
12. ECBQ/CBQ-S	-	-	-	-	-	-	-	-	-	-	-	-	-.00	-.41**	.01	.16*	.10	.01	-.03	.10	.01	.05
13. ECBQ/CBQ-EC	-	-	-	-	-	-	-	-	-	-	-	-	-	.05	-.34**	.46**	-.23**	.00	-.23**	-.23**	.00	-.11
14. ECBQ/CBQ-NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.43**	-.17*	.04	.12	.13	.04	.12	-.05
15. ERC-LN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.46**	.16*	.04	.17*	.17*	.04	.05
16. ERC-ER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.04	-.12	-.20*	-.04	-.12	-.10
17. TV-Child	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.07	.16*	1.00**	-.07	.00
18.Computer-Child	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.38**	-.07	1.00**	.20**
19. VideoGame-Child	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.16*	.38**	.42**
20. TV-Caregiver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.07	.00
21.Computer-Caregiver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.20**
22. VideoGame-Caregiver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note. MT-Child = Total Child Mobile Screen Time; MT-Caregiver = Total Caregiver Mobile Screen Time; ISCI = Inhibitory Self Control Index (BRIEF-P); CBCL $1^{1/2}$ – 5-AGG = Child Behavior Checklist- Preschool Version Aggression Subscale; YC-PEM = Young Children's Participation and Environment Measure; TIPS = Technology Interference in Parenting Scale (Total Technoference); PT = Total Parenting Tool; SDS-17 = Social Desirability Scale – 17; ECBQ/CBQ-S = Early Child Behaviour Questionnaire/Child Behaviour Questionnaire-Surgency; ECBQ/CBQ-EC = Effortful Control; ECBQ/CBQ-NA = Negative Affect; ERC – LN = Emotion Regulation Checklist – Lability/Negativity; ERC – ER = Emotion Regulation Checklist – Emotion Regulation Scale; TV-Child = Child Television Use; Computer-Child; Child Computer Use; VideoGame-Child = Child Video game Use; TV-Caregiver = Caregiver Television Use; Computer-Caregiver = Caregiver Computer Use; VideoGame – Caregiver = Caregiver Video game Use.
*$p < .05$. ** $p < .01$

Hypothesis 1A: Associations Between Child Mobile Technology Use, Self-regulation, and Aggression

Self-regulation. It was hypothesized that greater use of mobile technology by children (MT-Child) would predict greater deficits in self-regulation (ISCI). A hierarchical multiple regression model was tested by entering confounding demographic variables, such as child age and negative affect (ECBQ/CBQ-NA) into step one. Next, children's use of video games was entered into the second step (VideoGame-Child), followed by child mobile screen time (MT-Child) in the third step. The overall model for the hierarchical multiple regression analysis was significant ($R^2 = .16$, $F(4, 169) = 9.34$, $p < .001$) and the set of predictors accounted for 16% of the overall variance. Yet, only negative affect (ECBQ/CBQ-NA) emerged as a significant predictor of dysregulation, whereas child mobile screen time (MT-Child) did not, suggesting that children's mobile screen time did not uniquely predict greater dysregulation above and beyond children's negative affect. A summary of the MRA is presented in Table 8.

Table 8

Multiple Regression Analysis of Child Mobile Screen Time Predicting Self-Regulation (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ/CBQ-NA	4.64	.93	.45	.00	2.81	6.47	.12
	Child Age	-1.13	.97	-.11	.25	-3.04	.78	.01
Step 2								
	ECBQ/CBQ-NA	4.61	.92	.45	.00	2.80	6.43	.12
	Child Age	-1.39	.97	-.13	.15	-3.30	.52	.01
	VideoGame-Child	3.38	1.70	.14	.05	.03	6.73	.02
Step 3								
	ECBQ/CBQ-NA	4.36	.94	.42	.00	2.49	6.22	.10
	Child Age	-1.12	1.00	-.10	.26	-3.09	.84	.01
	VideoGame-Child	2.84	1.76	.12	.11	-.63	6.31	.01
	MT-Child	3.65	3.16	.09	.25	-2.59	9.89	.01

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; MT-Child = Total Child Mobile Screen Time

R^2 = .39, adjusted R^2 = .15 for step 1 (p < .001); ΔR2 = .02, adjusted R^2 = .16 for step 2 (p = .05); ΔR^2 = .02, adjusted R^2 = .16 for step 3 (p = .25).

Aggression. To test the hypothesis that greater use of mobile technology by children (MT-Child) would predict greater aggressive behavior (CBCL $1^{1/2}$ – 5-AGG), another hierarchical multiple regression model was tested. Social desirability (SDS-17), and negative affect (ECBQ/CBQ-NA) were entered into the first step of the model as controls, followed by children's mobile screen time (MT-Child) into the second and final step. Consistent with the hypothesis, the overall model was significant ($R^2 = .11$, $F(3, 170) = 7.80$, $p < .001$) and the set of predictors accounted for 11% of the overall variance. Specifically, lower social desirability (SDS-17), more negative affect (ECBQ/CBQ-NA), and greater use of mobile technology by children (MT-Child) all emerged as significant predictors of aggression. Child mobile screen time (MT-Child) accounted for 5% of unique variance in the model; thus, suggesting that greater use of mobile technology by children is a significant predictor of more aggressive behaviour over and above negative affect and socially desirable responding. A summary of the MRA is presented in Table 9.

Table 9

Multiple Regression Analysis of Child Mobile Screen Time Predicting Aggression (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ/CBQ-NA	.95	.38	.18	.01	.19	1.70	.03
	SDS-17	-.29	.13	-.17	.02	-.54	-.04	.03
Step 2								
	ECBQ/CBQ-NA	.77	.38	.15	.04	.03	1.52	.03
	SDS-17	-.29	.12	-.17	.02	-.53	-.04	.03
	MT-Child	5.04	1.55	.24	.00	1.98	8.12	.05

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; MT-Child = Total Child Mobile Screen Time

R^2 = .07, adjusted R^2 = .06 for step 1 (p < .001); ΔR^2 = .06, adjusted R^2 = .11 for step 2 (p < .001).

Hypothesis 1B: Associations Between Caregiver Mobile Technology use, Self-regulation, and Aggression

Self-regulation. It was hypothesized that greater use of mobile technology by caregivers (MT-Caregiver) would predict greater dysregulation in children (ISCI). A hierarchical multiple regression model was tested by entering child age and negative affect (ECBQ/CBQ-NA) into step one, child video game use (VideoGame-Child) into step two, and finally caregiver mobile screen time (MT-Caregiver) into step three. The overall model was significant (R^2 = .19, $F(4,169) = 11.14$, p =.00) and the set of predictors accounted for 19% of the overall variance. Specifically, greater negative affect (ECBQ/CBQ-NA) and greater caregiver mobile screen time (MT-Caregiver) emerged as significant predictors, with caregiver mobile screen time (MT-Caregiver) explaining 3% of unique variance. Taken together, the results supported the hypothesis that greater caregiver use of mobile technology predicts more dysregulation above and beyond negative affect, children's use of video games, and the age of the child. A summary of the MRA is presented in Table 10.

Table 10

Multiple Regression Analysis of Caregiver Mobile Screen Time Predicting Self-Regulation (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ/CBQ-NA	4.64	.93	.45	.00	2.81	6.47	.12
	Child Age	-1.13	.97	-.11	.25	-3.04	.78	.01
Step 2								
	ECBQ/CBQ-NA	4.61	.92	.45	.00	2.80	6.43	.12
	Child Age	-1.39	.97	-.13	.15	-3.30	.52	.01
	VideoGame-Child	3.38	1.70	.14	.05	.03	6.73	.02
Step 3								
	ECBQ/CBQ-NA	4.10	.92	.40	.00	2.28	5.92	.09
	Child Age	-.63	.99	-.06	.51	-2.61	1.30	.00
	VideoGame-Child	2.78	1.68	.12	.10	-.55	6.09	.02
	MT-Caregiver	8.50	3.15	.19	.01	2.28	14.72	.03

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; MT-Caregiver = Total Caregiver Mobile Screen Time

R^2 = .16, adjusted R^2 = .15 for step 1 (p < .001); ΔR2 = .02, adjusted R^2 = .16 for step 2 (p = .05); ΔR^2 = .03, adjusted R^2 = .19 for step 3 (p = .01).

Aggression. In terms of aggressive behaviour, it was predicted that greater use of mobile technology by caregivers (MT-Caregiver) would predict more aggressive behaviour (CBCL $1^{1/2}$ – 5-AGG) in children. Using a hierarchical multiple regression analysis, social desirability (SDS-17) and negative affect (ECBQ/CBQ-NA) were entered into the first step, followed by caregiver mobile screen time (MT-Caregiver) into the second step. As predicted, the overall regression model was significant ($R^2 = .13$, $F(3, 170) = 9.56$, $p < .001$) and accounted for 13% of the overall variance. Greater negative affect (ECBQ/CBQ-NA), less socially desirable responding (SDS-17), and greater caregiver's use of mobile technology (MT-Caregiver) all emerged as unique predictors of aggression (CBCL $1^{1/2}$ – 5-AGG). Specifically, caregiver mobile screen time accounted for 8% of unique variance in aggression, suggesting that caregiver's use of mobile technology is a significant predictor of aggressive behaviour in children over and above the effect of negative affect and socially desirable responding. A summary of the MRA is presented in Table 11.

Table 11

Multiple Regression Analysis of Caregiver Mobile Screen Time Predicting Aggression (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ/CBQ-NA	.95	.38	.18	.01	.19	1.70	.03
	SDS-17	-.29	.13	-.17	.02	-.54	-.04	.03
Step 2								
	ECBQ/CBQ-NA	.87	.37	.17	.02	.14	1.59	.03
	SDS-17	-.28	.12	-.17	.02	-.52	-.05	.03
	MT-Caregiver	6.18	1.57	.28	.00	3.08	9.28	.08

Note. ECBQ/CBQ-NA = Combined Negative Affect; SDS-17 = Social Desirability Scale -17; MT-Caregiver = Total Caregiver Mobile Screen Time

R^2 = .07, adjusted R^2 = .06 for step 1 (p < .001); ΔR2 = .08, adjusted R^2 = .13 for step 2 (p <.001).

Hypothesis 2A: Associations Between Caregiver and Child Mobile Screen Time and Children's Participation in the Environment

A multivariate multiple regressions analysis was conducted to examine whether child and caregiver screen time together (MT-Child and MT-Caregiver) collectively predicted fewer activities across the home, community, and daycare setting (YC-PEM-Home, Community, Daycare) after controlling for caregiver education, annual income, child use of television and computers, and caregiver use of television and computers. The first model was constructed with only potential covariates as predictor variables, while the second model was constructed with both potential covariates, as well as child and caregiver mobile screen time (MT-Child and MT-Caregiver) as predictor variables. The overall multivariate test (of the second model) revealed that caregiver's and children's use of mobile technology collectively (MT-Child and MT-Caregiver) were significant predictors of children's participation in the environment across domains, (Wilk's $\Lambda = .09$, $F(27, 470.85) = 21.69$, $p < .001$). Specifically, univariate results indicated that children's participation in the home (Adjusted $R^2 = .06$, $F(5.60, 2.50) = 2.24$, $p = .02$), community (Adjusted $R^2 = .50$, $F(72.56, 3.61) = 20.08$, $p < .001$), and daycare (Adjusted $R^2 = .81$, $F(106.10, 1.40) = 75.78$, $p < .001$) were significantly related to the set of predictors. When examining children's participation in the home setting (YC-PEM-Home), child or caregiver mobile technology did not predict participation at home beyond the set of covariates. When examining children's participation in the community (YC-PEM-Community), more caregiver mobile screen time (MT-Caregiver) significantly predicted greater participation in the community over and above the set of covariates. Finally, when examining children's participation in a daycare setting (YC-PEM-Daycare), less child mobile screen time (MT-Child)

significantly predicted greater participation in the daycare setting above and beyond the set of covariates. See Table 12 for a summary of the multivariate regression.

Table 12

Multivariate Regression Analysis of Caregiver and Child Mobile Screen Time Predicting Child Participation in Activities Across Domains (N=174)

						95% CI	
Dependent Variable	Predictors Variable	*B*	*SE B*	β	*p*	*Lower*	*Upper*
Model 1							
YC-PEM-Home							
	Parent Education	.03	.05	.06	.57	-.08	.14
	Other Parent Education	.01	.10	.01	.93	-.18	.20
	Family Income	-.06	.06	-.10	.33	-.17	.06
	TV-Child	.03	.08	.05	.71	-.13	.19
	Computer-Child	.08	.10	.14	.41	-.12	.28
	TV-Caregiver	.05	.09	.06	.57	-.13	.23
	Computer-Caregiver	-.24	.09	-.33	.01	-.41	-.07
YC-PEM-Community							
	Parent Education	.58	.07	.65	.00	.45	.71
	Other Parent Education	-.22	.11	-.19	.06	-.44	.01
	Family Income	-.60	.07	-.67	.00	-.74	-.47
	TV-Child	.18	.10	.16	.07	-.01	.38
	Computer-Child	.23	.12	.23	.06	-.01	.47
	TV-Caregiver	-.23	.11	-.17	.03	-.44	-.02
	Computer-Caregiver	-.11	.10	-.09	.30	-.31	.10

Table 12 Continued

						95% CI	
Dependent Variable	Predictors Variable	*B*	*SE B*	β	*p*	*Lower*	*Upper*
YC-PEM-Daycare							
	Parent Education	.06	.04	.07	.14	-.10	.13
	Other Parent Education	.75	.07	.65	.00	.62	.88
	Family Income	-.30	.04	-.34	.00	-.38	-.22
	TV-Child	-.65	.06	-.60	.00	-.77	-.54
	Computer-Child	.14	.07	.14	.06	-.01	.28
	TV-Caregiver	.14	.06	.11	.03	.01	.27
	Computer-Caregiver	-.16	.06	-.14	.01	-.29	-.04
Model 2							
YC-PEM-Home							
	Parent Education	.02	.06	.03	.77	-.10	.13
	Other Parent Education	-.04	.10	-.06	.69	-.24	.16
	Family Income	.09	.11	.10	.42	-.13	.31
	TV-Child	.13	.10	.15	.22	-.08	.34
	Computer-Child	-.13	.06	-.22	.04	-.25	-.00
	TV-Caregiver	.00	.06	.01	.96	-.12	.13
	Computer-Caregiver	.15	.10	.24	.11	-.04	.34
	MT-Child	.04	.09	.06	.66	-.14	.22
	MT-Caregiver	-.17	.09	-.21	.07	-.35	.02
YC-PEM-Community							
	Parent Education	.61	.07	.69	.00	.47	.75
	Other Parent Education	-.14	.12	-.12	.27	-.38	.12
	Family Income	-.04	.13	-.03	.78	-.30	.22

Table 12 Continued

Dependent Variable	Predictors Variable	*B*	*SE B*	β	*p*	95% CI *Lower*	95% CI *Upper*
	TV-Child	-.20	.13	-.14	.12	-.44	.05
	Computer-Child	-.61	.08	-.63	.00	-.76	-.46
	TV-Caregiver	.17	.08	.17	.02	.02	.32
	Computer-Caregiver	.05	.12	.05	.67	-.18	.28
	MT-Child	.05	.11	.04	.66	-.17	.26
	MT-Caregiver	.26	.11	.20	.03	.03	.48
YC-PEM-Daycare							
	Parent Education	.03	.04	.03	.50	-.06	.11
	Other Parent Education	.33	.08	.29	.00	.18	.49
	Family Income	.04	.08	.03	.63	-.12	.20
	TV-Child	.03	.08	.02	.71	-.12	.18
	Computer-Child	-.36	.05	-.39	.00	-.46	-.27
	TV-Caregiver	-.43	.05	-.44	.00	-.52	-.34
	Computer-Caregiver	.05	.07	.05	.52	-.10	.19
	MT-Child	-.21	.07	-.20	.00	-.34	-.08
	MT-Caregiver	.01	.07	.01	.87	-.13	.15

Note. TV-Child/TV-Caregiver = Total Child/Caregiver Television Use; Computer-Child/Computer-Caregiver = Total Child/Caregiver Computer Use; MT-Child/MT-Caregiver = Total Child/Caregiver Mobile Technology Use.

Model 1: Wilk's $\Lambda = .09$, $F(21, 468.60) = 29.30$; YC-PEM-Home: Adjusted $R^2 = .05$, $F(5.68, 2.53) = 2.24$, $p = .03$); YC-PEM-Community: Adjusted $R^2 = .50$, $F(92.34, 3.61) = 25.59$, $p < .001$); YC-PEM-Daycare: Adjusted $R^2 = .81$, $F(138.68, 1.29) = 107.80$, $p < .001$)

Hypothesis 2B: Associations Between Caregiver and Child Mobile Screen Time and Technoference in the Parent-Child Relationship

Two hierarchical multiple regression analyses were conducted to examine whether caregiver and child mobile screen time would predict technoference in the parent-child relationship.

Caregiver screen time. It was hypothesized that greater use of mobile technology by caregivers (MT-Caregiver) would predict greater technoference in the parent-child relationship (TIPS). A hierarchical multiple regression model was tested by entering confounding demographic information, such as child age and negative affect (ECBQ/CBQ-NA) into step one. Next, caregiver education, children's use of video games (VideoGame-Child), and caregiver use of television (TV-Caregiver) were entered into the second step. Finally, caregiver mobile screen time (MT-Caregiver) was entered into the third and final step. The overall model for the linear multiple regression analysis was not significant ($R^2 = .16$, $F(6, 167) = 6.34$, $p = .00$) and the set of predictors accounted for 16% of the overall variance. Yet, greater child negative affect (ECBQ/CBQ-NA) and lower caregiver education emerged as significant predictors of more technoference, while caregiver mobile screen time (MT-Caregiver) did not. These results suggest that caregiver mobile screen time did not uniquely predict more technoference above and beyond the covariates. A summary of the MRA is presented in Table 13.

Table 13

Multiple Regression Analysis of Caregiver Mobile Screen Time Predicting Technoference (N=174)

						95% CI		
		B	*SE B*	*β*	*p*	*Lower*	*Upper*	*sr²*
Step 1	Child Age	-.14	.08	-.17	.08	-.29	.02	.02
	ECBQ/CBQ-NA	.27	.08	.33	.00	.12	.42	.07
Step 2								
	Child Age	-.09	.08	-.11	.26	-.25	.07	.01
	ECBQ/CBQ-NA	.20	.07	.25	.01	.06	.35	.04
	Caregiver Education	-.25	.08	-.23	.00	-.40	-.09	.05
	VideoGame-Child	.24	.14	.13	.08	-.03	.51	.02
	TV-Caregiver	.47	.27	.13	.08	-.06	.99	.02
Step 3								
	Child Age	-.07	.08	-.09	.38	-.23	.09	.00
	ECBQ/CBQ-NA	.19	.07	.24	.01	.04	.34	.03
	Caregiver Education	-.23	.08	-.22	.00	-.39	-.08	.04
	VideoGame-Child	.23	.14	.16	.09	-.04	.50	.01
	TV-Caregiver	.34	.28	.10	.23	-.22	.89	.01
	MT-Caregiver	.37	.27	.11	.17	-.16	.90	.01

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; TV-Caregiver = Caregiver Television Use; MT-Caregiver = Caregiver Mobile Screen Time
R^2 = .07, adjusted R^2 = .06 for step 1 (p = .00); $\Delta R2$ = .11, adjusted R^2 = .15 for step 2 (p = .00); ΔR^2 = .01, adjusted R^2 = .16 for step 3 (p = .17).

Child screen time. It was also hypothesized that greater use of mobile technology by children (MT-Child) would predict greater technoference in the parent-child relationship (TIPS). A hierarchical multiple regression model using the same aforementioned covariates (ECBQ.CBQ-NA, VideoGame-Child, TV-Caregiver, caregiver education, child age) were entered as controls. Child mobile screen time (MT-Child) was entered into the third and final step. The overall model was significant (R^2 = .19, F(6, 167) = 7.76, p = .00) and the set of predictors accounted for 19% of the overall variance. Specifically, greater negative affect (ECBQ/CBQ-NA), lower caregiver education, and greater use of child mobile screen time (MT-Child) all emerged as significant predictors. Child mobile screen time (MT-Child) accounted for 4% of unique variance in the model; thus, suggesting that child use of mobile technology is a significant predictor of more technoference over and above negative affect and caregiver education. A summary of the MRA is presented in Table 14.

Table 14

Multiple Regression Analysis of Child Mobile Screen Time Predicting Technoference (N=174)

						95% CI		
		B	*SE B*	*β*	*p*	*Lower*	*Upper*	*sr²*
Step 1	Child Age	-.14	.08	-.17	.08	-.29	.02	.02
	ECBQ/CBQ-NA	.27	.08	.33	.00	.12	.42	.07
Step 2								
	Child Age	-.09	.08	-.11	.26	-.25	.07	.01
	ECBQ/CBQ-NA	.20	.07	.25	.01	.06	.35	.04
	Caregiver Education	-.25	.08	-.23	.00	-.40	-.09	.05
	VideoGame-Child	.24	.14	.13	.08	-.03	.51	.02
	TV-Caregiver	.47	.27	.13	.08	-.06	.99	.02
Step 3								
	Child Age	-.07	.08	-.08	.41	-.22	.09	.00
	ECBQ/CBQ-NA	.17	.07	.21	.02	.03	.31	.03
	Caregiver Education	-.23	.08	-.21	.00	-.38	-.08	.04
	VideoGame-Child	.16	.14	.09	.23	-.10	.43	.01
	TV-Caregiver	.11	.29	.03	.69	-.45	.67	.00
	MT-Child	.80	.27	.24	.00	.27	1.33	.04

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; TV-Caregiver = Caregiver Television Use; MT-Child = Child Mobile Screen Time

R^2 = .07, adjusted R^2 = .06 for step 1 (p = .00); $\Delta R2$ = .11, adjusted R^2 = .15 for step 2 (p = .00); ΔR^2 = .05, adjusted R^2 = .19 for step 3 (p = .00).

Hypothesis 3A: Associations Between Children's Participation in the Environment, Self-Regulation, and Aggression

Four hierarchical multiple regression analyses were conducted to examine whether the frequency at which children participate in the activities of their environment predicts dysregulation and aggression. It was hypothesized that less participation and engagement in the environment by children would predict greater dysregulation and aggression. Children's participation in their environment was examined by using an overall participation score (YC-PEM), as well as exploring participation across the home (YC-PEM-Home), community (YC-PEM-Community), and daycare setting (YC-PEM-Daycare).

Self-Regulation. To examine the role of children's overall participation in their environment (YC-PEM) in predicting dysregulation (ISCI), child age and negative affect (ECBC/CBQ-NA) were entered into the first step as controls. Next, child video game use (VideoGame-Child) was entered into the second step. Finally, children's overall participation in their environment was entered into the third step (YC-PEM). Consistent with the hypothesis, the overall model was significant ($R^2 = .21$, $F(4, 169) = 12.43$, $p < .001$) and the set of predictors explained 21% of the overall variance. Specifically, greater negative affect (ECBQ/CBQ-NA), greater children's use of video games (VideoGame-Child), and less overall participation in the environment (YC-PEM) emerged as significant predictors of aggression. Specifically, overall participation in the environment accounted for 5% of unique variance in the presence of all other predictors. See Table 15 for a summary of the MRA model.

