1-1-2019

Mapping Patterns of Restricted and Repetitive Behaviours and Media Use in Youth Diagnosed with Autism Spectrum Disorder and Typically Developing Youth

Eric Gilliland
University of Windsor

Mapping Patterns of Restricted and Repetitive Behaviours and Media Use in Youth Diagnosed with Autism Spectrum Disorder and Typically Developing Youth

By

Eric Gilliland

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

2019

Mapping Patterns of Restricted and Repetitive Behaviours and Media Use in Youth Diagnosed with Autism Spectrum Disorder and Typically Developing Youth

by

Eric Gilliland

APPROVED BY:

_____

D. Hernandez Jozefowicz
School of Social Work

_____

R. Menna
Department of Psychology

_____

K. Babb, Advisor
Department of Psychology

December 10, 2019

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(s) to include such material(s) in my thesis and have included copies of such copyright clearances to my appendix.

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

In recent years, the potential influences of media use on youth mental health and development have received increasing attention. Emerging research has suggested that youth diagnosed with Autism Spectrum Disorder (ASD) use media in problematic ways. However, few studies have investigated the possibility that the media use shown by these youths may be an extension of the symptoms of ASD into the media context. The current study explored similarities between classical restricted repetitive behaviours (RRBs) and proposed media RRBs in children with ASD. A sample of 36 parents of 4- to 11-year-old children (ASD = 25; non-ASD = 11) completed online surveys on RRBs, and media use. Classical RRBs were associated with greater numbers of media RRBs in children with ASD, and media RRBs were also reported in greater frequencies in these children compared with children without ASD. Children with ASD also demonstrated greater frequency, intensity, and duration of distress in response to interruption or prevented use of media than children without ASD. However, age and adaptive functioning level did not exhibit statistically significant associations to media RRBs in either of these group. Findings suggested that the ways children with ASD use media may reflect the underlying symptoms of ASD. The types of media accessed, the time spent engaged in different leisure activities, and number of digital literacy skills were also explored to find potential similarities and differences in the media use characteristics of children both with and without a diagnosis of ASD. Proposed media RRBs have implications for future research and clinical application, considering the incorporation of technology-based behavioural addictions in the current mental health diagnostic systems.

Keywords: Autism, restricted repetitive behaviour, media use

ACKNOWLEDGEMENTS

I write this section with the keen awareness that I am as a turtle atop a fence post in the middle of a prairie – not having gotten where I am without help.

I would like to thank my supervisor, Dr. Kimberley Babb, for your commitment to myself and my project, your guidance, and your patience with me as I navigated this process. I would also like to thank my committee members, Dr. Rosanne Menna and Dr. Debra Hernandez Jozefowicz, for your valuable insights and feedback, which helped strengthen this research undertaking. I am also incredibly thankful for the support, flexibility, and patience shown by the Dr. Gragg and the staff at the Summit Centre for Preschool Children with Autism as I balanced my time between working on this research and working with them.

To my wonderful fiancé, I am forever grateful for the safe harbor you provided me in times of stress and the gentle encouragement and compassion you gave me when I needed it most. To my parents, I can never thank you enough for the love and support that you readily provided throughout this process.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

People in today's society have unprecedented access to software, devices, and the Internet. These technologies are in a state of near constant evolution and advancement, and as this progress continues, these technologies become further interwoven into the daily lives of people. Within the overall growth in access to and use of media technologies, children and adolescents are groups that appear to have adopted these technologies rapidly. To date, relatively little information exists about the characteristics of media use at a national level for Canadian children; however, there have been several large-scale surveys of children and adolescents from the United States that can be used to illustrate this phenomenon. In one series of media use surveys conducted by the Kaiser Foundation on youth, ages 8 to 18, it was found that their media use has been steadily increasing across all platforms, with the exception of movies and print, since 1999 (Roberts, Foehr, & Rideout, 2005; Rideout, Foehr, & Roberts, 2010).

As media prevalence, access, and use has been increasing, so has the research into the influence of media on human cognition and behaviour. To date, there has been a proliferation of psychological research across various groups that has primarily focused on potentially concerning connections between media use and variables such as negative body image (e.g., Holland & Tiggemann, 2016), aggression (e.g., Slater, 2003; Slater, Henry, Swaim, & Anderson, 2003), low mood (e.g., Dillman Carpentier et al., 2008; Lin et al., 2016) and poor sleep (e.g., Cain & Gradisar, 2010; Garrison, Liekweg, & Christakis, 2011). Indeed, the prominence of media in society has captured the interest of clinical psychologists these concerns and the potential for media use to

represent a form of psychopathology that may have a deleterious impact on individuals. In fact, media as a distinct form of psychopathology was first suggested with the development of Internet Addiction Disorder (IAD), defined as difficulties controlling media use and behaviours associated with said use that cause impairment in an individual's daily life (Griffiths, 1999, 2000; Kuss, Griffiths, Karila, & Billieux, 2014; Widyanto & Griffiths, 2006; Young, 1998, 2004). Since the proposal of IAD, other similar disorders have been proposed and researched. Perhaps most notable are disorders that focus on impairment attributed to playing video games. These are Internet Gaming Disorder, which was included in the "Conditions for Further Research" section of the most recent edition of the DSM (i.e., DSM-5: APA, 2013) and Gaming Disorder, which was recently included in the DSM's European counterpart, the Eleventh Revision of the International Classification of Diseases (ICD-11: World Health Organization, 2018). The advancement of technology and its adoption by society shows no signs of slowing. As such, the integration between the study of psychopathology and media must continue, given the evolution of human-technology interactions that carry subsequent implications for mental health.

The inclusion of technology-based mental health disorders is a relatively new chapter for diagnostic science and, as such, there are many areas of the human-technology interaction that still need to be investigated to provide data on the form and function of these technology-based psychopathologies across clinical groups. Individuals diagnosed with Autism Spectrum Disorder (ASD), a neurodevelopmental disorder characterized by patterns of social and behavioural impairments, are one group in particular that has been thought to use media technologies in a problematic manner.

This perception is expressed in the rationales of many of the studies that have been conducted on media use by individuals diagnosed with ASD. For instance, one study reported their investigation was prompted by "anecdotal and clinical reports" suggesting problematic media use by young people diagnosed with ASD (Mazurek, Shattuck, Wagner, & Cooper, 2012 p.1757). However, there are competing perspectives relating to the exact nature of the "problematic" media use by these individuals. On one hand, certain researchers have investigated media use as a potential behavioural addiction (e.g., Mazurek & Wenstrup, 2013). Indeed, a recent study from Japan indicated clinicians involved in the research found evidence of cases matching proposed diagnostic criteria for and preliminarily applied a comorbid diagnosis of "Internet Addiction" to adolescents with ASD (So, Makino, Fujiwara, Hirota, Ohcho, & Ikeda, 2017). In contrast, there appears to be some consideration of media use as a restricted repetitive behaviour and, thus, a symptom of ASD (e.g., Bodfish et al., 2000; Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). This view is demonstrated in the inclusion of ways of using media into questionnaires assessing specific symptoms related to ASD. For example, the item "Likes the same CD, tape, record or piece of music played continually; Likes same movie / video or part of movie / video" is included in the questions assessing a variety of restricted repetitive behaviours associated with ASD in the Restricted Behavior Scale-Revised (RBS-R; Bodfish et al., 2000). There is little research evidence to provide clear support for one formulation over another. In fact, no research currently exists on the relation among various aspects of media use and specific ASD symptom presentations such as restrictive repetitive behaviours. This becomes an important consideration in light of the precedent set by the

Japanese study, as there is no way to state with any certainty whether the media use seen in those diagnosed with ASD is a distinct psychopathology as in IAD or if it is actually a symptom of ASD. The first step to addressing this major gap in the diagnostic understanding is to research the potential relation of media use and ASD symptoms, such as restricted repetitive behaviours, to determine if the media use patterns exhibited by individuals diagnosed with ASD are actually unique reflections of this neurodevelopmental disorder rather than the additional presence of a distinct psychopathology (i.e., behavioural addiction). Thus, the goal of the present study is to examine the relations among ASD symptoms and media use patterns of youth and to further assess the extent to which certain symptoms of ASD may transfer to ways of using media.