Table 15

Multiple Regression Analysis of Children's Overall Participation in the Environment Predicting Self-Regulation (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ-CBQ-NA	4.64	.93	.45	.00	2.81	6.47	.12
	Child Age	-1.13	.97	-.12	.25	-3.04	.78	.01
Step 2								
	ECBQ-CBQ-NA	4.61	.92	.45	.00	2.80	6.43	.12
	Child Age	-1.39	.97	-.13	.15	-3.30	.52	.01
	VideoGame-Child	3.38	1.70	.14	.05	.033	6.73	.02
Step 3								
	ECBQ-CBQ-NA	4.36	.89	.42	.00	2.59	6.12	.11
	Child Age	-1.08	.94	-.10	.26	-2.94	.79	.01
	VideoGame-Child	3.379	1.65	.14	.04	.13	6.63	.02
	YC-PEM	-3.88	1.14	-.23	.00	-6.13	-1.63	.05

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; YC-PEM = Young Children Participation and Environment Measure.

R^2 = .16, adjusted R^2 = .15 for step 1 (p < .001); ΔR2 = .02, adjusted R^2 = .16 for step 2 (p = .05); ΔR^2 = .05, adjusted R^2 = .21 for step 3 (p = .01).

The role of children's participation in the environment was further explored by examining the specific role of engagement in the home, community, and daycare setting in predicting self-regulation (ISCI) using hierarchical multiple regression analysis. Child age and negative affect (ECBQ/CBQ-NA) were entered into the first step, followed by child video game use (VideoGame-Child) in the second step, and children's participation in the home (YC-PEM-Home), community (YC-PEM-Community), and daycare setting (YC-PEM-Daycare) in the third step. Overall, the regression model was significant ($R^2 = .22$, $F(6, 167) = 9.22$, $p < .001$) and the set of predictors accounted for 22% of the overall variance. In particular, greater negative affect and less participation in the home environment uniquely predicted greater deficits in self-regulation, with participation in the home explaining 5% of unique variance. See Table 16 for a summary of the MRA model.

Table 16

Multiple Regression Analysis of Children's Participation Across Settings Predicting Self-Regulation (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ-CBQ-NA	4.64	.93	.45	.00	2.81	6.47	.12
	Child Age	-1.13	.97	-.12	.25	-3.04	.78	.01
Step 2								
	ECBQ-CBQ-NA	4.61	.92	.45	.00	2.80	6.43	.12
	Child Age	-1.39	.97	-.13	.15	-3.30	.52	.01
	VideoGame-Child	3.38	1.70	.14	.05	.03	6.73	.02
Step 3								
	ECBQ-CBQ-NA	4.14	.89	.40	.00	2.37	5.90	.10
	Child Age	-.76	.96	-.07	.43	-2.66	1.15	.00
	VideoGame-Child	2.99	1.64	.13	.07	-.25	6.23	.01
	YC-PEM-Home	-4.51	1.34	-.25	.01	-7.15	-1.87	.05
	YC-PEM-Community	.07	.93	.01	.94	-1.77	1.90	.00
	YC-PEM-Daycare	0.62	.62	-.08	.32	-1.85	.60	.00

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; YC-PEM = Young Children Participation and Environment Measure.
R^2 = .16, adjusted R^2 = .15 for step 1 (p < .001); $\Delta R2$ = .02, adjusted R^2 = .16 for step 2 (p = .05); ΔR^2 = .07, adjusted R^2 = .22 for step 3 (p < .001).

Aggression. To examine the role of children's overall participation in their environment (YC-PEM) in predicting aggression (CBCL $1^{1/2}$ – 5-AGG), negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) were entered into the first step of the regression model. Children's overall participation in the environment (YC-PEM) was entered into the second and final step. As predicted, the overall model was significant ($R^2 = .08$, $F(3, 170) = 5.83$, $p < .001$) and the set of predictors explained 8% of the total variance. Greater negative affect (ECBQ/CBQ-NA), less socially desirable responding (SDS-17), and less overall participation in the environment (YC-PEM) all emerged as significant predictors of more aggressive behaviour in the model. Specifically, overall participation in the environment explained 3% of unique variance in the presence of all other predictors. See Table 17 for a summary of the MRA model.

Table 17

Multiple Regression Analysis of Children's Overall Participation in the Environment Predicting Aggression (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ-CBQ-NA	.95	.38	.18	.01	.19	1.70	.03
	SDS-17	-.29	.13	-.17	.02	-.54	-.04	.03
Step 2								
	ECBQ-CBQ-NA	.92	.38	.18	.02	.17	1.67	.03
	SDS-17	-.30	.13	-.18	.02	-.55	-.06	.03
	YC-PEM	-1.39	.62	-.17	.03	-2.61	-.17	.03

Note. ECBQ/CBQ-NA = Combined Negative Affect; SDS-17 = Social Desirability Scale-17; YC-PEM = Young Children Participation and Environment Measure.
R^2 = .07, adjusted R^2 = .06 for step 1 (p < .001); ΔR2 = .03, adjusted R^2 = .08 for step 2 (p = .03).

The role of children's participation was further explored by examining participation in the home, community, and daycare setting in predicting aggression (CBCL $1^{1/2}$ – 5-AGG). Negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) were entered into the first step, followed by participation in the home (YC-PEM-Home), community (YC-PEM-Community), and daycare setting (YC-PEM-Daycare) in the second step. Overall, the regression model was significant ($R^2 = .10$, $F(5, 168) = 5.00$, $p < .001$) and the set of predictors accounted for 10% of the overall variance in aggression (CBCL $1^{1/2}$ – 5-AGG). In particular, greater negative affect (ECBQ/CBQ-NA), lower social desirability (SDS-17), and lower participation in the home environment (YC-PEM-Home) emerged as significant predictors of more aggressive behaviour, with home participation explaining 5% of unique variance. See Table 18 for a summary of the MRA model.

Table 18

Multiple Regression Analysis of Children's Participation Across Settings Predicting Aggression (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ-CBQ-NA	.95	.38	.18	.01	.19	1.70	.03
	SDS-17	-.29	.13	-.17	.02	-.54	-.04	.03
Step 2								
	ECBQ-CBQ-NA	.90	.38	.17	.02	.16	1.64	.03
	SDS-17	-.30	.12	-.17	.02	-.54	-.05	.03
	YC-PEM-Home	-2.24	.71	-.25	.00	-3.65	-.83	.05
	YC-PEM-Community	.54	.50	.09	.28	-.44	1.51	.01
	YC-PEM-Daycare	-.37	.33	-.09	.26	-1.01	.28	.01

Note. ECBQ/CBQ-NA = Combined Negative Affect; SDS-17 = Social Desirability Scale -17; YC-PEM-Home/Community/Daycare = Young Children's Participation and Environment Measure – Home/Community/Daycare Subscales.
R^2 = .07, adjusted R^2 = .06 for step 1 (p < .001); ΔR2 = .63, adjusted R^2 = .10 for step 2 (p = .01).

Hypothesis 3B: Associations Between Technoference, Self-Regulation, and Aggression

Self-regulation. It was hypothesized that greater technoference between the caregiver-child relationship (TIPS) would predict greater deficits in children's self-regulation (ISCI). A hierarchical multiple regression model was examined by entering child age and negative affect (ECBQ/CBQ-NA) into the first step, child video game use (VideoGame-Child) into the second step, and technoference (TIPS) into the third and final step. The overall model was significant ($R^2 = .16$, $F(4, 169) = 9.23$, $p < .001$) and the set of predictors explained 16% of the total variance. However, whereas greater negative affect (ECBQ/CBQ-NA) emerged as a unique predictor of dysregulation (ISCI), technoference (TIPS) did not; thus, disconfirming the hypothesis that greater technoference would predict more dysregulation in children. See Table 19 for a summary of the MRA.

Table 19

Multiple Regression Analysis of Technoference Predicting Self-Regulation (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ-CBQ-NA	4.64	.93	.45	.00	2.81	6.47	.12
	Child Age	-1.13	.97	-.11	.25	-3.04	.78	.01
Step 2								
	ECBQ-CBQ-NA	4.61	.92	.45	.00	2.80	6.43	.12
	Child Age	-1.39	.97	-.13	.15	-3.30	.53	.01
	VideoGame-Child	3.38	1.70	.14	.05	.03	6.73	.02
Step 3								
	ECBQ-CBQ-NA	4.37	.95	.42	.00	2.49	6.25	.10
	Child Age	-1.23	.98	-.12	.21	-3.17	.70	.01
	VideoGame-Child	3.05	1.73	.13	.08	-.36	6.47	.02
	TIPS	.94	.95	.07	.33	-.94	2.80	.00

Note. ECBQ/CBQ-NA = Combined Negative Affect; VideoGame-Child = Total Child Video Game Use; TIPS = Technoference in Parenting Scale.

R^2 = .16, adjusted R^2 = .15 for step 1 (p < .001); ΔR2 = .02, adjusted R^2 = .16 for step 2 (p = .05); ΔR^2 = .01, adjusted R^2 = .16 for step 3 (p = .33).

Aggression. It was also hypothesized that greater technoference in the caregiver-child relationship (TIPS) would predict more aggressive behaviour in children (CBCL $1^{1/2}$ – 5-AGG). A hierarchical multiple regression model was examined by entering negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) into the first step, followed by technoference (TIPS) into the second step. Overall, the regression model was significant ($R^2 = .09$, $F(3, 170) = 6.85$, $p < .001$) and the set of predictors accounted for 9% of the total variance. Specifically, lower social desirability (SDS-17) and greater technoference (TIPS) predicted more aggression in children. Technoference accounted for 4% of unique variance over and beyond the presence of negative affect and socially desirable responding. See Table 20 for a summary of the MRA model.

Table 20

Multiple Regression Analysis of Technoference Predicting Aggression (N=174)

						95% CI		
		B	*SE B*	β	*p*	*Lower*	*Upper*	sr^2
Step 1								
	ECBQ-CBQ-NA	.95	.38	.18	.01	.19	1.70	.03
	SDS-17	-.29	.13	-.17	.02	-.54	-.04	.03
Step 2								
	ECBQ-CBQ-NA	.70	.39	.14	.07	-.06	1.46	.02
	SDS-17	-.28	.12	-.17	.02	-.53	-.04	.03
	TIPS	1.35	.48	.21	.01	.40	2.30	.04

Note. ECBQ/CBQ-NA = Combined Negative Affect; SDS-17 = Social Desirability Scale -17; TIPS = Technoference in Parenting Scale.

R^2 = .07, adjusted R^2 = .06 for step 1 (p < .001); ΔR2 = .04, adjusted R^2 = .09 for step 2 (p = .01).

Hypothesis 3C: Mediating Role of Displacement, Mobile screen time, Self-regulation and Aggression

The third hypothesis tested the displacement hypothesis by examining whether displacement (the disruption and disengagement from activities by children as operationalized by children's participation in their daily environment (YC-PEM) and technoference (TIPS) would mediate the relation between child use of mobile technology (MT-Child) and self-regulation (ISCI) or aggression (CBCL $1^{1/2}$ – 5-AGG). Both children's participation in the environment (YC-PEM) and technoference (TIPS) were included as mediators in the same multiple mediation model to construct a more parsimonious model that captures overall displacement of important activities and social interactions in children's daily lives. Two multiple mediation models were tested using the PROCESS macro (Preacher & Hayes, 2008). Bias-corrected bootstrap analyses (k = 5,000) tested indirect effects.

Self-regulation. A multiple mediation model tested whether children's overall participation in their environment (M: YC-PEM) and technoference (M: TIPS) mediated the relation between child mobile screen time (X: MT-Child) and self-regulation (Y: ISCI), with child age, video game use (VideoGame-Child), and negative affect (ECBQ/CBQ-NA) as covariates in the model. The total indirect effect of child mobile screen time (MT-Child) on self-regulation (ISCI) through the set of mediators was not significant (B = 1.25, SE = 1.30, 95% CI [-1.17, 3.96]), suggesting no significant mediating role through the set of mediators. Specifically, neither children's participation in the environment (YC-PEM; B = .95, SE = .85, 95% CI [-.23, 3.18]) nor technoference (TIPS; B = .31, SE = 1.54, 95% CI [1.98, 2.61]) were significant

mediators in the model. Overall, displacement did not mediate the relation between children's mobile technology use and self-regulation. See Figure 1 for a summary of the mediation model.

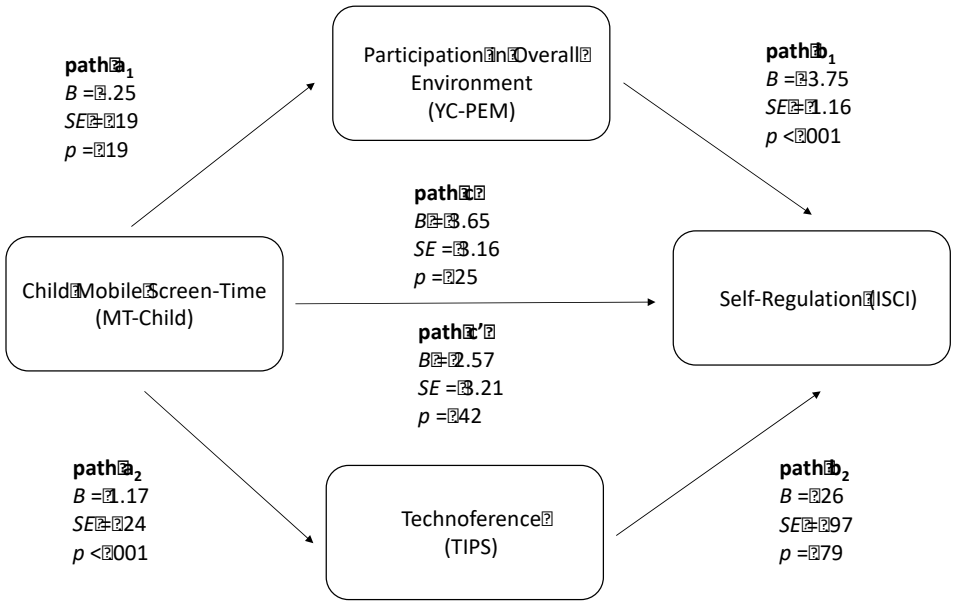

Figure 1. Hypothesis 3C multiple mediation model testing children's participation in the overall environment and technoference as mediators between child mobile screen time and self-regulation. Children's participation in the environment and technoference did not significantly mediate the relation between child mobile screen time and self-regulation.

Aggression. A second multiple mediation model tested whether children's overall participation in their environment (M: YC-PEM) and technoference (M: TIPS) would mediate the relation between child mobile screen time (X: MT-Child) and aggression (Y: CBCL $1^{1/2}$-5-AGG), with negative affect (ECBQ/CBQ-NA) and socially desirable responding (SDS-17) as covariates in the model. The total indirect effect of child mobile screen time (MT-Child) on aggression (CBCL $1^{1/2}$-5-AGG) through the set of mediators was significant (*B* = 1.61, *SE* = .74, 95% CI [.35, 3.30]. In particular, whereas technoference emerged as a significant partial mediator (TIPS; *B* = 1.30; *SE* = .65, 95% CI [.20,2.82]), children's participation in the environment (YC-PEM, *B* = .32, *SE* = .35, 95% CI [-.07, 1.41]) did not. As depicted in Figure 2, the total effect of child mobile screen time on aggression was significant, but after partialling out the effect of children's participation in the environment and technoference, the strength of the direct effect was reduced. Thus, representing a partial mediation with technoference as a significant partial mediator.

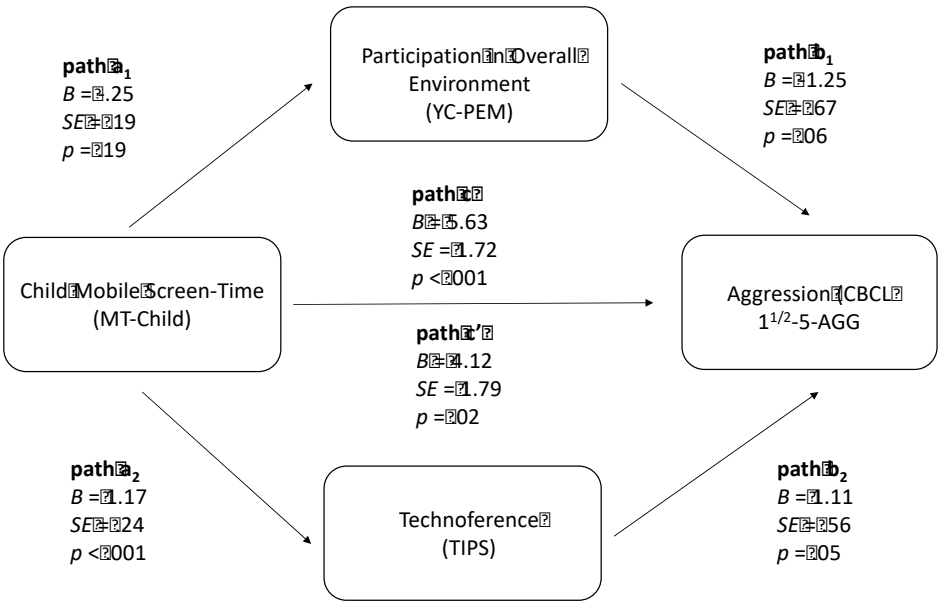

Figure 2. Hypothesis 3C multiple mediation model testing children's participation in the overall environment and technoference as mediators between child mobile screen time and aggression. As depicted in the figure, the direct effect (path c') weakened in the presence of the mediators. Particularly, technoference emerged as a significant partial mediator, thereby providing evidence for a partial mediation.

Additional analyses with self-regulation as Y. With respect to the aforementioned multiple regression models, given that the caregiver's mobile screen time significantly predicted dysregulation and aggression in children over and above all other covariates, two additional multiple mediation models were tested with caregiver mobile screen time as the predictor variable (X: MT-Caregiver).

The first model examined whether children's overall displacement (M: YC-PEM) and disruption (M: TIPS) in their environment would mediate the relation between caregiver's mobile technology use (MT-Caregiver) and self-regulation (Y: ISCI). Child age, video game use (VideoGame-Child), and negative affect (ECBQ/CBQ-NA) were entered as covariates in the model. The total indirect effect of caregiver mobile screen time (MT-Caregiver) on self-regulation (ISCI) through the set of mediators was significant (*B* = 1.97, *SE* = 1.10, 95% CI [.19, 4.48]. In particular, whereas children's participation in the environment emerged as a significant partial mediator (YC-PEM; *B* = 1.77, *SE* = .89, 95% CI [.45, 4.04]), technoference in the caregiver-child relationship did not (TIPS; *B* = .20, *SE* = .81, 95% CI [-1.13, 2.17]). As depicted in Figure 3, the total effect of caregiver mobile screen time on self-regulation was significant, but after partialling out the effect of children's participation in the environment and technoference, the strength of the direct effect was reduced. Thus, representing a partial mediation with child participation in the overall environment as a significant partial mediator.

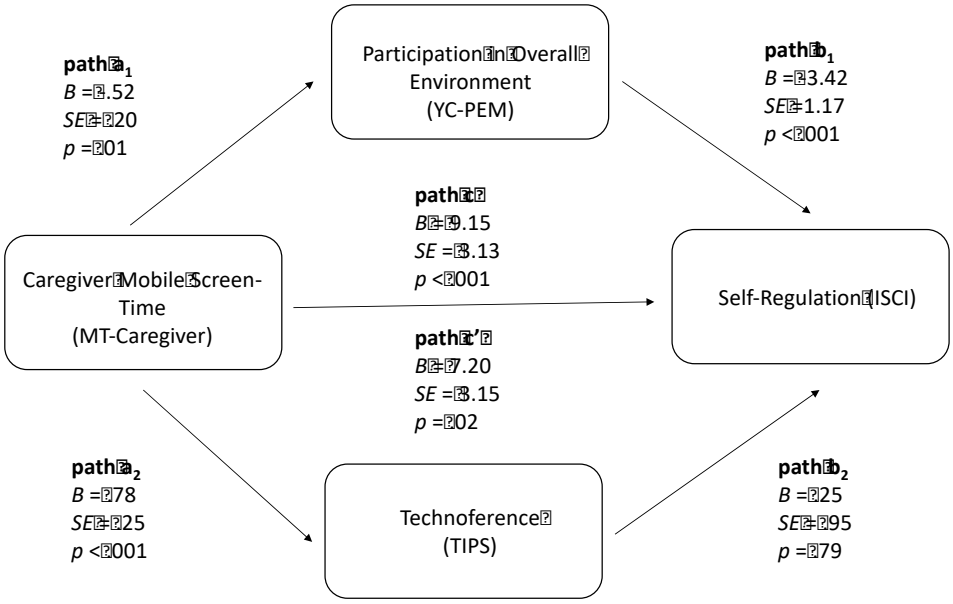

Figure 3. Hypothesis 3C multiple mediation model testing children's participation in the overall environment and technoference as mediators between caregiver mobile screen time and self-regulation. As depicted in the figure, the direct effect (path c') weakened in the presence of the mediators. Particularly, overall participation in the environment emerged as a significant partial mediator, thereby providing evidence for a partial mediation.

Additional analyses with aggression as Y. The second model tested whether children's overall displacement (M:YC-PEM) and disruption (M: TIPS) in their environment mediated the relation between caregiver's mobile screen time (X: MT-Caregiver) and aggression (Y: CBCL $1^{1/2}$-5-AGG). Negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) were entered as covariates in the model. The total indirect effect of caregiver mobile screen time (MT-Caregiver) on aggression (CBCL $1^{1/2}$-5-AGG) though the set of mediators together was significant (*B* = 1.14, *SE* = .58, 95% CI [.20, 2.58]). In particular, whereas technoference emerged as a significant partial mediator (*B* = .71, *SE* = .42, 95% CI [.08, 1.83]), children's participation in the environment did not (*B* = .43, *SE* = .40, 95% CI [-.20, 1.43]). As depicted in Figure 4, the total effect of caregiver mobile screen time on aggression was significant, but after partialling out the effect of children's participation in the environment and technoference, the strength of the direct effect was reduced. Thus, representing a partial mediation with technoference as a significant partial mediator.

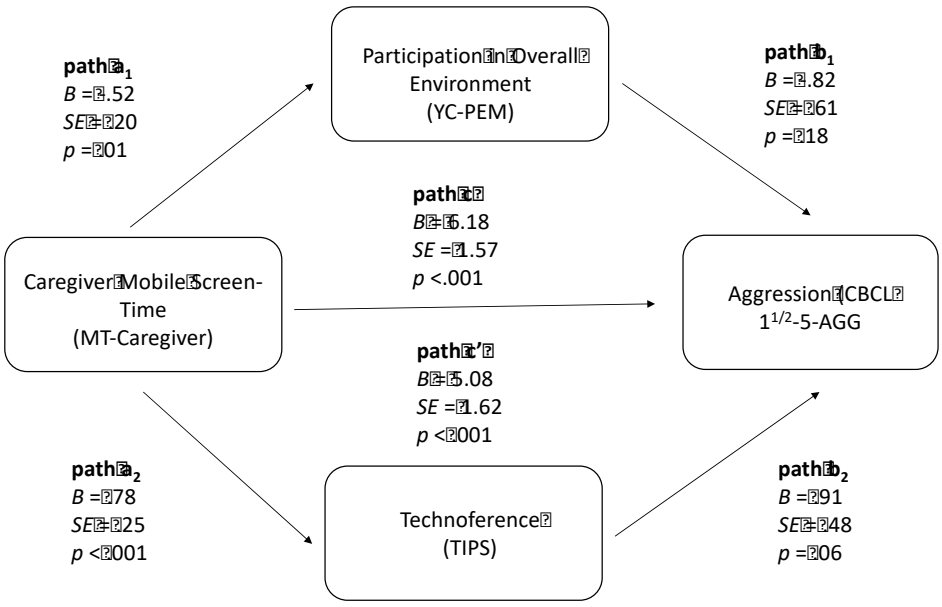

Figure 4. Hypothesis 3C multiple mediation model testing children's participation in the overall environment and technoference as mediators between caregiver mobile screen time and aggression. As depicted in the figure, the direct effect (path c') weakened in the presence of the mediators. Particularly, technoference emerged as a significant partial mediator, thereby providing evidence for a partial mediation.

Hypothesis 4A: Mediating Role of using Mobile Technology as a Parenting Tool, Mobile Screen Time, Self-Regulation, and Aggression

The fourth hypothesis examined whether using mobile technology as a parenting tool (PT) would mediate the relation between children's use of mobile technology (MT-Child) and self-regulation (ISCI) and aggression (CBCL-$1^{1/2}$-5-AGG). Two mediation analyses were tested using the PROCESS macro with the aforementioned parameters (Preacher & Hayes, 2008).

Self-regulation. The first mediation model tested whether using mobile technology as a parenting tool (M: PT) would mediate the relation between child mobile screen time (X: MT-Child) and self-regulation (Y: ISCI), with negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) as covariates in the model. The total indirect effect of child mobile screen time (MT-Child) on self-regulation (ISCI) through parenting tool (PT) was not significant (*B* =3.32, *SE* = 2.00, 95% CI [-.40, 7.54]), suggesting no mediating effect of using mobile technology as a parenting tool. See Figure 5 for a summary of the mediation model.

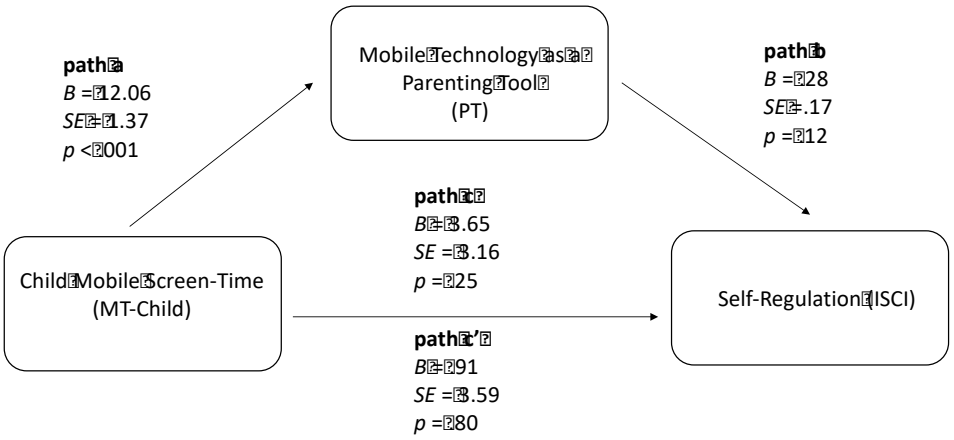

Figure 5. Hypothesis 4A mediation model testing the use of mobile technology as a parenting tool as a mediator between child mobile screen time and self-regulation. Using mobile technology as a parenting tool did not significantly mediate the relation between child mobile screen time and self-regulation.

Aggression. The second mediation model tested whether using mobile technology as a parenting tool (M: PT) would mediate the relation between child mobile screen time (X: MT-Child) and aggression (Y: CBCL $1^{1/2}$-5-AGG), with negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) as covariates in the model. The indirect effect revealed that using mobile technology as a parenting tool (PT) was a significant mediator (*B* = 3.15, *SE* = 1.13, 95% CI [1.23, 5.68]). As depicted in Figure 6, the total effect of child mobile screen time on aggression was significant, but after partialling out the effect of using mobile technology as a parenting tool, the strength of the direct effect was reduced to non-significance representing a full mediation. See Figure 6 for a summary of the mediation model.

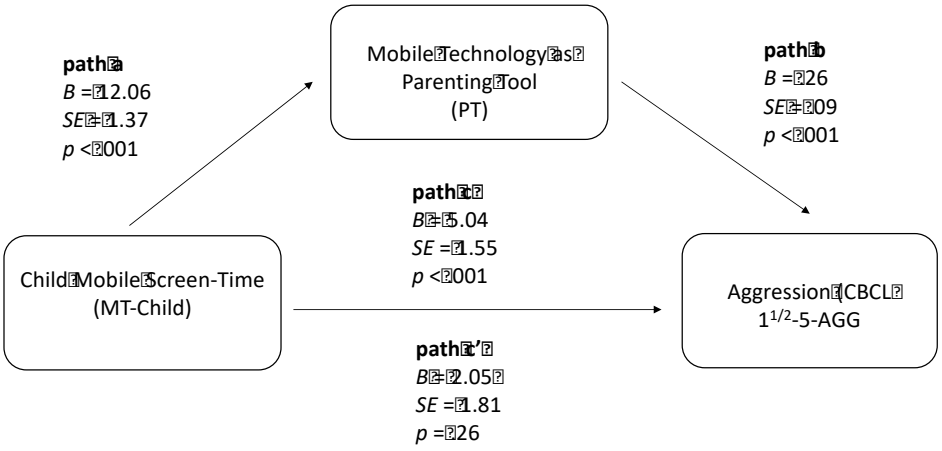

Figure 6. Hypothesis 4A mediation model testing the use of mobile technology as a parenting tool as a mediator in the relation between child mobile screen time and aggression. As depicted in the figure, the direct effect (path c') reduced to non-significance upon the inclusion of the mediator, providing evidence for a full mediation.

Additional analyses with self-regulation as Y. Given that the use of mobile technology by caregivers significantly predicted dysregulation and aggression in children, two additional mediation models were tested with caregiver mobile screen time as the predictor variable (X: MT-Caregiver).

The first model examined whether the use of mobile technology as a parenting tool (M: PT) mediated the relation between caregiver's mobile technology use (X: MT-Caregiver) and self-regulation (Y: ISCI). Child age, video game use (VideoGame-Child), and negative affect (ECBQ/CBQ-NA) were entered as covariates in the model. The total indirect effect of caregiver mobile screen time (MT-Caregiver) on self-regulation (ISCI) through parenting tool (PT) was not significant was significant (*B* = 1.48, *SE* = 1.19, 95% CI [-.49, 4.32]), suggesting no mediating effect of using mobile technology as a parenting tool. See Figure 7 for a summary of the mediation model.

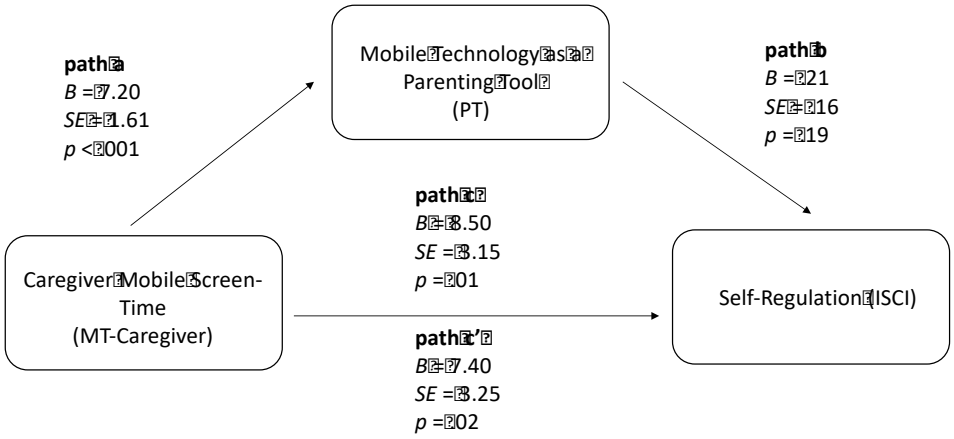

Figure 7. Hypothesis 4A mediation model testing the use of mobile technology as a parenting tool as a mediator between caregiver mobile screen time and self-regulation. The use of mobile technology as a parenting tool did not significantly mediate the relation between caregiver mobile screen time and self-regulation.

Additional analyses with aggression as Y. The second mediation model tested whether using mobile technology as a parenting tool (M: PT) mediated the relation between caregiver's mobile screen time (X: MT-Caregiver) and aggression (Y: CBCL $1^{1/2}$-5-AGG). Negative affect (ECBQ/CBQ-NA) and social desirability (SDS-17) were entered as covariates in the model. The total indirect effect of caregiver mobile screen time (MT-Caregiver) on aggression (CBCL $1^{1/2}$-5-AGG) was significant (*B* = 1.78, *SE* = .68, 95% CI [.70, 3.40]). As depicted in Figure 8, the total effect of caregiver mobile screen time on aggression was significant, but after partialling out the effect of using mobile technology as a parenting tool, the strength of the direct effect was reduced. Thus, representing a partial mediation with mobile technology as a parenting tool as a significant partial mediator.

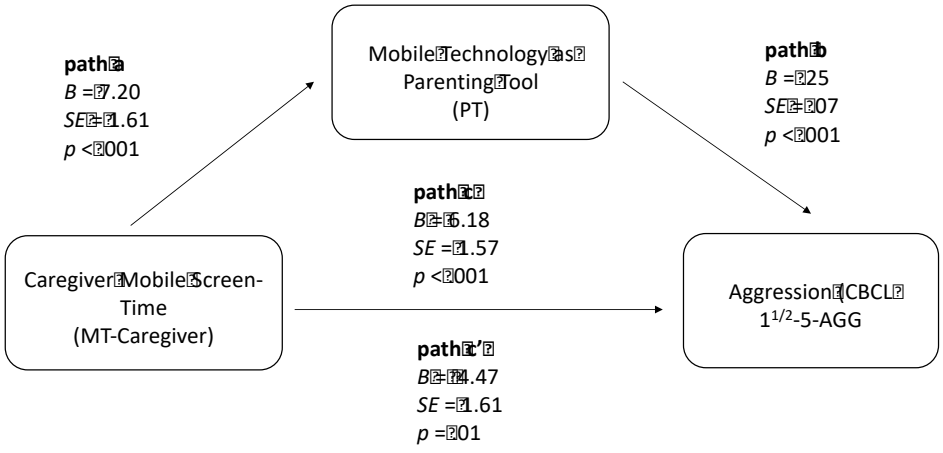

Figure 8. Hypothesis 4A mediation model testing the use of mobile technology as a parenting tool as a mediator between caregiver mobile screen time and aggression. As depicted in the figure, the direct effect (path c') weakened in the presence of the mediators. Particularly, with mobile technology as parenting tool emerging as a significant partial mediator, thereby providing evidence for a partial mediation.

Additional Analyses with Self-Regulation as a Mediator

When considering the relation between child screen time predicting self-regulation (i.e., Hypothesis 1A), the absence of a significant relationship does not dismiss the impact that mobile technology use may have on the self-regulation skills of children. Drawing from theory and previous studies, the skills used to inhibit impulses and regulate self-control are also used to modulate and inhibit aggression (Toole, Sarah, Monks, Tsermentseli, 2017; Rohlf, Holl, Kirsch, Krahé, & Elsner, 2018). Therefore, it stands to reason that deficits in self-regulation have implications for the development of aggressive behaviour in children. In other words, although children's use of mobile technology did not directly predict self-regulation (see Hypothesis 1A) and that technoference or the use of mobile technology as a parenting tool did not mediate this relation (see Hypothesis 3C and Hypothesis 4A), the role of self-regulation may be better captured as a set of skills responsible for setting forth the trajectories of aggressive and non-aggressive behaviour in children. That is, technoference and the use of mobile technology as a parenting tool may have an *indirect effect* on aggression *through* self-regulation.

To test this hypothesis, two mediation models were tested with child age, negative affect (ECBQ/CBQ-NA), and social desirability (SDS-17) as specified covariates. The first mediation model tested whether self-regulation (M: ISCI) mediated the relation between technoference (X: TIPS) and aggression (Y: CBCL $1^{1/2}$-5-AGG). The total indirect effect of technoference (TIPS) on aggression (CBCL $1^{1/2}$-5-AGG) was significant (*B* = .77, *SE* = .36, 95% CI [.16, 1.64]). As displayed in Figure 9, the total effect of technoference on aggression was significant, but upon the inclusion of self-regulation as a mediator, the strength of the direct effect was reduced. Thus, representing a partial mediation.

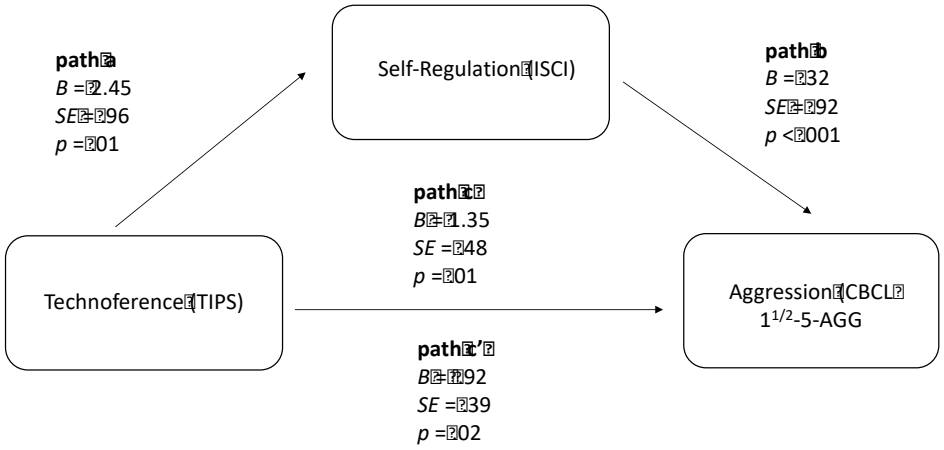

Figure 9. Mediation model testing the mediating effect of self-regulation between technoference and aggression. As depicted in the figure, the direct effect (path c') weakened in the presence of the mediators, thereby providing evidence for a partial mediation.

The second mediation model tested whether self-regulation (M: ISCI) mediated the relation between using mobile technology as a parenting tool (X: PT) and aggression (Y: CBCL $1^{1/2}$-5-AGG). The total indirect effect of using mobile technology as a parenting tool (PT) on aggression was significant (*B* = .17, *SE* = .05, 95% CI [.07, .29]). As displayed in Figure 10, the total effect of using mobile technology as a parenting tool on aggression was significant, but upon the inclusion of self-regulation as a mediator, the strength of the direct effect was reduced thus, representing a partial mediation.

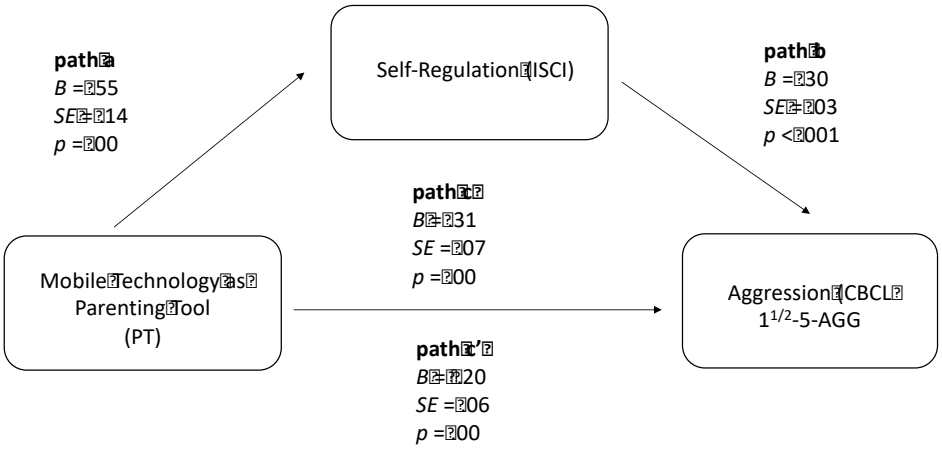

Figure 10. Mediation model testing the mediating effect of self-regulation between using mobile technology as a parenting tool and aggression. As depicted in the figure, the direct effect (path c') weakened in the presence of the mediators, thereby providing evidence for a partial mediation.

Additional Analyses with Temperament

Across the majority of analyses, child negative affect was included as a covariate given, as it was significantly related to self-regulation and aggression. Moreover, negative affect often emerged as a significant predictor of self-regulation or aggression; therefore, the temperament of children – particularly greater negative affect, appears to play a definitive role in the formation of self-regulation and aggressive behaviour in young children. Alarmingly, the attraction hypothesis (Gentile et al., 2012) proposed that more temperamental, difficult, and fussy children (e.g., greater negative affect) have underdeveloped self-control and thereby, have greater difficulty resisting the exciting appeal of digital media. This lack of self-control leads to increased mobile media usage in these children. Additionally, children with more difficult temperaments have been noted to use greater amounts of mobile technology because caregivers who are frustrated with their children's behaviour were found to be more likely to use mobile technology as a means to regulate or calm their fussy children (Radesky et al., 2014b). Taken together, although temperamental children may already be at a higher risk for displaying dysregulated and aggressive behaviour, greater use of mobile technology by either the child or the caregiver, greater use of mobile technology as a parenting tool, and greater technoference in the caregiver-child relationship, may exacerbate the risk of dysregulation and aggressive behaviour in children with high negative affect. Not surprisingly, higher negative affect (ECBQ/CBQ-NA) was significantly related to more dysregulation (ISCI), more aggression, (CBCL-$1^{1/2}$-5-AGG), greater technoference (TIPS), and greater use of mobile technology as a parenting tool (PT). For these reasons, further exploration into the role that mobile technology may play in the relation between negative affect, and self-regulation and aggression is warranted. Two multiple mediation models were tested, with technoference (M: TIPS), use of mobile technology as a parenting tool (M:

PT), and child and caregiver screen time (M: MT-Child and MT-Caregiver) as potential mediators. Including four mediators into one model parsimoniously captures a more holistic picture of the technology landscape in the child environment and child-caregiver relationship.

The first model examined the mediating effect of the four aforementioned mediators in the relation between negative affect (X: ECBQ/CBQ-NA) and self-regulation (Y: ISCI), with child age and child use of video game (VideoGame-Child) as specified covariates. As displayed in Figure 11, the total indirect effect of the set of mediators on self-regulation was not significant (*B* = .38, *SE* = .30, 95% CI [-.14, 1.05]). Specifically, neither the use of mobile technology as a parenting tool (*B* = .23, *SE* = .19, 95% CI [-.13, .61]), technoference (*B* = .03, *SE* = 1.04, 95% CI [-.13, .60]), child mobile screen time (*B* = -1.53, *SE* = 3.72 , 95% CI [-8.88, 5.83]), or caregiver mobile screen time (*B* = 7.79, *SE* = 3.42, 95% CI[1.04, 14.54]) mediated the relation between negative affect and self-regulation.

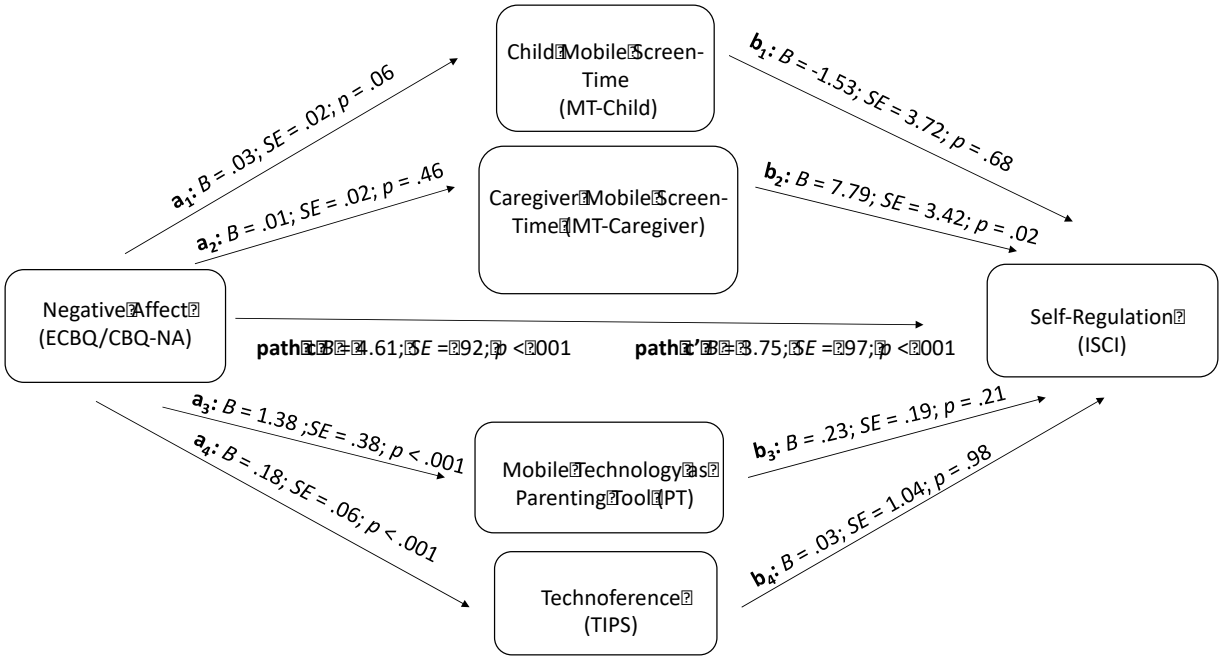

Figure 11. As depicted, the mobile technology landscape (set of four mediators) did not significantly mediate the relation between negative affect and self-regulation in children.

Although the mediation model included children aged of 2 to 5 years old, developmental changes that occur during early childhood create salient differences in temperament (Putnam & Rothbart, 2006). Therefore, additional mediation models were tested by splitting the sample up into toddlers (2 to 3-year-olds) and preschoolers (4 to 5-year-olds) to explore the role of mobile technology on temperament and self-regulation across different ages.

When examining toddlers (N = 97), the total indirect effect was not significant (B = .16, SE = .61, 95% CI [-1.06, 1.34]; See Figure 12), with neither the use of mobile technology as a parenting tools (B = -.56, SE = .67, 95% CI[-2.01, .65]), technoference (B = .52, SE = .48, 95% CI[-.11, 1.85]), child mobile screen time (B = -.19, SE = .37, 95% CI[-1.22, .35]), or caregiver mobile screen time (B = .39, SE = .39, 95% CI[-.05, 1.6]) as significant mediators.

When examining preschoolers (N = 77), the total indirect effect of the set of mediators was significant (B = 1.82, SE = .83, 95% CI [.48, 3.93]). Specifically, the use of mobile technology as a parenting tool (B = 1.74, SE = .85, 95% CI [.52, 4.12]), and caregiver's mobile screen time (B = .66, SE = .44, 95% CI [.02, 1.88]) significantly mediated the relation between child negative affect and self-regulation in preschoolers. Meanwhile, technoference (B = -.34, SE = .52, 95% CI [-.184, .40]) and child mobile screen time (B = -.24, SE = .47, 95% CI[-1.45, .50]) did not. As depicted in Figure 13, the total effect between negative affect and self-regulation was significant, but after partialling out the effect of the mediators, the direct effect reduced, though marginally. Thus, representing a partial mediation with the use of mobile technology as parenting tools and caregiver use of mobile technology as significant partial mediators.

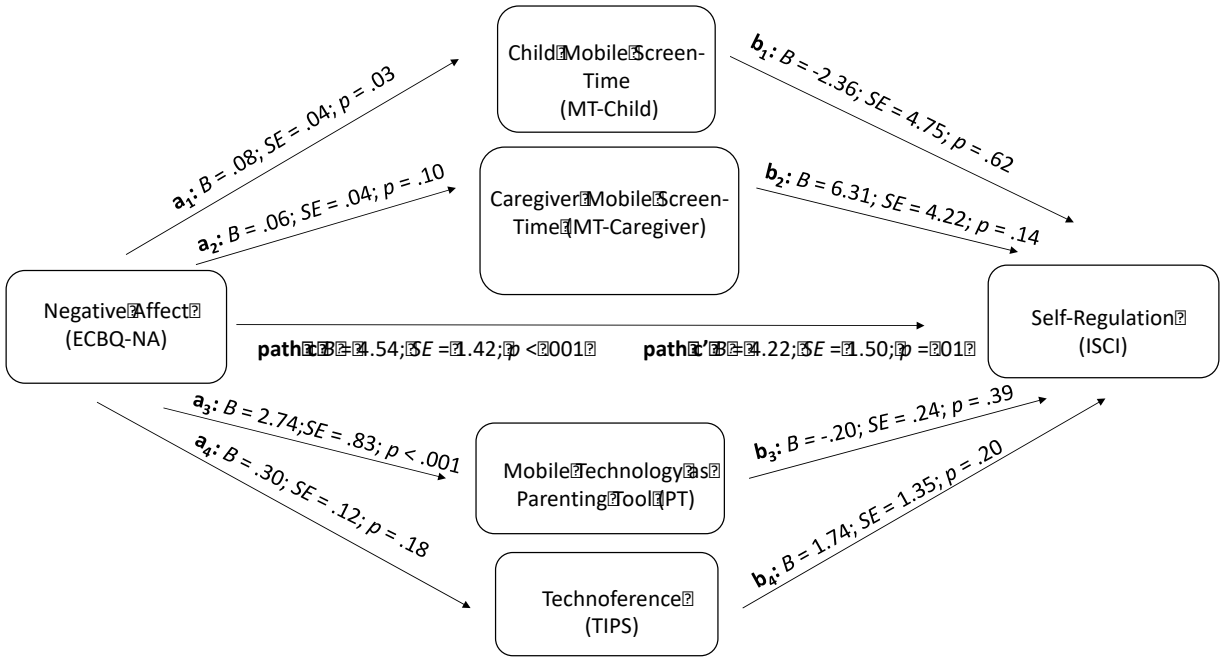

Figure 12. As depicted, the mobile technology landscape (set of four mediators) did not significantly mediate the relation between negative affect in toddlers (age 2 to 3 years old) and self-regulation in children.

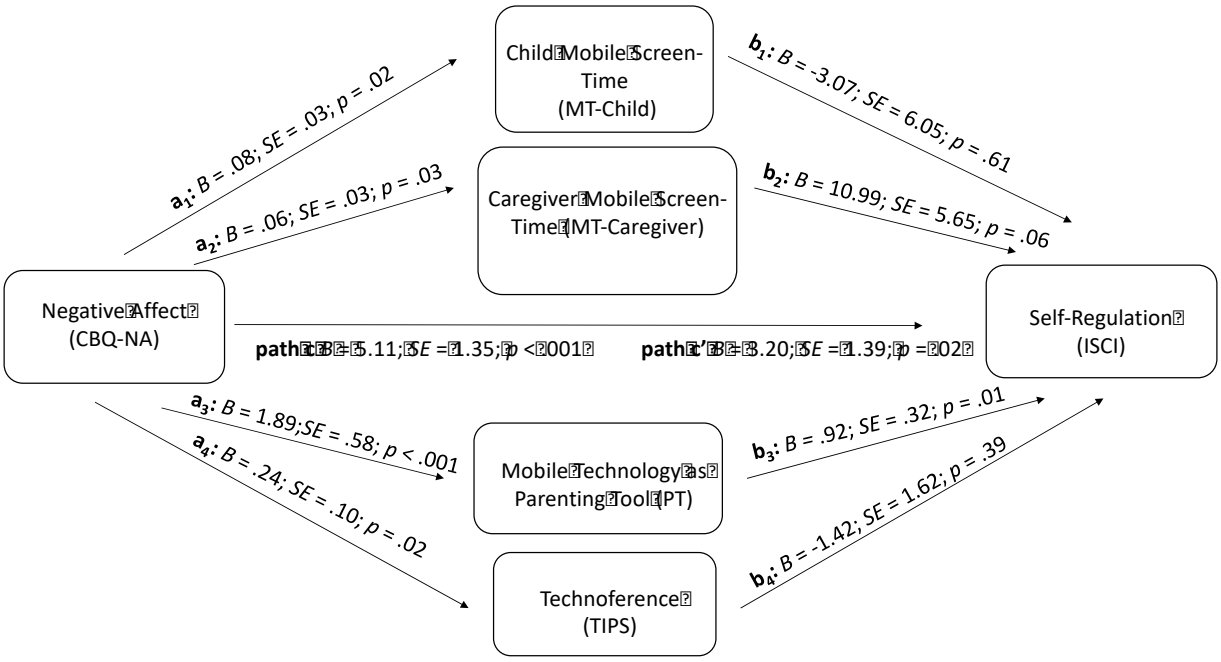

Figure 13. As depicted, the mobile technology landscape (set of four mediators) significantly mediated the relation between negative affect in preschoolers (age 4 to 5 years old) and self-regulation. The direct path (path c') weakened in the presence of the mediators. Particularly, caregiver mobile screen time and the use of mobile technology as a parenting tool emerged as significant partial mediators, thereby providing evidence for a partial mediation.

When considering aggression as the outcome, the second model examined the mediating effect of the four aforementioned mediators in the relation between negative affect (X: ECBQ/CBQ-NA) and aggression (CBCL $1^{1/2}$-5-AGG), with social desirability as a specified covariate. The total indirect effect of the set of mediators on aggression was significant (*B* = .43, *SE* = .19, 95% CI [.10,.83]). Specifically, the use of mobile technology as a parenting tool emerged as a significant mediator (*B* = .29, *SE* = .16, 95% CI [.05, .69]), while technoference (*B* = .07, *SE* = .11, 95% CI [-.11, .35]), child mobile screen time (*B* = .02, *SE* = .07, 95% CI [-.09, .23]), and caregiver mobile screen time (*B* = .06, *SE* = .09, 95% CI [-.08, .28]) did not. As displayed in Figure 14, the total effect of negative affect on aggression was significant, but upon the inclusion of the set of mediators – particularly, using mobile technology as a parenting tool, the direct effect reduced to non-significance thereby representing a full mediation.

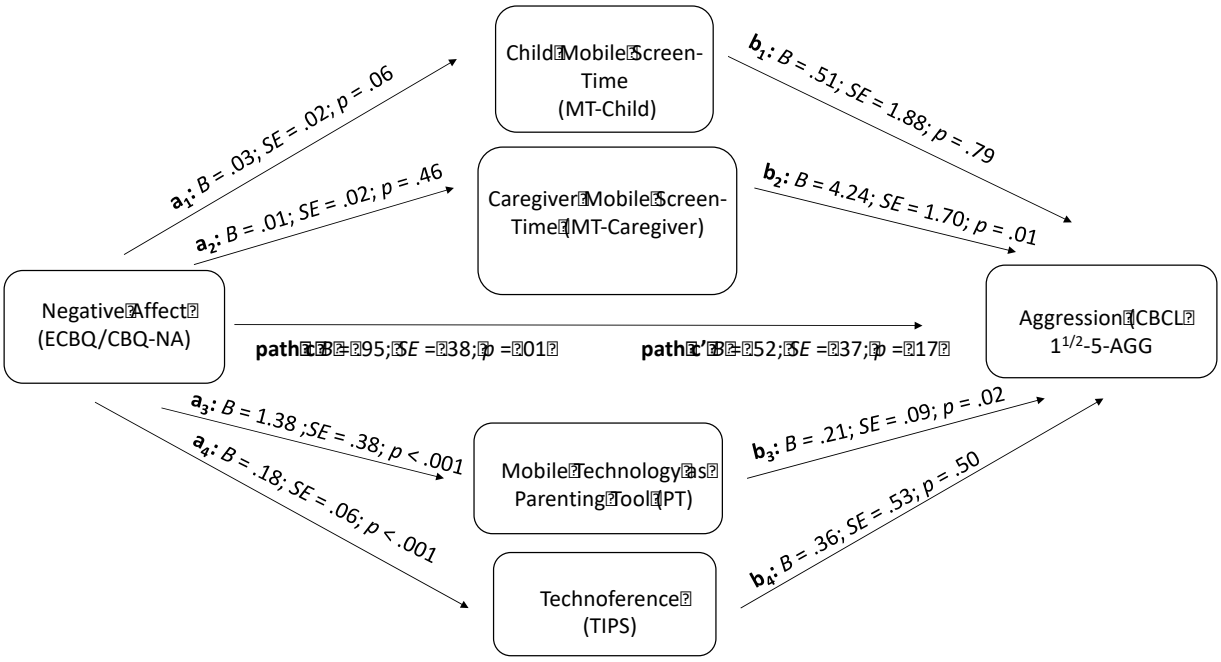

Figure 14. As depicted, the mobile technology landscape (set of four mediators) significantly mediated the relation between negative affect and aggression. The direct effect (path c') reduced to non-significance in the presence of the set of mediators. Particularly, the use of mobile technology as a parenting tool emerged as a significant mediator, thereby providing evidence for a full mediation.

Although the mobile technology landscape (set of 4 mediators) appeared to play a mediating role for both toddlers and preschoolers collectively, additional mediation models were examined to explore whether the mediating effect of the mobile technology landscape (4 mediators) differed across ages in young children.

When examining toddlers (N = 97), the total indirect effect of the set of mediators was significant (*B* = .72, *SE* = .39, 95% CI [.06, 1.57]); however, neither the use of mobile technology as a parenting tool (*B* = .31, *SE* = .39, 95% CI [-.30, 1.29]), technoference (*B* = .14, *SE* = .27, 95% CI [-.27, .86]), child mobile screen time (*B* = .04, *SE* = .21, 95% CI [-.33, .57]), or caregiver mobile screen time (*B* = .21, *SE* = .20, 95% CI [-.02, .86]) emerged as significant mediators. As depicted in Figure 15, the total effect of negative affect on aggression was significant, but upon the inclusions of the set of mediators, the strength of the direct effect marginally reduced but remained significant.

With preschoolers (*N* = 77), the total indirect effect of the set of mediators was also significant (*B* = .88, *SE* = .33, 95% CI [.30, 1.60]), with the use of mobile technology as a parenting tool emerging as a significant mediator (*B* = .59, *SE* = .36, 95% CI [.12, 1.63]), but not technoference (*B* = .08, *SE* = .22, 95% CI [-.26, .70]), child mobile screen time (*B* = -.03, *SE* = .24, 95% CI [-.56, .44]), or caregiver mobile screen time (*B* = .24, *SE* = .21, 95% CI [-.01, .86]). As depicted in Figure 16, the total effect of negative affect on aggression was significant, but upon the inclusion of the set of mediators – particularly the use of mobile technology as a parenting tool, the direct effect reduced to non-significance signally the presence of a full mediation.

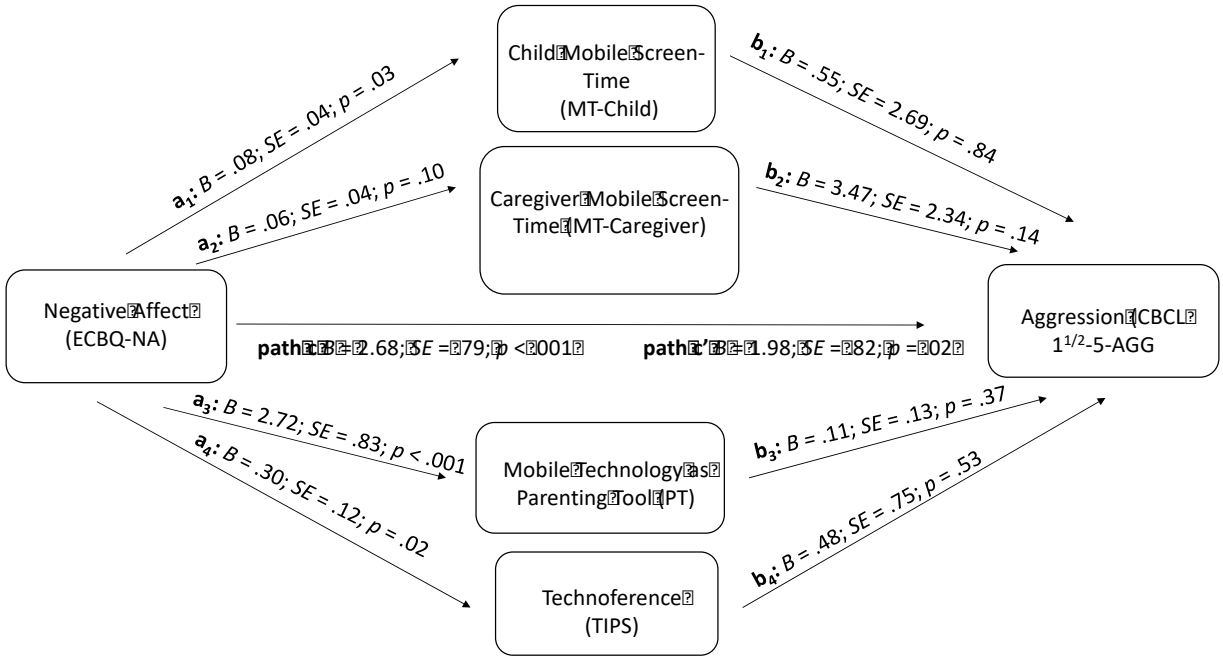

Figure 15. As depicted, the mobile technology landscape (set of four mediators) significantly mediated the relation between negative affect in toddlers (age 2 to 3 years old) and aggression. The direct effect (path c') weakened in the presence of the set of mediators, thereby providing evidence for a partial mediation.

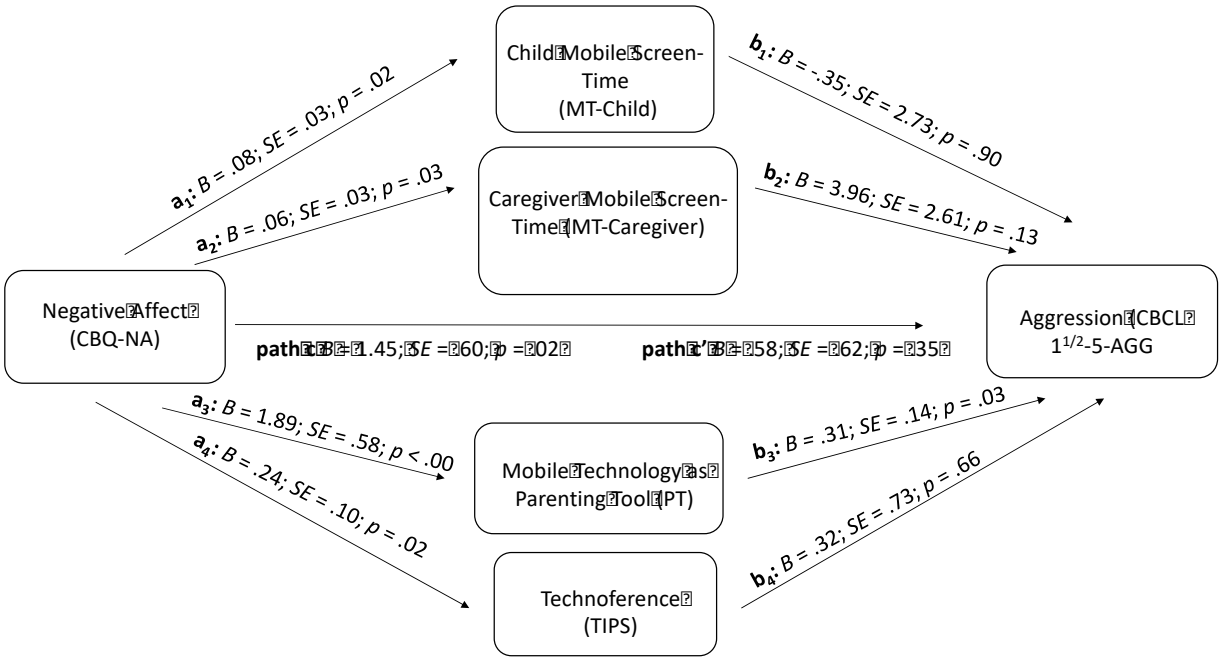

Figure 16. As depicted, the mobile technology landscape (set of four mediators) significantly mediated the relation between negative affect in preschoolers (age 4 to 5 years old) and aggression. The direct effect (path c') reduced to non-significance in the presence of the set of mediators, particularly with the use of mobile technology as a parenting tool as significant mediator, thereby providing evidence for a full mediation.

Table 21

Summary of Hypotheses and Analyses

Hypothesis	IV [Covariates]	DV	Analysis	Results
(1a) Greater child mobile screen time will predict poor self-regulation	MT-Child [Child age; ECBQ/CBQ-NA; VideoGame-Child]	ISCI	Hierarchical Multiple Regression	Greater child mobile screen time did not predict dysregulation
(1a) Greater child mobile screen time will predict higher levels of aggression	MT-Child [SDS-17; ECBQ/CBQ-NA]	CBCL $1^{1/2}$ – 5-AGG	Hierarchical Multiple Regression	Greater child mobile screen time predicted more aggression
(1b) Greater caregiver screen time will predict poor self-regulation in children	MT-Caregiver [Child age; ECBQ/CBQ-NA; VideoGame-Child]	ISCI	Hierarchical Multiple Regression	Greater caregiver mobile screen time predicted greater dysregulation
(1b) Greater caregiver screen time will predict higher levels of aggression in children	MT-Caregiver [SDS-17; ECBQ/CBQ-NA]	CBCL $1^{1/2}$ – 5-AGG	Hierarchical Multiple Regression	Greater caregiver mobile screen time predicted more aggression
(2a) Greater caregiver and child screen time will collectively predict lower frequency of children's activities across activity settings	MT-Child, MT-Caregiver [Caregiver education; Annual Income; TV-Child; Computer-Child; TV-Caregiver; Computer-Caregiver]	YC-PEM (Home, Community, Daycare,)	Multivariate Multiple Regression	Mobile screen time collectively predicted children's participation across different settings (see univariate test results)
(2b) Greater child screen time will predict greater technoference	MT-Child [Child age; ECBQ/CBQ; Caregiver education, VideoGame-Child; TV-Caregiver]	TIPS	Hierarchical Multiple Regression	Greater child mobile screen time predicted greater technoference

Table 21 Continued

Hypothesis	IV [Covariates]	DV	Analysis	Results
(3a) Lower overall participation in the environment will predict poor self-regulation	YC-PEM [Child age; ECBQ/CBQ-NA; VideoGame-Child]	ISCI	Hierarchical Multiple Regression	Lower overall participation in the environment predicted greater dysregulation
(3a) Lower participation in the environment across specific settings will predict poor self-regulation	YC-PEM-Home; YC-PEM-Community; YC-PEM-Daycare [Child age; ECBQ/CBQ-NA; VideoGame-Child]	ISCI	Hierarchical Multiple Regression	Lower participation in the home setting predicted greater dysregulation
(3a) Lower overall participation in the environment will predict higher levels of aggression	YC-PEM [SDS-17; ECBQ/CBQ-NA]	CBCL $1^{1/2}$ – 5-AGG	Hierarchical Multiple Regression	Lower overall participation in the environment predicted more aggression
(3a) Lower participation in the environment across specific settings will predict higher levels of aggression in children	YC-PEM-Home; YC-PEM-Community; YC-PEM-Daycare [SDS-17; ECBQ/CBQ-NA]	CBCL $1^{1/2}$ – 5-AGG	Hierarchical Multiple Regression	Lower participation in the home setting predicted more aggression
(3b) Greater technoference will predict poor self-regulation	TIPS [Child age; ECBQ/CBQ-NA; VideoGame-Child]	ISCI	Hierarchical Multiple Regression	Greater technoference did not predict dysregulation
(3b) Greater technoference will predict higher levels of aggression	TIPS [SDS-17; ECBQ/CBQ-NA]	CBCL $1^{1/2}$ – 5-AGG	Hierarchical Multiple Regression	Greater technoference predicted more aggression

Table 21 Continued

Hypothesis	IV [Covariates]	DV	Analysis	Results
(3c) The relationship between child screen time, and self-regulation will be mediated by overall displacement (both displacement of activities and technoference)	X: MT-Child [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: YC-PEM; TIPS Y: ISCI	Multiple Mediation	No mediation effect found
(3c) The relationship between child screen time, and aggression will be mediated by overall displacement (both displacement of activities and technoference)	X: MT-Child [SDS-17; ECBQ/CBQ-NA]	M: YC-PEM; TIPS Y: CBCL $1^{1/2}$ – 5-AGG	Multiple Mediation	Partial mediation (TIPS unique mediator)
(3c) Additional Analyses with Self-Regulation as Y: The relationship between caregiver screen time, and self-regulation will be mediated by overall displacement (both displacement of activities and technoference)	X: MT-Caregiver [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: YC-PEM; TIPS Y: ISCI	Multiple Mediation	Partial mediation (YC-PEM unique mediator)
(3c) Additional Analyses with Aggression as Y: The relationship between caregiver screen time, and aggression will be mediated by overall displacement (both displacement of activities and technoference)	X: MT-Caregiver [SDS-17; ECBQ/CBQ-NA]	M: YC-PEM; TIPS Y: CBCL $1^{1/2}$ – 5-AGG	Multiple Mediation	Partial mediation (TIPS unique mediator)
(4a) The relationship between child screen time and self-relation will be mediated by using mobile technology as a parenting tool	X: MT-Child [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: PT Y: ISCI	Simple Mediation	No mediation effect found

Table 21 Continued

Hypothesis	IV [Covariates]	DV	Analysis	Results
4a) The relationship between child screen time and aggression will be mediated by using mobile technology as a parenting tool	X: MT-Child [SDS-17; ECBQ/CBQ-NA]	M: PT Y: CBCL $1^{1/2}$ – 5-AGG	Simple Mediation	Full mediation
(4a) Additional Analyses with Self-Regulation as Y: The relationship between caregiver screen time and self-regulation will be mediated by using mobile technology as a parenting tool	X: MT-Caregiver [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: PT Y: ISCI	Simple Mediation	No mediation effect found
(4a) Additional Analyses with Aggression as Y: The relationship between caregiver screen time and aggression will be mediated by using mobile technology as a parenting tool	X: MT-Caregiver [SDS-17; ECBQ/CBQ-NA]	M: PT Y: CBCL $1^{1/2}$ – 5-AGG	Simple Mediation	Partial mediation
Additional analyses with self-regulation as a mediator	X: TIPS [SDS-17; ECBQ/CBQ-NA]	M: ISCI Y: CBCL $1^{1/2}$ – 5-AGG	Simple Mediation	Partial mediation
Additional analyses with self-regulation as a mediator	X: PT [SDS-17; ECBQ/CBQ-NA]	M: ISCI Y: CBCL $1^{1/2}$ – 5-AGG	Simple Mediation	Partial mediation
Additional analyses with temperament	X: ECBQ/CBQ-NA [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: MT-Child; MT-Caregiver; PT; TIPS Y: ISCI	Multiple Mediation	No mediation effect found
Additional analyses with temperament	X: ECBQ-NA [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: MT-Child; MT-Caregiver; PT; TIPS Y: ISCI	Multiple Mediation	No mediation effect found
Additional analyses with temperament	X: CBQ-NA [Child age; ECBQ/CBQ-NA; VideoGame-Child]	M: MT-Child; MT-Caregiver; PT; TIPS Y: ISCI	Multiple Mediation	Partial mediation (MT-Caregiver and PT as unique mediators)

Table 21 Continued

Hypothesis	IV [Covariates]	DV	Analysis	Results
Additional analyses with temperament	X: ECBQ/CBQ-NA [SDS-17; ECBQ/CBQ-NA]	M: MT-Child; MT-Caregiver; PT; TIPS Y: CBCL $1^{1/2}$ – 5-AGG	Multiple Mediation	Full mediation (PT unique mediator)
Additional analyses with temperament	X: ECBQ-NA [SDS-17; ECBQ/CBQ-NA]	M: MT-Child; MT-Caregiver; PT; TIPS Y: CBCL $1^{1/2}$ – 5-AGG	Multiple Mediation	Partial mediation (no significant unique mediators)
Additional analyses with temperament	X: CBQ-NA [SDS-17; ECBQ/CBQ-NA]	M: MT-Child; MT-Caregiver; PT; TIPS Y: CBCL $1^{1/2}$ – 5-AGG	Multiple Mediation	Full mediation (PT unique mediator)

Note. MT-Child = Total Child Mobile Screen Time; MT-Caregiver = Total Caregiver Mobile Screen Time; ISCI = Inhibitory Self Control Index (BRIEF-P); CBCL $1^{1/2}$ – 5-AGG = Child Behavior Checklist- Preschool Version Aggression Subscale; YC-PEM = Young Children's Participation and Environment Measure; TIPS = Technology Interference in Parenting Scale; PT = Total Parenting Tool; SDS-17 = Social Desirability Scale – 17; ECBQ/CBQ-NA = Negative Affect; TV-Child = Child Television Use; Computer-Child; Child Computer Use; VideoGame-Child = Child Video game Use; TV-Caregiver = Caregiver Television Use; Computer-Caregiver = Caregiver Computer Use.

Qualitative Analyses

The purpose of the qualitative analysis of interviews was to reveal and capture caregiver attitudes, perceptions, and experiences about their personal use, as well as their children's use of mobile technology. Three main themes were identified: *(1) concerns about the negative effects or changes in children due to the use of mobile technology; (2) a good sense of control over children's activity on mobile technology as demonstrated by various monitoring strategies (3)* and *tension between the use of mobile technology and caregiver attitudes.* Within these themes, notable aspects were captured to create subthemes (codes) and are described in greater detail, along with illustrative quotes, below. The proportion of responses containing each theme is presented in Table 4.

Negative effects. The first overarching theme captured caregivers' concerns about the negative effects that mobile technology may have on their children. The most prevalent concerns expressed by caregivers (86.7%) was related to the potential for children to *Model Poor Behaviour,* such as aggression, sexually explicit content, and profanity that they are exposed to on mobile media. One parent commented:

> I'm afraid that she watches it too much and sometimes maybe she's picking up on some of the poor behaviour of kids in the show[…] like when the little baby [on the show] has a temper tantrum or […] a baby hits someone […] she's maybe sometimes picking up that behaviour, and thinking that's appropriate. (Mother of 2-year-old girl)

Aside from the exposure to inappropriate content on mobile technology, caregivers also expressed concerns about the potential for children to model excessive mobile technology use displayed by other individuals around them:

> There was a woman there with her two kids and she was just sitting, flipping through Facebook the whole time. So that I think is totally inappropriate and […] kids pick up on that too, right? I think they think "Oh mommy doesn't want to spend time with me or […] I'm not important […] then that's behaviour that they learn too. That they think that it's okay for them to do it too (Mother of 2-year-old girl).

Concerns about how using mobile technology may affect the *physical health* of children, such as decreased physical activity, poor posture, and eye or neck strain, amongst many other concerns, were also reported by approximately 40% of caregivers:

> I just worry about their vision. How starting at the phone could impact their vision. I worry about […] what it could do to the fine motor skills in their hands, what sort of effect it could have on their overall strength in their hands if they're always using the phone and they're not holding a pen, like there's a difference in their abilities there. (Mother of 5-year-old boy)

Approximately 66.7% of caregivers noted that when their children use mobile technology, they become completely absorbed into their devices and worried about their children becoming too *disengaged with the environment*:

> My [children are] so engrossed [in the mobile technology] that most of the time he doesn't hear you call his name or you talking to him if he's in the middle of watching something […] They usually pay attention to […] the screens more than if something

was happening around us. So they would prefer the screens. (Mother of 4-year-old girl)

As a result of children's disengagement with their environment, some caregivers (26.7%) expressed specific worries about the use of mobile technology *delaying the development of children's self-regulation:*

> We were out at dinner and the kids […] were both fidgeting. And they [in-laws] both pulled out their phones to give to them, and […] I said "don't do that," just because I think it's important that kids learn how to control themselves when they're out at dinner. I don't think that it's necessary to give them a phone, like they should be able to sit and wait for their food […]. And you know, the same thing [...] we were out shopping[…] they have to get used to experiencing interactions like in a shopping setting or an eating setting. So a cell phone to me is unhelpful in those ways because they should be able to [...] be out in an environment like that without having a meltdown (5-year-old boy; Participants 12).

Along with concerns about delayed self-regulation, caregivers (33.3%) also expressed specific worries about how the use of mobile technology may *delay the development of appropriate social skills* of young children*:*

> I think sometimes we focus too much on it [mobile technology] and we need to start teaching our kids how to resolve conflict face to face. And it's not clear whether they're learning these skills when they're absorbed in technology all the time, right? Well I think they're […] watching but they're not necessarily practicing. So they can watch conflict resolution […] on shows but they're not necessarily learning how to

> resolve conflict with other people because […] everybody has a different opinion and you don't learn that until you socialize with other people (Mother of 2-year-old girl)

Approximately 46.7% of caregivers expressed fears about children becoming overly *preoccupied* with using mobile technology, with several caregivers noting that their children persistently asked for their mobile devices:

> When it's time to put it [mobile technology] away, or say the batter dies and I need to plug it in, then he gets quite agitated. That he wants it back and he wants it now, or the second he woke up. The other day, he comes into my room, jumps on my bed, and says "I want my iPad now. Get it." […] I know it's really bad. I know he's getting addicted to it […] When we're eating dinner or eating lunch, he wants to watch it as well. And I've been trying to get him not to do that, and just kind of sit there and have a conversation with me. But he'll just keep pestering and say, he wants it, he wants it. And then sometimes it's like "Ok fine." It's not worth the fight. (Mother of 3-year-old boy)

When caregivers attempted to limit their children's use of mobile technology, many caregivers (73.3%) noted that these restrictions resulted in *temper tantrums or heightened emotionality*:

> Sometimes limiting it [mobile technology] can [create] a couple of temper tantrums around taking it away. She'll probably use it for longer than we like so it's almost like a double-edged sword, you want to limit it but then you're limiting it and taking it away from her, she throws a tantrum. (Father of 3-year-old girl)

Sometimes *temper tantrums or heightened emotionality* were caused by encountering encountered difficulties, such as bad internet connection or a difficult level in a game:

> Sometimes if they're playing a game and it's not going well, they'll get super frustrated and […] banging on the tablet rather than using it appropriately […] It's supposed to be fun and if it's not fun you got to step away from it. It's not supposed to be a frustrating activity so if it's just not going well […] or they're not winning the game, they're not being successful, then they get really frustrated and irritable. (Mother of 4-year-old boy).

Interestingly, many caregivers (73.3%) noticed changes in their children's behaviour when the caregivers were preoccupied with mobile technology. While caregivers were using technology, children were reported to *increase their bids for caregiver attention* more so than if their caregivers were *not* using mobile technology (e.g., while cooking):

> Especially if I'm trying to do something that's really important or work-related. I find that he's very […] kind of acts up as far as attention. He wants attention because he knows my attention is elsewhere, so he might act up and be really silly or do something that he knows will catch my attention because he wants the one-on-one time with me as opposed to me kind of soaking into my phone. (Mother of 4-year-old boy)

Caregiver strategies. The second overarching theme captured the strategies caregivers used to monitor and regulate the content children can access on mobile technology. Caregivers shared many different monitoring strategies, which also reflected the overall sense of confidence that caregivers' had about their ability to regulate what their children are accessing on mobile technology at this young age. Many caregivers (66.7%) reported being weary about the array of inappropriate content on the Internet. As a result, caregivers gave their children access to only

regulated apps as a strategy to filter out inappropriate content. The most popular apps included, YouTube Kids and Netflix Kids:

> He goes on Kid's YouTube. I used to have the regular YouTube, but I didn't like some of the videos even though they were aimed towards kids. I didn't like what he was watching, so I deleted the regular YouTube App. He has access to Netflix and he knows how to get onto the kid's site on Netflix. I prefer the YouTube Kids app […] and the Netflix one's pretty safe too […] I prefer the Netflix over the YouTube because anyone can post on YouTube. (Mother of 3-year-old boy)

The most widely used strategy, which was reported by 86.7% of caregivers, was to keep their children *within arms reach.* This strategy allowed caregivers to physically see their children's screens or listen to what they were doing on their devices:

> There really isn't a time, except for when I'm not home, that he's not near me and I can hear the iPad. Unless we are, I don't know, at a banquet or something and I put headphones on him but he's still sitting next to me. So yeah, I mean how I monitor is by him just being next to me and listening to see what he's listening to and watching to see what he's playing. (Mother of 5-year-old boy)

Caregivers (73.3%) also reported more restrictive strategies such as installing a *childlock* feature or sliding apps into hidden folders to restrict access to specific content:

> We put on guided access so he can't exit an app. So if I have to go to the washroom or I'm actually cooking dinner and I give him an iPad, he will be locked into the app that he's initially chosen unless it's YouTube. He can't have Youtube unmonitored. (Mother of 2-year-old boy)

Approximately 53.3% of caregivers stated that their children were too young to download apps themselves so when children request using new apps, *caregiver's test* the appropriateness of the content prior to giving their children access to the new app:

> She has games on her iPad that we've picked out for her. So we know that they're […] for her age group and appropriate […] And we'll try them out. And like different games pop-up and ones that we find, we'll try them out. (Mother of 4-year-old girl)

Tense caregiver attitudes. The third overarching theme that emerged across interviews were *tense caregiver attitudes* that conflicted with wanting to limit or permit the use of mobile technology. The majority of caregivers (86.7%) expressed tension over wanting to *limit their children's time on mobile technology but feared that their children would miss out on the educational and technological* (technology literacy) *benefits* of using technology:

> I'm sure I'm going over the limit of […] tablet or electronic use […] if someone at 2 and a half [years-old] doesn't know what a cell phone is or what a tablet is I have a little bit of a concern. But I also respect the fact that those children's parents don't want to use the tablets or phones in front of their kids, or have their kids use them. So, I don't know, I guess I'm on the fence? I respect those who don't use it, and my own kid uses it. And we try to limit the time. (Mother of 2-year-old boy)

Although many caregivers stated wanting to limit their use of mobile technology, many caregivers (73.3%) also expressed *tension over needing to use their mobile technology* and thereby *experiencing negative feelings for not prioritizing their children*. Specifically, caregivers reported feeling *guilty* (66.7% of caregivers), and some feeling *frustrated* (26.7% of caregivers),

in situations where they are using mobile technology but also recognizing that they are not interacting with their children:

> I remember the old days when I had no responsibilities, I can just do whatever I want, whenever I want it, so it's different now. He has to be my priority, but then […]. He can't – it just can't be that he's my priority all the time. There are other things I need to do and other people I need to talk to […] So, it gets frustrating to try to balance between these two […] It's frustrating because there's that feeling of guilt that I have to be spending my time with him, but then that feeling that I have other things, obligations to do. (Mother of 4-year-old boy)

All caregivers (100%) noted the utility of using mobile technology to regulate their children's behaviour, but this convenience was often met with tensions over wanting to limit their children's use of mobile technology:

> My friend and I will text each other and we'll say, "you know, I feel like a bad mommy today because I let him on the iPad" … but I'm so tired … it really comes down to the fact that we're exhausted and he's been busy and quiet [on the mobile technology]. (Mother of 3-year-old boy)

The most popular strategy reported by approximately 86.7% caregivers were related to using mobile technology as a *distraction tool* while caregivers were busy with a task at home or in public:

> We let him watch cartoons in the morning on it while we're sleeping because he gets up super early […]. If we're in a restaurant and he's done eating and we're trying to finish eating, we would […] put a video or something on the phone, because it keeps

him sitting […] so a lot of it has to do with desperation as parents. (Mother of 3-year-old boy)

Approximately 60% of caregivers also recounted specific instances when they used mobile technology as a means to *calm* their children down when they were acting out or upset:

> […] at a family function when someone pulled out their tablet and just put it in front of him. And he was happy. And he was quiet and […] he'd sit still. So I'm guilty of letting that happen. I don't know if I'd do it myself, but it happened and he was quiet. (Mother of 2-year-old boy)

Other caregivers (26.7%) expressed tensions about using mobile technology as a *reward* after children displayed good behaviour or limiting the use of mobile technology as a form of punishment:

> And parents […] if they need to punish them [their children], they take it [mobile technology] away from them […]. So yes, it's being used in the wrong ways. There's big potential for these devices, in parenting especially and these kind of things are being used in the wrong way I think[…] instead of a positive thing […] education or that kind of thing, it's becoming more like a reward or punishment type. (Mother of 4-year-old boy)

Other codes. There were three codes that were relevant to the research questions but did not fit well thematically with the three over-arching themes. Caregivers were not explicitly asked how they perceive their own mobile technology use to affect their child, but one question asked caregivers whether they believed they pay less attention to their children while on their phones. Almost all caregivers (86.6%) stated that using mobile technology reduced their capacity to attend to their child:

> Less attention for sure. I wouldn't say I'm a good multitasker. I'd say that my attention is on my phone […] If I'm trying to get something done, an email sent out or something like that then I'm definitely focused on that […] I am not necessarily 100% paying attention to her. (Mother of 2-year-old girl)

Approximately 60% of caregivers revealed passing judgements about other caregivers who use their phones around their children. The majority of these caregivers stated that the appropriateness of this behaviour depends on the context of the situation:

> It definitely depends on the circumstances. There's times when parents are at the park or that sort of idea, when you should definitely be engaged with your child and they're just sitting there on the bench with their phone as opposed to kind of interacting with them. I understand for pictures, because I do that as well, you want to soak in the moments, but other than that it's kind of a lost opportunity for the most part. Just to be interacting with your child and creating those memories. (Mother of 4-year-old boy)

Finally, although the majority of caregivers did report some type of concern about the negative effects of mobile technology for children or tensions about using mobile technology in the household, a smaller subset of caregivers (40%) occasionally indicated that *technology is a normal part of l*ife that should be accepted and not overly stigmatized in society:

> Using my phone is just a part of life, I guess? […] I think that it [mobile technology] has this stigma, and I know […] studies that go off saying that it's not beneficial for children […] but I don't view it like that. Because TV, technology, these are things that are going to be here to stay. As opposed to saying, "you should just not let your child [use mobile technology]", you should limit your usage, you have to start

learning ways to incorporate it to be beneficial for children […]. Especially when I look at my daughter who has such a strong command of English […] and as much as she uses technology, she also engages in physical play and plays with other children. At the same time though, I guess I have met children who do have delays who maybe watch or [use] too [much technology], but it's hard to tell, because I don't know […] a delay could be from so many factors and not just too much technology right? So it should be teaching parents how to use it in more productive ways, like maybe that's something that could be beneficial, I don't know. (Mother of 4-year-old girl)

CHAPTER V

Discussion

The overall purpose of the present study was to examine the impact of mobile technology use on Canadian children's participation in their environment, interaction with their caregivers, self-regulation, and aggressive behaviour. Moreover, the present study is one of the first to test the displacement hypothesis with mobile technology exclusively.

Impact of Mobile Technology on Self-Regulation and Aggression

The first goal of the present study was to establish whether child mobile screen time predicted children's self-regulation and aggression.

Child mobile technology use. The hypothesis that greater child mobile screen time would predict greater dysregulation was not supported. These findings are not consistent with preliminary evidence suggesting that a relation between greater mobile technology use and self-regulation problems would exist (Radesky, Silverstein, et al., 2014). These findings are also not consistent with the large body of literature demonstrating how television and video games negatively impact children's self-regulation (Anderson & Bushman, 2001). However, the absence of a significant effect may be related to three possible explanations. First, the existing literature that has found associations between greater mobile screen time and greater dysregulation have been significant, though small in effect (Radesky, Silverstein, et al., 2014; Munzer et al., 2018). Second, many of these studies include children with pre-existing social-emotional and behavioural issues, making it difficult to conclude whether the use of mobile technology created regulatory difficulties, or whether dysregulation was already present before the introduction of mobile technology (Radesky, Silverstein, et al., 2014). Third, the majority of the existing research does not exclusively measure mobile technology use, but also considers

children's time spent using other forms of technologies (e.g, Munzer et al., 2018), making it difficult to draw conclusions about the unique effect of mobile technology on self-regulation in these studies. Given the small effect of the previous findings, as well as the non-specific measurement of mobile technology use, it is unclear whether a relation between mobile technology and self-regulation truly exists. More research is needed to confirm or contradict the findings from the present study.

The hypothesis that greater child mobile screen time would predict more aggressive behaviour was supported. These findings are consistent with the large body of literature linking television and video game use, irrespective of violent content, to more aggressive behaviour (Anderson & Bushman, 2001; Verlinden et al., 2012). Thus, the novelty of the present study adds mobile technology to the list of digital media (alongside television and videogames) found to escalate aggressive behavior in young children.

Caregiver mobile technology use. The hypothesis that greater use of mobile technology by caregivers would predict more self-regulation problems and aggression, was supported. Although child mobile screen time did not predict greater dysregulation, caregiver screen time did emerge as a significant predictor. This discrepancy suggests that child use of mobile technology may not necessarily have a strong or direct impact on their self-regulation skills, but these skills are significantly hampered when caregivers are preoccupied with their own mobile devices. This line of reasoning highlights the instrumental role of caregivers in emerging self-regulation and childhood aggression and potential mechanisms through which this relation exists are discussed below.

The Role of Child Participation in the Environment

The second goal of the present study was to explore whether mobile technology displaces activities in the home, community, and daycare setting, as well as introduce greater technoference in the parent child relationship.

Participation in the environment. The hypothesis that greater use of mobile technology by both caregivers and children would predict less frequent participation by children in their overall environment, was supported. However, when examining the role of mobile technology use on participation across the home, community, and daycare settings environment specifically, the findings differed. Contrary to the prediction, greater mobile technology use did not predict how frequently children participated in their home environment. Thus, the time children spend using mobile technology did not appear to significantly limit their time participating in other developmentally important activities at home. Conversely, less use of mobile technology *by children* predicted greater participation in activities occurring in a daycare setting. However, since the inverse of this relation is not implied (greater use of mobile technology predicts less participation in daycare) this finding does not strongly support the hypothesis that technology use displaces activities at daycare. It is possible that greater use of mobile technology by children could be related to greater participation in the daycare setting. Interestingly, greater use of mobile technology *by caregivers* predicted greater participation in the community. Caregivers using a lot of mobile technology may be more likely to browse the Internet and social media, where they can be easily alerted to community events. Mobile technology is also a means to communicate with other community members (e.g., through social media, by texting) and to efficiently organize community activities (e.g., playdates) for children. Therefore, greater use of mobile technology may help facilitate children's participation in the community if these devices

are being used to gather information about, and organize, local events. Yet, observational studies of caregiver-child dyads in the community have noted that caregivers who use their mobile devices at the playground and restaurants, becomes less responsiveness, engage in fewer conversations, and even respond more harshly to their children (Radesky, Kistin, et al., 2014; Hiniker et al., 2015). Thus, this disengagement by caregivers can still have implications for self-regulation difficulties, even if caregiver mobile screen time is not necessarily displacing children's community participation.

Technoference.

The hypothesis that greater caregiver mobile screen time would predict greater technoference in the parent child relationship was not supported. One study previously found that caregivers who perceived their mobile technology use to be more problematic (e.g., unable to resist checking a message) also reported greater technoference in the parent child relationship. The present study is the first known study to explore whether caregiver screen time more broadly (without differentiating between problematic use) would also predict greater technoference. No support for this relation was found.

On the other hand, the hypothesis that greater child mobile screen time would predict greater technoference in the parent child relationship was supported. There are several reasons why the relationship between mobile screen time and technoference was found when considering child mobile screen time, but not caregiver mobile screen time. First, when younger children are using mobile technology, the nature of their activities (e.g., watching videos, playing games), demand more continuous attention compared to activities, such as sending an e-mail or messaging with others, that allow the user to briefly pause and disconnect from their devices. Thus, this more continuous use of mobile technology may lend itself to greater technoference if

children are unable to momentarily disconnect from their devices. Therefore, it stands to reason that greater child mobile screen time predicted greater technoference.

Second, caregivers reported on their children's use of mobile technology, the time that children were reported to use mobile technology were also presumably times spent around their caregivers – and thus, parent-child parenting domains. Therefore, there is a greater overlap between the time that children are using mobile technology, and the time they are with their parents engaging in different activities that could be disrupted by technoference. Meanwhile, caregivers could be using their mobile technology when they are away from their children. Therefore, the amount of caregiver screen time may not necessarily translate to greater technoference in the parent child relationship.

Third, caregivers could also be muting their phones which limit or allow the flow of notifications and disturbances from mobile technology (Wajcman, Bittman, & Brown, 2008). Therefore, the degree to which caregivers mute their phones can widely fluctuate and thus, be unrelated to their amount of mobile screen time.

This was the first known study to examine how children's own use of mobile technology may relate to technoference in the parent child relationship. Although a relation between caregiver screen time and technoference was not found, technoference introduced by children's mobile technology use can still negatively affect child development since important caregiver-child interactions are being disrupted regardless of whose mobile technology is causing the disturbance. When children play with caregivers, learn from their caregivers, and receive discipline from their caregivers, there are many opportunities rich with teachable moments that can be capitalized on to help build children's regulatory skills (Bronfenbrenner, 1979, 1992; Dunst et al., 2000; Florez, 2011). However, the quality of these opportunities may be jeopardized

because of technoference. Notably, technoference also captures how mobile technology can disturb the parent-child dyad in public places (e.g., while shopping), during mealtime, and during care activities. Before the introduction of mobile technology, the size of televisions, computers, and most video game platforms restricted the use of these technologies in public places and in certain areas of the home. With the portability of mobile technology, however, families can bring these devices nearly everywhere they travel - such as on shopping trips, and into new areas of the home – such as the kitchen and bathroom. Thus, activities that were not previously burdened by digital media are now subject to interruptions from these portable devices.

Overall, the present study suggests that greater use of mobile technology by young children may not necessarily limit the time they spend participating in other activities across all activity settings. Instead, more frequent use of mobile technology by young children was found to disrupt caregiver-child interactions across a variety of activities by introducing greater technoference. Therefore, although children may still be participating in their environment, the quality of these experiences can become disrupted by their mobile technology use, which can then negatively impact young children's emerging self-regulation and aggressive behaviour.

The Displacement Hypothesis

The third goal of the present study was to examine whether child participation in the environment and technoference was related to self-regulation and aggression. After exploring these associations, the displacement hypothesis was tested.

Participation in the environment. The hypothesis that lower overall participation in the environment (home, community, and daycare collectively) would predict greater dysregulation and aggression was supported. Consistent with previous theoretical and empirical literature, child participation in activity settings afford children the opportunities to learn and develop their self-

regulation skills, as well as the skills needed to regulate aggression (Bronfenbrenner, 1979, 1992; Dunst et al., 2000; Florez, 2011). Thus, it stands to reason that children who participate in activity settings less frequently have limited exposure to opportunities that facilitate these skills, thereby increasing the likelihood of regulatory deficits and more aggressive behaviour. In terms of specific settings, whereas less participation in the home setting predicted greater difficulties with self-regulation and more aggression, participation in the community and daycare setting did not have a significant effect on self-regulation or aggression. Participation in the home setting may be most strongly related to child development since these activities bring children in close contact with their caregivers, who directly engage children in daily chores, routines, and play to help them gain social-adaptive competencies. Conversely, although community and daycare activities also provide a context for children to practice emerging regulatory skills (e.g., shopping, dining out, routine appointments), caregiver's direct intent to teach is more absent here (Dunst et al., 2000).

Technoference. The hypothesis that greater technoference in the caregiver-child relationship would predict more dysregulation was not supported. Yet, because the current study is the first known study to examine the effect of technoference on self-regulation, more research is needed to dismiss the role of technoference in developing self-regulation. As predicted, greater technoference did predict more aggressive behaviour. These results are consistent with previous findings that more technoference in the mother-child relationship alters parental responsiveness and therefore, predicts more externalizing behaviours, such as aggression (McDaniel & Radesky, 2017).

Testing the displacement hypothesis. The displacement hypothesis predicted that greater mobile technology use by children would displace time from participating in

developmentally enriching activities, as well as disrupt social interactions, therefore leading to greater dysregulation and aggression. Overall displacement included both child participation in the overall environment and technoference.

In the present study, a number of themes emerged from caregiver interviews that support the quantitative results herein. Some of these qualitative findings will be discussed in the following sections to further support the present study's quantitative findings.

Self-regulation. Contrary to the hypothesis, the indirect effect of overall displacement was not significant, indicating no mediating effect between child mobile screen time and self-regulation (Figure 1). The lack of a mediating effect was somewhat surprising since more frequent use of mobile technology significantly displaced activities and disrupted social interactions, which are considered essential for fostering self-regulation. However, results from the present study revealed that greater use of mobile technology by children did not predict dysregulation (no significant total effect), and technoference did not predict dysregulation. Therefore, children's mobile screen time may not have a negative impact on their self-regulation skills. Since this is the first known study to test the displacement hypothesis more research is needed to draw further conclusions about these null findings.

When considering caregiver use of mobile technology in the mediation model, a partially mediating effect was supported (Figure 3). A significant indirect effect revealed that greater use of mobile technology by caregivers was associated with less participation in activity settings (but not technoference) by children, and in turn greater child dysregulation. Additionally, more caregiver mobile screen time continued to have a significant direct effect on dysregulation in the presence of the mediators, signifying that both direct and indirect effects operate simultaneously (Hayes, 2013). Interestingly, a mediating effect of overall displacement was not found in the

relation between *child* mobile screen time and self-regulation (Figure 1). This inconsistency may be explained by two possible reasons. First, the direct effect between caregiver mobile screen time and dysregulation imply that using greater amounts of mobile technology effect caregiver behaviours in a way that is detrimental for child self-regulation. In line with the aforementioned literature, caregivers have been shown to become less responsive and engage in less verbal and non-verbal interactions with their children while using mobile technology (e.g., Radesky, Kistin, et al., 2014; Hiniker et al., 2015). Qualitative results from the present study also suggested that the majority of caregivers (86.6%) believed that using mobile technology negatively affected their ability to pay attention to their children. For instance, a father of a 3-year-old girl commented that: "I believe I don't pay less attention to her behaviour […] that's my perception of it. I'd love to do an independent study to verify that." Therefore, the use of mobile technology by caregivers may have a larger effect on children's self-regulation since caregiver preoccupation with mobile technology can translate into fewer direct interactions with children that are important for fostering self-regulation.

Second, child participation in the environment emerged as a significant mediator only in the model that included caregiver mobile technology use as the predictor (Figure 3). Since preschool children rely on their caregivers to organize and initiate developmentally enriching activities, caregivers who are preoccupied with their mobile technology may be less inclined to initiate these activities with their children. Accordingly, greater use of mobile technology by children was not related to overall participation in the environment, whereas greater use of mobile technology by caregivers was significantly related to lower participation in the environment by children (Table 7). Interestingly, these patterns of results suggest that the use of mobile technology by caregivers has a greater displacing effect on child activities since the

responsibility to initiate these activities falls on caregivers. As a result, fewer opportunities for children to learn and practice self-regulation in these activity settings can lead to greater difficulties with self-regulation.

Aggression. The displacement hypothesis with respect to aggression was supported (Figure 2). When considering child use of mobile technology in the mediation model, a partially mediating effect was found. A significant indirect effect revealed that greater use of mobile technology by children was associated with greater technoference (but not participation in the environment), and in turn more aggression. Additionally, higher child mobile screen time continued to have a significant direct effect on aggression in the presence of the mediators, signifying that both direct and indirect effects operate simultaneously (Hayes, 2013). Similarly, when considering caregiver use of mobile technology in the mediation model, the same pattern of results was found (Figure 4). These findings are consistent with a previous study that found that greater technoference in the mother-child relationship predictedgreater externalizing problems in young children (McDaniel & Radesky, 2017). The novelty of the present study expanded on this study by demonstrating that children's own use of mobile technology can also contribute to technoference that give rise to aggressive behaviour.

There are several possible reasons why technoference can contribute to more aggressive behaviour in young children. First, in previous interviews, caregivers reported difficulties with multi-tasking between mobile technology use and the management of their children's difficult behaviour (Radesky, Kistin, Eisenberrg, et al., 2016). As previously noted, if parents are not effective in managing their children's behaviour, children can act more freely on their impulses and engage in unregulated behaviour (Baumrind, 1971). Moreover, qualitative interviews in the present study revealed that some caregivers (26.7%) feel frustrated while multi-tasking. For

instance, a caregiver of a 5-year-old boy recalled feeling "frustrated when I was trying to work on taxes […]. I feel frustrated sometimes if they're trying to get my attention" (Participation 12). Although caregivers did not report responding to children in a frustrated manner, observational studies of caregivers using their mobile devices in naturalistic environments revealed that caregivers can respond to children with anger while when they are interrupted (Radesky, Kisten, et al., 2014). This hostility can set poor examples for children who may model their caregivers aggressive behaviour. Second, qualitative interviews and naturalistic observations from a previous study (Radesky, Kisten, et al., 2014) also revealed that children often act out and displayed unregulated or aggressive behaviour to try to capture their caregiver's attention while they are using their devices. If caregivers do respond to children when they acted out, children may be reinforced for acting aggressively. Finally, mobile technology may be interfering with caregiver-child interactions when limit-setting is being enforced. Caregivers revealed that their children often threw temper tantrums when their mobile screen time was being limited. One parent of a 2-year-old girl commented "I'd say a lot of the times her temper tantrums revolve around – she just wants to watch more" (Mother of 2-year-old girl). Caregivers also voiced that children acted aggressively if they were frustrated by technical difficulties such as slow Internet connection or a difficult level during a game. A mother of a 4-year-old boy stated, "Sometimes if they're playing a game and it's not going well, they'll get super frustrated … almost like banging on the tablet." Thus, these displays of aggression related to limit setting and technical difficulties may be sufficiently pronounced to disrupt important caregiver-child interactions.

This was the first known study to demonstrate some support for the displacement hypothesis with respect to the use of mobile technology. In summary, the displacement of activities was found to intensify self-regulation problems, whereas greater technoference was

found to intensify aggressive behaviour. These findings further inform our understanding about how mobile technology can displace important activities and social interactions that help develop the skills that children need to regulate their emotions, thoughts, behaviours, and aggressive impulses.

The Role of Mobile Technology as a Parenting Tool

The fourth goal of the present study was to examine the role of caregivers more directly by exploring their use of mobile technology as a parenting tool, and how that may affect children's self-regulation and aggressive behaviour.

With respect to self-regulation, it was hypothesized that greater use of mobile technology by caregivers and children would be associated with greater use of mobile technology as parenting tools and thus, greater dysregulation in children. Contrary to the hypothesis, a mediating effect was not supported (Figure 5 and Figure 7). These findings were surprising since many caregivers noted using mobile technology to calm their upset children (Radesky, Peacock-Chambers, et al., 2016). These findings were also supported by the qualitative responses in the present study. A theme that emerged from the interviews captured the various ways that caregivers used mobile technology to discipline, calm, and distract their children. For instance, a mother of 4-year-old girl recalled "before we had kids, we [thought] we would never […] give phones to our children if they're misbehaving […] then sure enough we had kids and there are certain circumstances where we have to do that to keep the peace."

With respect to aggression, it was hypothesized that greater use of mobile technology by caregivers and children would be associated with greater use of mobile technology as parenting tools and thus, more aggressive behaviour. When considering child use of mobile technology in the mediation model, a full mediating effect was supported (Figure 6). A significant indirect

effect revealed that greater child mobile screen time was associated with higher use of mobile technology as a parenting tool, and in turn more aggression. After the inclusion of the mediator, child mobile screen time no longer had a direct effect on aggression, signifying that the use of mobile technology as parenting tools fully accounts for increased aggression in this mediation model. When considering caregiver use of mobile technology in the mediation model, a partially mediating effect was found (Figure 8). A significant indirect effect revealed that greater caregiver mobile screen time was associated with higher use of mobile technology as a parenting tool, and in turn more aggressive behaviour in young children. Higher caregiver mobile screen time continued to have a significant direct effect on aggression in the presence of the mediators, signifying that both direct and indirect effects operate simultaneously (Hayes, 2013).

This was the first known study to empirically explore the effect of using mobile technology as parenting tools on young children's self-regulation and aggressive behaviour. Overall, using mobile technology to manage children's behaviour did not account for greater self-regulation difficulties, but did account for more aggressive behaviour. These findings suggest that mobile technology may offer a moment of peace and quiet in the family, but these devices cannot teach children how to regulate their aggression. As caregivers continue to use this parenting strategy, they may unknowingly create a cycle where they exacerbate their children's aggressive behaviour and then rely on mobile technology to manage this behaviour. It is therefore imperative that caregivers become aware of how using mobile technology to regulate their children can negatively affect their aggressive behaviour.

The Role of Self-Regulation in Aggressive Behaviour

There were several unforeseen findings that were inconsistent with the existing theoretical and empirical literature. First, greater child mobile screen time did not predict greater

dysregulation. Second, greater technoference in the caregiver-child relationship did not predict greater dysregulation. Third, the displacement hypothesis, with respect to child mobile screen time and self-regulation, was not supported. Finally, the use of mobile technology as a parenting tool did not exacerbate regulatory deficits. Yet, when self-regulation was replaced with aggression as the outcome variable, these relations became significant. The pattern of these results are interesting because self-regulation plays a strong role in regulating aggressive impulses (e.g., Ellis et al., 2009; Raaijmakers et al., 2008; White et al., 2013). Accordingly, a set of additional research questions found that greater technoference *and* use of mobile technology as a parenting tool did in fact associate with greater self-regulation difficulties, and in turn more aggressive behaviour (Figure 9 and Figure 10). The direct effect in both mediation models remained significant in the presence of self-regulation as a mediator suggesting that both direct and indirect effects operate simultaneously (Hayes, 2013). Stated different, greater technoference and use of mobile technology as parenting tools is related to more aggressive behaviour, but also related to greater deficits in self-regulation which manifests as aggression. Therefore, there is some preliminary support that mobile technology does disrupt internal mechanisms, such as self-regulation, which are necessary for regulating aggression.

The Role of Child Negative Affect

The final set of additional research questions explored whether the mobile technology landscape (caregiver and child mobile screen time, technoference, and mobile technology as a parenting tool) exacerbated the risk for dysregulated and aggressive behaviour in children with difficult temperaments (high negative affect).

When considering self-regulation, the mobile technology landscape did not mediate the relation between negative affect and dysregulation in the overall sample (Figure 11), or with the

younger sample (Figure 12; age 2 to 3 years old). With older children, however (Figure 13; age 4 to 5 years old), a partially mediating effect was found. Significant indirect effects revealed that more negative affect was related to greater caregiver mobile screen time, as well as greater use of mobile technology as parenting tools, which in turn was related to greater dysregulation. The direct effect between negative affect and self-regulation remained significant in the presence-of the mediators, suggesting that direct and indirect effects operate simultaneously (Hayes, 2013).

When considering aggression, the mobile technology landscape fully mediated the relation between negative affect and aggression across the overall sample (Figure 14), and the older sample (Figure 16; 4 to 5 years old). The significant indirect effects revealed that more negative affect was related to greater use of mobile technology as a parenting tool, and in turn more aggressive behaviour. With the younger sample (Figure 15; age 2 to 3 years old), a partial mediating effect was found. Although the overall indirect effect was significant, there were no unique indirect effects in the younger sample.

Taken together, these results signify that children with more difficult temperaments, such as higher negative affect, are more likely to experience greater difficultly with regulating themselves and more likely to display aggressive behaviour. Greater use of mobile technology as parenting tools can exacerbate both self-regulation problems and aggressive behaviour in these children. These findings are especially alarming in light of previous findings that children who are more difficult to sooth have caregivers who are more likely to use mobile technology to manage their difficult children (Radesky, Silverstein, et al., 2014; Radesky, Peacock-Chambers, et al., 2016). The present study therefore adds to the literature by demonstrating that this parenting strategy can exacerbate dysregulation and aggression problems in already difficult children. The initial effectiveness of this strategy may subsequently reinforce caregiver's use of

mobile technology as parenting tools to manage further difficult behaviour. Thus, this strategy puts children who are already at risk for maladjustment later in life at an even higher risk for dysregulated and aggressive behaviour (Abulizi, Pryor, Michel, Melchor, & van der Waerden, 2017).

Developmental trajectories suggest that children begin to internalize and display more mature self-regulation skills by the third year onward (Kopp, 1989). Likewise, aggression is expected to steadily decline after age 3 (Alink et al., 2006). Contradicting this timeline, the present study found that the mediating effect of the mobile technology landscape was more prevalent in the mediation models with older children (ages 4 to 5 years old). This pattern suggests that using mobile technology, especially to regulate difficult behaviour, can delay the maturation of self-regulation skills and actually escalate aggressive behaviour as children become older. On the other hand, self-regulation and aggression problems may not have been as apparent in the younger sample since these skills are still in the early stages of development. Therefore, it can be especially important for caregivers to minimize the use of mobile technology around younger children as these skills are still maturing during a critical period of development. Additionally, intervention efforts aimed at reducing mobile screen time may be especially effective with younger children whose self-regulation and aggression problems are not yet apparent.

Mobile Technology Use: Caregiver Attitudes

The qualitative portion of the present study explored caregiver attitudes towards mobile technology use in the family and the effect these devices have on the family dynamic. This was the first known study to interview Canadian caregivers, who were asked questions centered around three main topics: (a) whether caregivers had any concerns about how mobile technology

may impact young children; (b) whether caregivers experience any stress regarding limiting setting and rules; and (c) whether caregivers have any tensions about their attitudes towards permitting or limiting the use of these devices in the family. Exploration of these research questions, as well as the additional sub-themes and codes that emerged through the thematic analysis provided a detailed portrayal of caregivers' concerns, stressors, and attitudes towards mobile technology use (see Table 4). These themes complemented the quantitative results in the present study and will be discussed in the greater context of the findings from the entire study.

Negative effects/Changes in child. All caregivers expressed having concerns about how mobile technology may negatively impact their children's development, which encompassed the first major theme (Negative Effects/Changes in Child). Three concerns were notable in light of the study's quantitative research questions.

First, a major concern from the majority of caregivers were that children became preoccupied (46.7% of caregivers) and disengaged (66.7%) with their environment when they used mobile technology. One mother of a 5-year-old boy described her children as becoming "withdrawn zombies, they don't pay attention to what's going on […] it's important that they become part of the community."

Second, several caregivers (26.7%) reported being worried about how mobile technology may affect their children's self-regulation skills. For instance, one caregiver stated that her 2-year-old daughter has "to learn that she needs to talk […] and behave herself in a restaurant without an iPad."

Third, one of the biggest concerns that caregivers noted were related to children's aggressive behaviour. The majority of caregivers (86.7%) were worried about the potential for children to model aggressive behaviour they see online. When asked what caregivers considered

to be an inappropriate app, a mother of a 4-year-old boy replied "[A bad app is] anything with swearing, violence, just rude things. I mean they're sponges, so they monkey see monkey do at this age." Additionally, most caregivers (73.3%) commented on the aggressive behaviour their children displayed when limits were set on how much screen time children were allowed, as well as when children encountered technical difficulties while using these mobile devices. One mother noted that "using it [mobile technology] too long creates temper tantrums when I have to turn it off" with her 2-year-old girl.

These responses from participants revealed that caregivers have some awareness about the potential dangers of introducing mobile technology at an early age, such as being disengaged from the environment, delays in the development of self-regulation, and increased aggression. In fact, some caregivers have already established a strong link between mobile technology use and aggressive behaviour in their children. In line with caregiver's worries, the present study's quantitative results demonstrated that children's disengagement with their environment and social interactions (from using mobile technology) can negatively impact their self-regulation and aggressive behaviour due to the lost opportunities to foster regulatory skills. Yet, despite caregiver's worries, because there is such little empirical evidence that caregivers can easily access, they cannot evaluate the validity of their concerns. Thus, their worries remain largely based on speculation. Moreover, this is the first known study to test the displacement hypothesis, suggesting that knowledge about how children's preoccupation with mobile technology affects their development is not widely explored. Altogether, there is little incentive for caregivers to limit their children's mobile technology use if they are not aware of how these devices can be harmful for their children. More accessible research that targets these concerns and uncertainties can help caregivers make more informed decisions about their children's mobile technology use.

Caregiver strategies. The second qualitative research question explored whether caregivers would express being stressed about setting limits on their children's mobile technology use. Stressors regarding limit setting did not emerge as a prominent theme, but instead all caregivers alluded to having a good sense of control over what type of content their children were allowed to access. This confidence was reflected across the various strategies that caregivers shared about regulating their children' use of mobile technology, which emerged as the second major theme (Caregiver Strategies). Yet, underlying this confidence remained some weariness about the limitless array of inappropriate content that children may accidently stumble upon, especially on apps such as YouTube. For instance, one mother of a 3-year-old boy stated that "even though the parental guidance was on, […] it was just dark and didn't seem like kid's content […] so we don't go on YouTube anymore." To remedy this problem, caregivers adopted many different strategies to monitor their children's digital activity, such as using child friendly apps (kid version of YouTube; 66.7%) or testing the appropriateness of apps before allowing children to use them (53.3%). The most popular strategy endorsed by 86.7% of caregivers were to keep their children physically near them. For instance, a father of a 3-year-old girl reported "never [being] too far from it. We just sort of keep an eye over her shoulder […] you could hear even if we're not staring at it."

Notably, all the strategies that caregivers used to monitor their children's digital activity were easy to employ with young children, especially because young children typically use their caregiver's devices and rely on their caregivers to help them navigate the technology and download apps. Hence, no caregivers expressed being stressed about limit setting, and a strong sense of control through the use of various monitoring strategies emerged as an overall theme. Yet, as children become older, these strategies will quickly become ineffective. Children will

begin to have their own personal devices, have the liberty to choose the media they interact with, and have the means to conceal these activities. This was a prominent theme found in qualitative interviews with a set of American caregivers who expressed worries about their older children (0 to 8 years old) downloading apps for themselves (Radesky, Eisenberg, et al., 2016). Therefore, this study adds to the current literature by demonstrating how caregivers perceive their sense of control over young children's mobile media use.

Interestingly, despite the worries that caregivers previously disclosed about the negative impacts of prolonged mobile technology use (Negative effects/Changes in child theme), almost no strategies were targeted at limiting their children's *time* using mobile technology. Instead, strategies were entirely focused on filtering out inappropriate content. Thus, the lack of strategies focused on reducing child mobile screen time further reinforce the notion that caregivers are not fully aware about the negative impact of these devices on young children, and educating caregivers may encourage them to implement new strategies aimed at limiting screen time.

Tense caregiver attitudes.

Disadvantages of mobile technology. The last overarching theme captured the tensions between permitting or limiting mobile technology use in the family. There were several codes and sub-themes that provided insight into what shaped caregiver's negative attitudes towards mobile technology use. Aside from the aforementioned concerns that caregivers had about their children's development and behaviour (Negative effects/Changes in child theme), a sub-theme that emerged were negative feelings associated with using these devices around their children (Needing to use mobile technology VS. **Negative feelings for not prioritizing child needs**). Most caregivers (73.3%) commented on the frustrated or guilty feelings that arise while choosing to use mobile technology around their children instead of prioritizing their children's needs. A

mother of a 2-year-old girl recalled feeling "torn […] I'm trying to get something done, but then I want to pay attention to her."

Three additional factors that were not grouped under this theme, but contributed to caregiver's negative perception of mobile technology were shared. The majority of caregivers (86.6%) reported that using mobile technology interfered with their ability to pay attention to their children. One mother of a 3-year-old boy stating that she pays "tries to pay attention […] but if I'm looking at the phone […] I'm not as engaged [with her child]. I don't love it." In a similar manner, this observation was also expressed by American caregivers who used mobile technology while their children were at the playground (Hiniker et al., 2015) Additionally, caregivers (73.3%) also noticed that their children's bids for attention increased while caregivers were busy on their mobile devices, which may exacerbate the negative feelings. One mother stated that her 3-year-old son "got really upset because he wanted me to play with him, I realized I should try to pay more attention to him." These observations about increased bids for attention were also noted during naturalistic observations of parent-child dyads in a previous study (Radesky, Kistin, et al., 2014). Lastly, many caregivers (60%) expressed judging other caregivers who appeared to use their mobile technology at the expense of neglecting their children. These judgements suggest that caregivers acknowledge the negative tone surrounding the use of mobile technology around children. Taken together, these concerns, negative feelings, observations, and judgements suggest that caregivers do recognize how mobile technology use can negatively effects their families and that limiting these devices could help relieve some of these tensions.

Advantages of mobile technology. Despite the disadvantages of using mobile technology in the family, there were three main factors that caregivers shared during interview to justify the use of these devices. First, many caregivers expressed a strong need or desire to use their mobile

technology despite the negative feelings associated with using these devices around their children (**Needing to use mobile technology** VS. Negative feelings for not prioritizing child needs). One mother admitted that when her 5-year-old daughter wants attention "I probably will be more dismissive, you know, trying just to buy myself more time to finish what I'm doing [on mobile technology.]" These feelings of needing to use mobile technology is reflected in one un-themed code which captured some caregivers (40%) perception that mobile technology is a normal part of everyday life that should be accepted. Alarmingly, the present study's quantitative results demonstrated that caregiver's mobile screen time can have immense impacts on children's self-regulation and aggression. Greater use of mobile screen by caregivers introduced greater technoference in the caregiver-child relation. Additionally, caregivers who used more mobile technology were less likely to initiate developmentally enriching activities for their children. As a result, caregiver mobile screen time was found to predict greater dysregulation and aggressive behaviour in young children. Therefore, although mobile technology has become an ever-present part of Western life, caregivers should be informed of their role in their children's development and be made aware of how mobile technology may interfere with this critical role.

Second, the majority of caregivers (86.7%) shared wanting to use mobile technology due to the learning opportunities that "educational apps" offer (Limiting Time VS. **Educational benefits/Technology literacy**). One mother with a 2-year-old daughter noted the opportunities for "learning about letters, learning about numbers […] if they're on an iPad they might as well be learning something." Likewise, American caregivers from a previous study also shared that they felt comfortable allowing their children to use apps with "educational" labels (Radesky, Eisenberg, et al., 2016). However, the educational benefits of many apps are common misconceptions. Thousands of apps that are marketed as educational have no empirical evidence

to support these claims (Hirsh-Pasek et al., 2015). Furthermore, the idea that children can learn from any "educational app" is another common misconception. There are cognitive constraints on children's ability to learn from touchscreens and transfer what they learn into the three-dimensional world (Barnet & Ceci, 2002; American Academy of Pediatrics, 2016). Children require their caregivers to help them internalize what they are learning from mobile technology (Radesky, Schumacher, et al., 2015). Yet, even if caregivers do jointly use mobile technology with their children during activities that are considered developmentally enriching, children are not benefiting from these activities the same they would if mobile technology was removed entirely. For instance, children were shown to have greater difficulty understanding what they were reading from electronic books compared to traditional books (Krcmar & Cingel, 2014), even with the help of an adult. Likewise, caregiver-child dyads also exchanged less verbal and nonverbal interactions during play with electronic devices compared to traditional toys (Hiniker, Lee, Kientz, & Radesky, 2018). Helping caregivers clear up these misconceptions may allow them to feel less worried about the educational benefits their children are missing when limiting mobile technology use.

Third, all caregivers shared different ways they used mobile technology as a parenting tool to regulate their children's behaviour (Wanting to limit time VS. **Useful Parenting Tool).** Caregivers reported on the utility of mobile technology when rewarding their children, calming irritated, dysregulated, or upset children, and distracting children at home or in public places as a means to occupy them. The use of these parenting tools appeared to persist despite some recognition that these strategies may be wrong. As stated by one caregiver of a 3-year-old boy "I feel like a bad mommy today because I let him on the iPad for […] all morning – but I'm so tired […] and he's been busy and quiet" (Interview 4). These strategies are particularly alarming in

light of the quantitative results in the present study that found that using mobile technology as parenting tools significantly impacts aggressive behaviour and increases the risk for dysregulation and aggression, especially if children already have difficult temperaments.

Overall, caregivers identified many disadvantages of using mobile technology, but also several advantages as well. Because there is very little research exploring the present study's research questions, as well as limited accessibility of existing research for caregivers, they are likely making uninformed decisions about mobile technology use with their families. The present study's interviews clearly demonstrate that this lack of knowledge has manifested into negative feelings, worries, misconceptions, and tensions that have created ambivalent attitudes about mobile technology. As a result, caregivers have appeared to default into permitting the use of these devices. Fortunately, individuals with ambivalent attitudes have been shown to be more susceptible to change (Freijy & Kothe, 2013). Thus, the tensions and ambivalence that caregivers expressed are good opportunities to educate caregivers about how mobile technology can affect child development and inspire change.

Applied Implications and Conclusions

Early childhood is a period when children develop their self-regulation and learn to regulate their aggressive behaviour. The present study demonstrated that mobile technology can significantly interrupt the development of these imperative skills *through* the displacement of important activities and social interactions. The findings herein support the current American Academy of Pediatric (2016) recommendations to limit the amount of screen exposure in young children. Decreasing overall screen time in the family is one strategy that can reduce the negative impact mobile technology can have on child development. Specific actions caregivers can take include limiting their mobile technology use around children, avoiding the use of mobile

technology to regulate child behaviour, restricting the use of these devices during important family activities (e.g., meal time), and dedicating periods of times where the family does not use any technology. Aside from the need for more research related to this study, it is apparent that caregivers also need more accessible information that can guide the rules they create about mobile technology use around the home. Professionals working with caregivers of young children are encouraged to educate caregivers about the impact that mobile technology use by the family can have on young children adaptive outcomes. Professionals are also encouraged to explore different ways families are using these devices. Gaining insight into why and how families are using mobile technology may highlight the function of these devices (e.g., distracting children), to which a non-digital alternative may be introduced. One example of how caregivers are being educated come from a commentary issued by the American Academy of Pediatrics. Pediatricians are being encouraged to discuss with caregivers the reasons for using mobile technology in the waiting room and transition them to interpersonal interactions instead (Erkoboni & Radesky, 2018). These efforts can facilitate greater caregiver awareness about mobile technology's impact on young children and help them make more informed decisions about when, where, and how much mobile technology use is appropriate for their families.

The findings from this study create an interesting theoretical story whereby greater use of mobile technology by caregivers and children (a) displaces developmentally enriching activities, (b) introduces greater disturbances in the caregiver-child relationship, and (c) makes caregivers more likely to use mobile technology to regulate their children's behaviour. In turn, children (a) have limited contexts (activity settings) to learn and practice their self-regulation skills, (b) interact with less responsiveness caregivers, and (c) rely on mobile technology to regulate their behaviour. As a result, these children are more likely to develop self-regulation difficulties.

Problems with self-regulation then lead to difficulties inhibiting aggressive impulses, which therefore lead to a greater likelihood of developing externalizing problems. Evidently, the present study did not examine these relations collectively in one model and findings from the present study do not infer causality. Nonetheless, the current study hopes to stimulate future research aimed at exploring this framework using more sophisticated multivariate modelling techniques.

Limitations

The conclusions from the present study must be interpreted in light of several limitations. The cross-sectional nature of the study limits any conclusions drawn about the causal nature of the relations herein. Lingering questions about the nature of several bidirectional relations need to be addressed in future research with longitudinal designs that are urgently needed.

One possible explanation for the link between mobile technology and aggression is the quality of content that children are accessing. However, content quality was not measured in the present study, which is a limitation. Future research in this area could identify whether violent content further contributes to aggressive behaviour, but also whether children who access higher quality content have more positive cognitive and developmental outcomes.

The demographic characteristics of the sample were another limitation. Respondents in both the quantitative and qualitative component of the study were primarily Caucasian females (though children were more diversely represented). Future research should focus on recruiting more male caregivers to explore the nature of potential gender differences. Additionally, quantitative information was only collected from one informant, which introduces single-informant biases.

A methodological limitation was the use of novel measures that have little or no validated psychometric properties (e.g., using mobile technology as a parenting tool). As studies in this area continues to grow, research focused specifically on evaluating the psychometric properties of the measures used in this study, as well as on developing new measures centered around mobile technology is needed. An additional methodological limitation was the nature of using self-report measures. Although a heuristic template was provided to participations while they reported on their mobile technology use, retrospective accounts of technology use can be inaccurate and are undeniably inferior to the use of alternative methods, such as time diaries. The accuracy of time diaries was found to be highly correlated with the accuracy of video recording (Anderson, Field, Collins, Lorch, & Natham, 1985) and should be used in future research whenever possible. Likewise, children's self-regulation skills were indexed by self-report measures, whereas more objective measures, such as the Preschool Self Regulation Assessment (Smith-Donald, Raver, Hayes, & Richardson, 2007) can eliminate informant bias and capture how different children behave across standardized activities. Finally, very few caregivers reported that their children used computers or played video games which created positively skewed distributions. To remedy this problem, variables had to be dichotomized at the expense of lost variability.

Future Directions

The novelty of the present study highlights the critical need for future research, as well as raise a number of questions for future research beyond replicating the study's findings. In the current study, there was some support that mobile technology disrupts internal mechanisms, such as self-regulation, which are necessary for regulating aggression (Figure 9 and Figure 10). Research aimed at exploring the process by which mobile technology contributes to aggression

will be informative, and help identify potential points for intervention. Additionally, technoference was found to predict more aggressive behaviour in children, but have also been found to predict other factors such as more depressive symptoms and parenting stress (McDaniel & Radesky, 2017). Therefore, caregiver and child characteristic not measured in this study may also impact self-regulation and aggression. Future research can explore how different characteristics of mobile technology use (e.g., higher use, frequency of caregivers and children co-using mobile technology), are associated with caregiver and child characteristics (e.g., household stress), and how these variables impact self-regulation and aggression. Likewise, interviews with a larger and more diverse sample may capture caregiver attitudes about mobile technology that vary based on different demographic characteristics.

As research in this area continues to grow, intervention studies will be informative. For instance, studies may explore whether limiting caregiver and child use of mobile technology result in any changes to their self-regulation skills and aggressive behaviour. As alluded to earlier, the content quality of mobile media could also be targeted as a point of intervention to examine whether changes in media content lead to subsequent changes in child outcomes. These types of studies will provide further evidence to support the findings of this study, as well as test different strategies that caregivers can implement at home for when their children use mobile technology.

Lastly, a line of research that is not discussed in this study but rapidly expanding is the relation between mobile technology use and language development. The development of self-regulation and ability to modulate aggression is largely dependent on children's language abilities (Clark, Menna, & Johnson, 2014). Language development is also highly sensitive to the responsiveness of caregivers (Clark, Menna, & Tran, 2018). Thus, as mobile technology disrupts

social interactions and contribute to more unresponsive parenting, the language development of young children may also suffer and lead to more dysregulated and aggressive behaviour.

REFERENCES

Aamoth, D. (2014, August 18). First smartphone turns 20: Fun facts about the Simon. *Time.* Retrieved from: http://time.com/3137005/first-smartphone-ibm-simon/

Abulizi, X., Pryor, L., Michel, G., Melchor, M., & van der Waerden, J. (2017). Temperament in infancy and behavioural and emotional problems at age 5.5: The EDEN mother-child cohort. *PLOS.* doi: 10.1371/journal/pone.0171971

Achenbach, T. M. (1991). *Manual for the Revised Child Behavior Profile and Child Behavior Checklist.* Burlington, VT.

Achenbach, T. M., & Rescorla, L. A. (2001). *Manual for the ASEBA School-Age Forms & Profiles*. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families

Ainsworth, M. S. (1989). Infant-mother attachment. *American Psychologist, 24*(10), 932-937. doi: 10.1037/0003-066X.34.10.932.

Alarcón-Rubio, D., Sánchez-Medina, J. A., & Prieto-Garćia, J. R. (2014). Executive function and verbal self-regulation in childhood: Developmental linkages between partially internalized private speech and cognitive flexibility. *Early Childhood Research Quarterly, 29*, 95-105. doi: 10.1016/j.ecresq.2013.11.002.

Alink, L. R., Mesman, J., van Zeijl, J., Stolk, M. N., Juffer, F., Koot, H. M… van Ijzendoorn, M. H. (2006). The early childhood aggression curve: Development of physical aggression in 10-to-50 month-old children. *Child Development, 77*(4), 945-966. doi: 10.1111/j.1467-8624.2006.00912.x

Anderson, C. A., & Bushman, B. J. (2001). Effects of violent video games on aggressive behaviour, aggressive cognition, aggressive affect, physiological arousal, and prosocial

behaviour: A meta-analytic review of the scientific literature. *Psychological Science, 12*(5), 353-359. doi: 10.1111/1467-9280.00366.

Anderson, D. R., Field, D. E., Collings, P. A., Lorch, E. P. & Nathan, J G. (1985). Estimates of young children's time with television: A methodological comparison of parent reports with time-lapse video home observations. *Child Development, 56*(5), 1345-1357. doi: 10.2307/1130249.

Anderson, C. A., Gentile, D.A., & Buckley, K. E. (2007). *Violent video game effects on children and adolescents: Theory, research, and public policy.* New York, NY: Oxford University Press.

Anderson, C. A., Ihori, N., Bushman, B. J., Rothstein, H. R., Shibuya, A., Swing, E. L., … Salem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behaviour in Eastern and Western Countries: A meta-analytic review. *Psychological Bulletin, 136*(2), 151-173. doi: 10.1037/a0018251.

American Academy of Pedatrics. (2016). American Academy of Pediatrics announces new recommendations for children's media use. Retrieved from https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/American-Academy-of-Pediatrics-Announces-New- Recommendations-for-Childrens-Media-Use.aspx

Axelsson, A. K., Granlund, M., & Wilder, J. (2013). Engagement in family activities: A quantitative, comparative study of children with profound intellectual and multiple disabilities and children with typical development. *Child Care Health and Development, 39*(4), 523-34. doi: 10.1111/cch.12044.

Bacigalupa, C. (2005). The use of video games by kindergarteners in a family child care setting. *Early Childhood Education Journal, 33*(1), 25-30. doi: 10.1007/s10643-005-0016-4.

Bailey, R., Jones, S. M., & Partree, A. (2015). *Mapping the executive function literature: Developing a framework to organize executive function and self-regulation concepts.* Paper presented at the Society for Research in Child Development 2015 Biennial Meeting, Philadelphia, PA.

Bandura, A. (1977). *Social learning theory.* Oxford, England: Prentice-Hall.

Baumrind, D., (1971). Current patterns of parental authority. *Developmental Psychology Monograph, 4,* 1-103. doi: 10.1037/h0030372

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin, 121,* 65-94. doi: 10.1037/0033-2909.121.1.65. Barnett, S. M., & Ceci, S. J. (2002). When and where do we apply what we learn? A taxonomy for far transfer. *Psychological Bulletin, 128*(4), 612-637. doi: 10.1037//0033-2909.128.4.612

Bentley, G. F., Turner, K. M., & Jago, R. (2016). Mothers' views of their preschool child's screen-viewing behaviour: A qualitative study. *BioMed Central Public Health, 16(718), 1-11.* doi: 10.1186/s12889-016-3440-z.

Berkowitz, L. (1978). Whatever happened to the frustration-aggression hypothesis? *American Behavioural Scientist, 21,* 691–708.

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychology, 75*(2), 111-127. doi: 10.1037/0003-066X.57.2.111

Blair C, & Diamond A. (2008). Biological processes in prevention and intervention: The promotion of self- regulation as a means of preventing school failure. *Development and Psychopathology, 20,* 899–911. doi: 10.1017/S0954579408000436.

Blake, B. F., Valdiserri, J., Neuendorf, K. A., & Nemeth, J. (2006). Validity of the SDS-17 measure of social desirability in the American context. *Personality and Individual Differences, 40,* 1625-1636. doi: 10.1016/j.paid.2005.12.007

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. doi: 10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2014). What can "thematic analysis" offer health and wellbeing researchers? *International Journal of Qualitative Studies on Health and Well-being, 9.* doi: 10.3402/qhw.v9.26152

Bronson, B. M. (2000). Recognizing and supporting the development of self-regulation in young children. *Young Children, 55*(2), 32-37.

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1993). Ecological models of human development. In M. Gauvain & M. Cole (Eds.), *Readings on the development of children* (2nd ed., pp. 37–43). New York: Freeman.

Bushman, B. J., & Anderson, C. A. (2002). Violent video games and hostile expectations: A test of the general aggression model. *Personality and Social Psychology Bulletin, 28*(12), 1679-1686. doi: 10.1177/014616702237649.

Bushman, B.J., & Huesmann, L.R. (2001). Effects of televised violence on aggression. In D.G. Singer & J.L. Singer (Eds.), *Handbook of children and the media* (pp. 223-254). Thousand Oaks, CA: Sage.

Bus, A.G., Takacs, Z.K., & Kegel, C.A. (2015). Affordances and limitations of electronic storybooks for young children's emergent literacy. *Developmental Review, 35,*

79-97. doi: 10.1016/j.dr.2014.12.004

Card, N. A., & Little, T. D. (2006). Proactive and reactive aggression in childhood and adolescence: A meta-analysis of differential relations with psychosocial adjustment. *International Journal of Behavioral Development, 30,* 466–480. doi: 10.1177/0165025406071904

Chugani, H. T. (1988). A critical period of brain development: Studies of cerebral glucose utilization with PET. *Preventive Medicine, 27*(2), 184-188. doi: 10.1006/pmed.1998.0274

Christakis, D. A., Gilkerson, J., Richards, J. A., Zimmerman, F. J., Garrison, M. M., Xu, D., … Yapanel U. (2009). Audible television and decreased adult words, infant vocalizations, and conversational turns: A population-based study. *Archives of Pediatrics and Adolescent Medicine, 163*(6), 554-558. doi: 10.1001/archpediatrics.2009.61

Christakis, D.A., Zimmerman, F.J., DiGiuseppe, D.L., & McCarty, C.A. (2004). Early television exposure and subsequent attentional problems in children. *Pediatrics, 113*(4), 708 –713. doi: 10.1111/j.1365-2214.2004.00456_4.x

Clark, R., Menna, R., & Johnson, E.M. (2014, July) Language-aggression hypothesis in young children: The role of self-regulation, The 9th International Conference on Child and Adolescent Psychopathology, London, UK.

Clark, R., Menna, R., & Tran, A. (2018, August). Language aggression hypothesis in preschoolers: The role of maternal scaffolding and self-regulation, The 126th American Psychological Association Annual Conference, San Francisco, California, USA.

Conners-Burrow, N.A., McKelvey, L.M., & Fussell, J.J. (2011). Social outcomes associated with media viewing habits of low-income preschool children. *Early Education and Development, 22*, 256–73. doi: 10.1080/10409289.2011.550844

Cummings, E. M., Davies, P. T., & Campbell, S. B. (2000). *Developmental psychopathology and family processes: Theory, research, and clinical implications*. New York: Guilford.

Denham, S. A., Warren-Khot, H. K., Bassett, H. H., Wyatt, T., & Perna, A. (2012). Factor structure of self-regulation in preschoolers: Testing models of field-based assessment for predicting early school readiness. *Journal of Experimental Child Psychology, 111*(3), 386-404. doi: 10.1016/j.jecp.2011.10.002

Dodge, K. A., & Coie, J. D. (1987). Social-information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology, 53,* 1146–1158. doi: 10.1037/0022-3514.53.6.1146

Dollard, J., Miller, N. E., Doob, L. W., Mowrer, O. H., & Sears, R. R. (1939). *Frustration and aggression*. New Haven: Yale University Press.

Dunst, C. J., Bruder, M. B., Trivette, C. M., & Hamby, D. W. (2006). Everyday activity settings, natural learning environments, and early intervention practices. *Journal of Policy and Practice in Intellectual Disabilities, (3)*1, 3-10. doi: 10.1111/j.1741-1130.2006.00047.x

Dunst, C. J., Bruder, M. B., Trivette, C. M., Raab, M., & McLean, M. (2001). Natural learning opportunities for infants, toddlers, and preschoolers. *Young Exceptional Children, 4*(3), 18-15. doi: 10.1177/109625060100400303

Dunst, C. J., Hamby, D., Trivette, C.M., Raab, M. & Bruder, M. B. (2002) Young children's participation in everyday family and community activity. *Psychological Reports, 91*, 875–897. doi: 10.2466/pr0.2002.91.3.875

Dunst, C. J., Hamby, D., Trivette, C. M., Raab, M., & Bruder, M. B. (2000). Everyday family and community life and children's naturally occurring learning opportunities. *Journal of Early Intervention, 23*(3), 151-164. doi: 10.1177/10538151000230030501

Dunst, C. J., Valentine, A., Raab, M., & Hamby, D. W. (2013). *Everyday activities as sources of language learning opportunities for infants, toddlers, and preschoolers* (Everyday Child Language Learning Reports No. 6.). Retrieved from: http://www.cecll.org/products.php.

Dunst, C. J., Trivette, C. M., & Raab, M. (2013). Everyday child language learning early intervention practices. *Infants and Young Children 27*(3), 207-219. doi: 10.1097/IYC.0000000000000015

Duku, E., & Vaillancourt, T. (2014). Validation of the BRIEF-P in a sample of Canadian preschool children. *Child Neuropsychology, 20*(3), 358-371. doi: 10.1080/09297049.2013.796919

Elias, C. L., & Berk, L. E. (2002). Self-regulation in young children: Is there a role for sociodramatic play? *Early Childhood Research Quarterly, 17,* 216-238. doi: 10.1016/S0885-2006(02)00146-1

Ellis, M. L., Weiss, B., & Lochman, J. E. (2009). Executive functions in children: associations with aggressive behavior and appraisal processing. *Journal of Abnormal Child Psychology, 37,* 945–956. doi: 10.1007/s10802-009-9321-5

Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6,* 495-525. doi: 10.1146/annurev.clinpsy.121208.131208

Endestad, T., Heim, J., Kaare, B., Torgersen, L., & Brandtzaeg, P. B. (2011). Media user types among young children and social displacement. *Noridcom Review, 32,* 17-30. doi: 10.1515/nor-2017-0102

Farver, J. A. M. (1999). Activity setting analysis: A model for examining the role of culture in development. In A. Gōncū (Ed.), *Children's engagement in the world: Sociocultural perspectives* (pp. 99–127). Cambridge, England: Cambridge University Press.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioural, and biomedical sciences. *Behaviour Research Methods, 39*(2), 175-91. doi: 10.3758/BF03193146

Feldman, R. & Klein, P. S. (2003). Toddler's self-regulated compliance to mothers, caregivers, and fathers: Implications for theories of socialization. *Developmental Psychology, 39*(4), 680-682. doi: 10.1037/0012-1649.39.4.680

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics.* SAGE Publications Ltd.

Flavell, J. H. (1977). *Cognitive development.* Englewood Cliffs, NJ: Prentice Hall.

Florez, I. R. (2011). Developing young children's self-regulation through everyday experiences. *Young Children, 66*(4), 46-51.

Freijy, T., & Kothe, E. J. (2013). Dissonance-based interventions for health behaviour change: A systematic review. *British Journal of Health Psychology, 18*(2), 310-337. doi: 10.1111/bjhp.12035

Gallimore, R.,Weisner, T. S., Kaufman, S. Z. & Bernheimer, L. P. (1989) The social construction of ecocultural niches – family accommodation of developmentally delayed children. *American Journal of Mental Retardation, 94*, 216–230

Garrison, M., & Christakis, D. A (2005). A teacher in the living room? Educational media for babies, toddlers, and preschoolers. *The Kaiser Family Foundation.* Retrieved from: https://kaiserfamilyfoundation.files.wordpress.com/2013/01/7427.pdf

Gentile, D. A., Swing, E. L., Lim, C. G., & Khoo, A. (2012). Video game playing, attention problems, and impulsiveness: Evidence of bidirectional causality. *Psychology of Popular Media Culture, 1*(1), 62-70. doi: 10.1037/a0026969

Giancola, P. R., Moss, H. B., Martin, C. S., Kirisci, L., & Tarter, R. E. (1996). Executive cognitive functioning predicts reactive aggression in boys at high risk for substance abuse: A prospective study. *Alcoholism, Clinical and Experimental Research, 20,* 740 – 744. doi: 10.1111/j.1530-0277.1996.tb01680.x

Gioia, G. A., Espy, K. A., & Isquith, P. K. (2002). *Behavior rating inventory of executive function, preschool version (BRIEF-P).* Odessa, FL: Psychological Assessment Resources.

Grolnick, W. S., & Farkas, M. (2002). Parenting and the development of children's self-regulation. In M. H. Bornstein (Ed.), *Handbook of parenting: Vol. 5. practical issues* (2nd ed., pp. 89–110). Mahwah, NJ: Lawrence Erlbaum Associates

Grolnick, W. S., Kurowski, C. O., & Gurland, S. T. (1999). Family processes and the development of children's self-regulation. *Educational Psychologist, 34*, 3-14. doi: 10.1207/s15326985ep3401_1

Ha, E.H., Kim, S.Y., Song, D.H., Kwak, E.H., & Eom S.Y. (2011). Discriminant validity of the CBCL 1.5-5 in diagnosis of developmentally delayed infants. *Journal of the Korean Academy of Child Adolescent Psychiatry*, *22*(2), 120-127. doi: 10.5765/JKACAP.2011.22.2.120

Hair, G., Black, B., Babin, B., Anderson, R., & Tatham, R. (2010). *Multivariate Data Analysis. 7th Edition.* New Jersey: Pearson.

Halle, T. G., & Darling-Churchill, K. E. (2016). Review of measures of social and emotional development. *Journal of Applied Developmental Psychology, 25,* 8-18. doi: 10.1016/j.appdev.2016.02.003

Harrison, L. F., & Williams, T. M. (1986). Television and cognitive development. In T. M. Williams (Ed.), *The impact of television. A natural experiment in three commonalities* (pp. 87-142). New York: Academic Press.

Hayes, A. F. (2013). *Methodology in the social sciences. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* New York, NY, US: Guilford Press.

Hayes, A. F., & Preachers, K. J. (2010). Quantifying and testing indirect effects in simple mediation models when the constituent paths are nonlinear. *Multivariate Behavioural Research, 45,* 627-660. doi: 10.1080/00273171.2010.498290

Hiniker, A., Lee, B., Kientz, J. A., & Radesky, J. S. (2018). Let's play! Digital and anolog play patterns between preschoolers and parents. *Proceedings of the 36th annaual conference on human factors in computing systems*, 659, 1-3. doi: 10.1145/3173574.3174233

Hiniker, A., Sobel, K., Suh, H., Sung, Y. C., Lee, C. P., & Kientz, J. (2015). Texting while parenting: How adults use mobile phones while caring for children at the playground. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing,* 727-736.

Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in "educational" apps: Lessons from the science of learning. *Psychological Science in the Public Interest, 16*(1), 3-34. doi: 10.1177/1529100615569721

Howse, R., Calkins, S. D., Anastopoulos, A., Keane, S. & Shelton, T. (2003) Regulatory contributors to children's kindergarten achievement. *Early Education and Development* 14, 101-119. doi. 10.1207/s15566935eed1401_7

Hughes, C., White, A., Sharpen, J., & Dunn, J. (2000). Antisocial, angry and unsympathetic: "Hard-to-manage" preschoolers' peer problems and possible cognitive influences. *Journal of Child Psychology and Psychiatry, 41,* 169–179. doi: 10.1111/1469-7610.00558

Hyde, R., O'Callaghan, M.J., Bor, W., Williams, G.M., & Najman, J.M. (2012). Long-term outcomes of infant behavioral dysregulation. *Pediatrics, 30*(5), 1243 - 1251. doi: 10.1542/peds.2010-3517

IBM Corp. Released 2017. IBM SPSS Statistics for Macintosh, Version 25.0. Armonk, NY: IBM Corp.

Inoue, S., Yorifuji, T., Kati, T., Sanada, S., Dio, H., & Kawachi, I. (2016). Children's media use and self-regulation behaviour: Longitudinal associations in a nationwide Japanese Study. *Journal of Child Health Care, 20,* 2084-2099. doi: 10.1007/s10995-016-2031-z

Ivanova, M . Y., Achenbach, T. M., Rescorla, L. A., Harder, V. S., Ang, R. P., Bilenberg, N…. Bjarnadottir, G. (2010). Preschool psychopathology reported by parents in 23 societies: Testing the seven-syndrome model of the child behaviour checklist for ages 1.5 – 5. *Journal of the American Academy of Child and Adolescent Psychiatry, 49*(120), 1215-1224. doi: 10.1016/j.jaac.2010.08.019

Jago, R., Stamatakis, E., Gama, A., Carvalhal, I. M., Nougueria, H., Rosado, V., & Padez, C. (2012). Parent and child screen-viewing time and home media environment. *American Journal of Preventive Medicine, 43*(2), 150-158. doi: 10.1016/j.amepre.2012.04.012

Johnson, J. S., & Newport, E. L. (1989). Critical period effect in second language learning: The influence of maturational state on the acquisition of English and second language. *Cognitive Psychology, 21,* 60-99. doi: 10.1016/0010-0285(89)90003-0

Kabali, H. K., Irigoyen, M. M., Nunez-Davis, R., Budacki, J. G., Mohanty, S. H., Leister, K. P., & Bonner, R. L. (2015). Exposure and use of mobile media devices by young children. *Pediatrics, 136*(6), 1044-50. doi: 10.1542/peds.2015-2151

Kelishadi, R., Qorbani, M., Motlagh, M. E., Heshmat, R., Ardalan, G., & Jari, G. (2014). Relationship between leisure time screen activity and aggressive and violent behaviour in Iranian children and adolescents: The CASPIAN-IV study. *Paediatrics and International Child Health, 35*(4), 305-311. doi: 10.1080/20469047.2015.1109221

Khetani, M. A. (2015). Validation of environmental content in the Young Children's Participation and Enviornment Measure. *Archives of Physical Medicine and Rehailitation, 96*(2), 317-322. doi: 10.1016/j.apmr.2014.11.016

Khetani, M.A., Coster, W., Law, M., & Bedell, G.M. (2013) *Young Children's Participation and Environment Measure (YC-PEM).* Fort Collins: Colorado State University.

Khetani, M. A., Graham, J. E., Davies, P. L., Law, M. C., & Simeonsson, R. J. (2015). Psychometric properties of the Young Children's Participation and Environment Measure. *Archives of Physical and Medicine and Rehabilitation, 96,* 307-316. doi: 10.1016/j.apmr.2014.09.031

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*(2), 199-214. doi: 10.1037/0012-1649.18.2.199

Kostyrka-Allchorne, K., & Cooper, N. R., & Simpson, A. (2017). The relationship between television exposure and children's cognition and behaviour: A systematic review. *Developmental Review, 44,* 19-58. doi: 10.1016/j.dr.2016.12.002

Krcmar, M., & Cingel, D. P. (2014). Parent-child joint reading in traditional and electronic formats. *Media Psychology, 17*(3), 262-281. doi: 10.1080/15213269.2013.840243

Krikorian, H. L., Pempek, T. A., Murphy, L. A., Schmidt, M. E., & Anderson, D. R. (2009). The impact of background television on parent-child interactions. *Child Development, 80*(5), 1350-1359. doi: 10.1111/j.1467-8624.2009.01337.x

Kubey, R. & Csikszentmihalyi, M. (2002). Television addiction is no mere metaphor. *Scientific American, 286*(2), 74-80.

Landhuis, C.E., Poulton, R., Welch, D., & Hancox, R.J. (2007). Does childhood television viewing lead to attention problems in adolescence? Results from a prospective longitudinal study. *Pediatrics, 120*(3), 532–537. doi: 10.1542/peds.2007-0978

Lauricella A. R. Wartella, E., & Rideout, V. J. (2015). Young children's screen time: The complex role of parent and child factor. *Journal of Applied Developmental Psychology, 36,* 11-17. doi: 10.1016/j.appdev.2014.12.001

Lave, J. (1988). *Cognition in practice: Mine, mathematics and culture in everyday life.* Cambridge, UK: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Lee, W., & Kuo, E. C. (2002). Internet and displacement effect: Children's media use and activities in Singapore. *Journal of Computer-Mediated Communication, 7*(2). doi: 10.1111/j.1083-6101.2002.tb00143.x

Levine, L.E., & Waite, B.M. (2000). Television viewing and attentional abilities in fourth and fifth grade children. *Journal of Applied Developmental Psychology, 21*(6), 667-679. doi: 10.1016/S0193-3973(00)00060-5

Lillard, A. S., & Peterson, J. (2011). The immediate impact of different types of television on young children's executive function. *Pediatrics, 128*(4), 44-49. doi: 10.1542/peds.2010-1919

Luria, A. R. (1959). The directive function of speech in development and dissolution. *Word, 15*(2), 341-352. doi: 10.1080/00437956.1959.11659703

Maccoby, E. F. (1951) Television: Its impact on school children. *Public Opinion Quarterly, 15,* 421-444. doi: 10.1086/266328

Mannell, R. C., Zuzanek, J., & Aronson, R. (2005). *Internet/computer use and adolescent leisure behavior, flow experiences and psychological well-being: The displacement hypothesis*. Paper presented at the eleventh Canadian Congress on Leisure Research, Nanaimo, British Columbia, Canada.

McDaniel, B. T., & Coyne, S. M. (2016a). "Technoference": The interference of technology in couple relationships and implications for women's personal and relational well-being. *Psychology of Popular Media Culture, 5,* 85-98. doi: 10.1037/ppm0000065

McDaniel, B. T., & Coyne, S. M. (2016b). Technology interference in the parenting of young children: Implications for mothers' perceptions of co-parenting. *The Social Science Journal*, 53(4), 435-443. doi: 10.1016/j.soscij.2016.04.010

McDaniel, B. T., & Radesky, J. S. (2017). Technoference Parent distraction with technology and associations with child behaviour problems. *Child Development, 1-10.* doi: 10.1111/cdev.12822

Mendelsohn, A.L., Berkule, S.B., Tomopoulos, S., Tamis-LeMonda, C. S., Guberman, H. S., Alvir, J., & Dreyer, B. P. (2008). Infant television and video exposure associated with limited parent-child verbal interactions in low socioeconomic status households. *Archives of Pediatric Adolescence Medicine Journal, 162*(5), 411-417. doi: :10.1001/archpedi.162.5.411

Miller, C. J., Marks, D. J., Miller, S. R., Berwid, O. G., Kera, E. C., Santra, A., & Halperin, J.M. (2007). Brief report: Television viewing and risk for attention problems in preschool children. *Journal of Pediatric Psychology, 32,* 448-452. doi: 10.1093/jpepsy/jsl035

Munzer, T. G., Miller, A. L., Peterson, K. E., Brophy-Herb, H. E., Horodynski, M. A., Contreras, D…. Radesky, J. (2018). Media exposure in low-income preschool-age children is associated with multiple measures of self-regulatory behaviour. *Journal of Developmental and Behavioural Pediatrics, 39,* 303-309. doi: 10.1097/DBP.0000000000000560

Muratori, F., Narzisi, A., Tancredi, R., Cosenza, A., Calugi, S., Saviozzi, I., … Calderoni, S. (2011). The CBCL 1.5 – 5 and the identification of preschoolers with autism in Italy. *Epidemiology and Psychiatric Sciences, 20*(4), 329-338. doi: 10.1017/S204579601100045X

Mutz, D. C., Roberts, D. F., & van Vuuren, D. P. (1993). Reconsidering the displacement hypothesis: Television's influence on children's time use. *Communication Research, 20*(1), 51-75. doi: 10.1177/009365093020001003

Pandolfi, V., Magyar, C. I., & Dill, C. A. (2009). Confirmatory factor analysis of the Child Behavior Checklist 1.5-5 in a sample of children with autism spectrum disorders. *Journal of Autism Developmental Disorders, 39,* 986-995. doi: 10.1007/s10803-009-0716-5

Piaget. J. (1952). *The origins of intelligence in children.* New York: International Universities Press.

Prior, M., Oberklaid, A. F., Northam, E. (1987). Measurement of temperament in one to three-year-old children. *International Journal of Behavioural Development, 10*(1), 121-132. doi: 10.1177/016502548701000108

Putnam, S. P., Jacobs, J., Gartstein, M. A., & Rothbart, M. K. (2010, March). *Development and assessment of short and very short forms of the Early Childhood Behavior Questionnaire.* Poster presented at International Conference on Infant Studies, Baltimore, MD.

Putnam, S. P., & Rothbart, M. K. (2006). Development of Short and Very Short forms of the Children's Behavior Questionnaire. *Journal of Personality Assessment, 87 (1),* 103-113. doi: 10.1207/s15327752jpa8701_09

OSR International Pty Ltd. (2018). NVivo qualitative data analysis softeware.

Raaijmakers, M. A. J., Smidts, D. P., Sergeant, J. A., Maasssen, H., Posthumous, J. A., van Engeland, H., Matthys, W. (2008). Executive functions in preschool children with aggressive behaviour: Impairments in inhibitory control. *Journal of Abnormal Child Psychology, 36,* 1092-1107. doi: 10.1007/s10802-008-9235-7

Radesky, J. S., & Christakis, D. A. (2016). Increased screen time: Implications for early childhood development and behaviour. *Pediatric Clinics of North America, 63*(5), 827-839. doi: 10.1016/j.pcl.2016.06.006

Radesky, J. S., Dimitri, A., & Christakis, D. A. (2016). Keeping children's attention: The problem with bells and whistles. *Journal of the American Medical Association Pediatrics, 170*(2), 112-113. doi: 10.1001/jamapediatrics.2015.3877

Radesky, J. S., Eisenberg, S., Kristin, C. J., Gross, J., Block, G., Zuckerman, B., & Silverstein, M. (2016). Overstimulated consumers or next generation learning? Parent tensions about child mobile technology use. *Annals of Family Medicine, 14*(6), 503-508. doi: 10.1370/afm.1976

Radesky, J. S., Kistin, C. J., Zuckerman, B., Nitzberg, K., Gross, J., Kaplan-Sanoff, M….. Silverstein, M. (2014). Patterns of mobile device use by caregivers and children during meals in fast food restaurants. *Pedatircs, 133(4),* 843- 849. doi: 10.1542/peds.2013-3703.

Radesky, J. S., Peacock-Chambers, E., Zuckerman, B., & Silverstein., M. (2016). Use of mobile technology to calm upset children: Associations with social-emotional development. *Journal of the American Medical Association Pediatrics, 170*(4), 397-399. doi: 10.1001/jamapediatrics.2015.4260

Radesky, J., Miller A. L., Rosenblum, K. L., Appugliese, D., Kaciroti, N., & Lumeng, J. C. (2015). Maternal mobile device use during a structured parent-child interaction task. *Academic Pediatrics, 15*(2), 238-244. doi: 10.1016/j.acap.2014.10.001

Radesky, J.S., Schumacher, J., & Zuckerman, B. (2015b). Mobile and interactive media use by young children: the good, the bad, and the unknown. *Pediatrics, 135*(1), 1–3. doi: 10.1542/peds.2014-2251

Radesky, J. S., Silverstein, M., Zuckerman, B., & Christakis, D. A. (2014). Infant self-regulation and early childhood media exposure. *Pediatrics, 133,* 1172-1178. doi: 10.1542/peds.2013-2367

Raman, S., Geurrero-Duby, S., McCullough, J. L., Brown, M., Ostrowski-Delahanty, S., Langkamp, D., & Duby, J. C. (2017). Screen exposure during daily routines and young child's risk for having social-emotional delay. *Clinical Paediatrics,* 1-10. doi: 10.1177/0009922816684600

Rideout, V. (2013). *Zero to eight: Children's media use in America 2013*. San Francisco, CA: Common Sense Media.

Rodriguez, M. L., Ayduk, O., Aber, J. L., & Mischel, W. (2005). A contextual approach to the development of self-regulatory competences: The role of maternal unresponsivity and toddler's negative affect in stressful situations. *Social Development, 14,* 136- 157. doi: 10.1111/j.1467-9507.2005.00294.x

Rohlf, H., Holl, A., Kirsch, F., Krahé, B., & Elsner, B. (2018). Longitudinal links between executive function, anger, and aggression in middle childhood. *Frontiers in Behavioural Neuroscience, 12.* doi: 0.3389/fnbeh.2018.00027

Rosen, L. D., Whaling, K., Carrier, L. M., Cheever, N. A., & Rokkum, J. (2013). The Media and Technology Usage and Attitudes Scale: An empirical investigation. *Computers in Human Behaviour*, *29*(6), 2501-2511. doi: 10.1016/j.chb.2013.06.006

Rothbart, M. K., Ellis, L. K., & Posner, M. I. (2004). Temperament and self-regulation. In R. F. Baumeister & K. D. Wohs (Eds.), *Handbook of self-regulation: research theory, and applications* (pp. 357-370). New York: Guildford Press.

Schramma, W., Lyle, J., & Parker, E. (1961). *Television in the lives of our children.* Stanford, CA: Stanford University Press.

Séguin, J. R., & Zelazo, P. D. (2005). Executive function in early physical aggression. In J. Archer, R. E. Tremblay, W. W. Hartup, & W. Willard (Eds.), *Developmental origins of aggression* (pp. 307–329). New York: Guilford.

Shields, A. M., & Cicchetti, D. (1995, March). *The development of an emotion regulation assessment battery: Reliability and validity among at-risk grade-school children.* Poster session presented at the biennial meeting of the Society for Research in Child Development, Indianapolis, IN.

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology, 33*(6), 906-916. doi. 10.1037/0012-1649.33.6.906

Skinner, B. F. (1938). *The behaviour of organisms: An experimental analysis.* Englewood Cliffs, NJ: Prentice Hall

Skinner, B. F. (1974). *About behaviourism.* New York: Knopf

Skogan, A. H., Egeland, J., Zeiner, P., Overgaard, K R., Oerbeck, B., Reichborn-Kjennerud, T., …. Aase, H. (2016). Factor structure of the Behaviour Rating Inventory of Executive Functions (BREIF-P) at age three years. *Child Neuropsychology*, *22*(4), 472-492. doi: 10.1080/09297049.2014.992401

Sosa, A. V. (2016). Associate of the type of toy used during play with the quantity and quality of parent-infant communication. *Journal of the American Medical Association Paediatrics,* 170(2), 132-137. doi: 10.1001/jamapediatrics.2015.3753

Spinrad, T. L., Stiffer, C. A., Donelan-McCall, N., & Turner, L. (2004). Mothers' regulation strategies in response to toddlers' affect: Links to later emotion self-regulation. *Social Development, 13,* 40-55. doi: 10.1111/j.1467-9507.2004.00256.x

Staiano, A. E., & Calvert, S. L. (2011). Exergames for physical education courses: Physical, social, and cognitive benefits. *Child Development Perspectives, 5*(2), 93-98. doi: 10.1111/j.1750-8606.2011.00162.x

Stats, G. J. M., Juffer, F., & van IJzendoorn, M. H. (2002). Maternal sensitivity, infant attachment, and temperament in early childhood predict adjustment in middle childhood: The case of adopted children and their biologically unrelated parents. *Developmental Psychology*, *38*(5), 806-821. doi: 10.1037/0012-1649.38.5.806

Stayton, D. J., Hogan, R., & Ainsworth, M. D. S. (1971). Infant obedience and maternal behavior: The origins of socialization reconsidered. *Child Development, 42,* 1057-1069. doi: 10.2307/1127792

Stober, J. (1999). The social desirability scale-17 (SDS17): Development and first results on reliability and validity. *Diagnostica*, *45,* 173–177.

Stober, J. (2001). The social desirability scale-17 (SDS17): Convergent validity, discriminant validity, and relationship with age. *European Journal of Psychological Assessment, 17*(3), 222–232. doi: 10.1027//1015-5759.17.3.222

Swing, E. L., Gentile, D. A., Anderson, C. A., & Walsh, D. A. (2010). Television and video game exposure and the development of attention problems. *Pediatrics, 126*(2), 214-221. doi: 10.1542/peds.2009-1508

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Upper Saddle River, NJ: Pearson.

Tatman, A. W., & Kreamer, S. (2014). Psychometric properties of the Social Desirability Scale-17 with individuals on probation and parole in the United States. *International Journal of Criminal Justice Sciences*, *9*(1), 122-130.

Teitcher, J. E., Bockting, W. O., Bauermeister, J. A., Hoefer, C. J., Miner, M. H., & Klitzman, R. L. (2015). Detecting, preventing, and responding to "fraudsters" in Internet research: ethics and tradeoffs. *The Journal of Law, Medicine & Ethics*, *43*(1), 116-133. doi: 10.1111/jlme.12200

Toole, O., Sarah, E., Monks, C. P., & Tsermentseli, S. (2017). Executive function and theory of mind as predictors of aggressive behaviour and peer acceptance in early childhood. *Social Development, 26*(4), 907-920. doi: 10.1111/sode.12231

Tremblay, R. E., Nagin, D. A., Seguin, J. R., Zoccolillo, M., Zelazo, P. D., Bovin, M., ... Japel, D. (2004). Physical aggression during early childhood: Trajectories and predictors. *Pediatrics*, *114,* 43-50. doi: 10.1542/peds.114.1.e43

Tomopoulos, S., Dreyer, B. P., Valdez, P., Flynn, V., Foley, G., Berkule, S., B., & Mendelsohn, A. L. (2007a). Media content and externalizing behaviours in Latino Toddlers, *Ambulatory Pediatrics, 7,* 232-238. doi: 10.1016/j.ambp.2007.02.004

Tomopoulos, S., Valdes, P. T., Dreyer, B. P., Fierman, A. H., Berlue, S. B., Kuhn, M., & Mendelssohn, A. L. (2007b). Is exposure to media intended for preschool children associated with less parent-child sharing reading aloud and teaching activities? *Ambulatory Paediatrics, 7*(1), 18-24. doi: 10.1016/j.ambp.2006.10.005

Vanderwater, E. A., Bickham, D. S., & Lee, J. H. (2006). Time well spent? Relating television use to children's free-time activities, *Pediatrics*, *117*(2), 181-191. doi: 10.1542/peds.2005-0812

Vanderwater, E., & Lee, S. (2009). Measuring children's media use in the digital age: Issues and challenges. *American Behavioural Scientist, 52*(8), 1152-1176. doi: 10.1177/0002764209331539

Velikonja, T., Edbrooke-Childs, J., Calderon, A., Sleed, M., Brown, A., & Deighton, J. (2017). The psychometric properties of the Ages and Stages Questionnaires for ages 2 - 2.5: A systematic review. *Child: Care, Health and Development, 43*(1), 1-17. doi: 10.1111/cch.12397

Verlinden, M., Timelier, H., & Hudziak, J., (2012). Television viewing and externalizing problems in preschool children: The generation R study. *Archives of Pediatrics and Adolescent Medicine, 166*(10), 919-925. doi: 10.1001/archpediatrics.2012.653

Vygotsky, L. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Vygotsky, L. (1978). *Mind in society. The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wachs, T. D. (1979). Proximal experience and early cognitive-intellectual development: The physical environment. *Merrill Palmer Quarterly, 25,* 3-41.

Wachs, T. D. (1990). Must the physical environment be mediated by the social environment in order to influence development? A further test. *Journal of Applied Developmental Psychology, 11,* 163-178. doi: 10.1016/0193-3973(90)90003-3

Wajcman, J., Bittman, M., & Brown, J. E. (2008). Families without borders: Mobile phones, connectedness and work-home divisions. *Sociology, 42*(4), 635-652. doi: 10.1177/0038038508091620

Wartella, E., Rideout, V., Lauricella, A. R., & Connell, S. L. (2014). *Parenting in the age of digital technology: A national survey.* Retrieved from University of North Western website:http://web5.soc.northwestern.edu/cmhd/wpcontent/uploads/2014/03/ParentingAgeDigitalTechnology.REVISED.FINAL_.2014.pdf.

White, B. A., Jarrett, M. A., & Ollendick T. H. (2013). Self-Regulation deficits explain the link between reactive aggression and internalizing and externalizing behaviour problems in children. *Journal of Psychopathological Behaviour Assessment, 35*(1), 1-9. doi: 10.1007/s10862-012-9310-9

Winsler, A., Diaz, R. M., McCarthy, E. M. Atencio, D. J., & Chabay, L A., (1999). Mother-child interaction, private speech, and task performance in preschool children with behaviour problems. *The Journal of Child Psychology and Psychiatry, 40*(6), 891-904. doi: 10.1111/1469-7610.00507

Wood, E., Petkovski, M., de Pasquale, D. Gottardo, A., Evans, M. A., & Savage, R. S. (2016). Parent scaffolding of young children when engaged with mobile technology. *Frontiers in Psychology, 7*(690), 1-11. doi: 10.3389/fpsyg.2016.00690

Zimmerman, F. J., & Christakis, D. A. (2007). Associations between content types of early media exposure and subsequent attentional problems. *Pediatrics, 120*, 986-992. doi: 10.1542/peds.2006-3322

VITA AUCTORIS

Amy Wei-Yan Tran was born in 1993 in Hamilton, Ontario. She graduated from Lester B. Pearson High School in 2011. From there she went on to the University of Guelph where she obtained a B.A. in Psychology in 2016. She is currently a Doctoral student in the Clinical Psychology program at the University of Windsor and hopes to graduate in Fall 2022.