CHAPTER 2
LITERATURE REVIEW

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is a relatively new conceptualization of Autism, a neurodevelopmental disorder first described by Leo Kanner (1943) and Hans Asperger (1944, as cited in Wolff, 2004) in the 1940s, which is characterized by difficulties with various aspects of social communication and restricted repetitive behaviours. For example, an individual with ASD may have difficulty holding coherent conversations with others (social communication difficulties) and demonstrate an intense interest in a very particular subject (restricted repetitive behaviours). In North America, the estimated rates of ASD in the United States have gone from 1 in every 110 children (Center for Disease Control [CDC], 2009) to 1 in every 66 (CDC, 2014). This increasing trend has also been reflected in Canada (Ouellette-Kuntz et al., 2014), with the most current national epidemiological report indicated the prevalence of ASD is very similar to the US: roughly 1 in 66 children aged 5 to 17 (Government of Canada, 2018). In the past, Autism and other closely related neurodevelopmental disorders such as Asperger's Disorder, Autistic Disorder, and Pervasive Developmental Disorder Not Otherwise Specified were considered distinct categories even though they shared similar symptoms (American Psychiatric Association [APA], 2013; Volkmar & McPartland, 2014; Volkmar, Reichow, & McPartland, 2012). In recent years, this categorical approach has been challenged due to research indicating the lack of distinction between these diagnostic groups. Based on these research findings, the validity of having these four diagnoses was called into question. In response, these separate neurodevelopmental disorders were collapsed into a singular spectrum format under ASD in the most recent edition of the Diagnostic Manual of Mental Disorders

(DSM-5: APA, 2013). In the present study, the ASD nomenclature will be used for the remainder of the document, unless referring broadly to the pre-DSM-5 conceptualization of Autism.

Symptoms. An overview of ASD symptoms is necessary to provide context for an attempt to determine the nature of the media use exhibited by youth diagnosed with ASD. In the current DSM-5 conceptualization of ASD, there are two main symptom constellations: (1) impairments in social and social communicative functions and (2) the presence of restricted repetitive behaviours and interests (APA, 2013). The social and social communicative functions that the DSM-5 attributes to ASD are deficits in social-emotional reciprocity between the individual and others, typical nonverbal communicative behaviors during social interactions (e.g., eye-contact), and developing, maintaining, and understanding human relationships (APA, 2013). These symptoms are often the focus of research relating to ASD, as these impairments are often associated with the essence of the disorder. These deficits in social interaction and communication present barriers to the social development of individuals diagnosed with ASD, especially in relation to initiating and maintaining significant relationships such as friendships (see Petrina, Carter, & Stevenson, 2014, for a review). For instance, research has indicated that individuals diagnosed with ASD had smaller numbers of friends, maintained these friendships for shorter periods of time, and spent less time interacting with these friends than their typically developing peers (Petrina et al., 2014). Furthermore, the more severe the symptoms, the more intractable the developmental outcome tends to be for these individuals (Szatmari et al., 2015). In cases of individuals diagnosed with ASD exhibiting higher degrees of symptom severity, these individuals

tend to be placed in special education classrooms (White, Scahill, Klin, Koenig, & Volkmar, 2006), live at home for longer (Howlin, 2005), and have difficulty finding employment (e.g., Howlin, 2004; Taylor & Seltzer, 2010). The social and communicative symptoms are important components in both the identification and understanding of ASD; however, the current study will focus more on the second major symptom constellation, composed of restricted repetitive behaviours, to investigate media use.

Restricted repetitive behaviours. Restricted Repetitive Behaviours (RRBs) are the second symptom set of ASD (APA, 2013). The DSM-5 identifies RRBs as behaviours such as stereotyped speech and motor activity, insistence on sameness, highly fixated restricted interests, and either hyper- or hypo-sensitivity to sensory stimulation (APA, 2013). Studies show that RRBs are separate and distinct from social communication symptoms (Frazier et al., 2012; Georgiades et al., 2007; Mandy, Charman, & Skuse, 2012). Research on RRB symptoms in populations of children and youth diagnosed with ASD suggest there are common themes among the RRBs. These studies indicate there is a two-factor structure consisting of repetitive sensory motor behaviours (RSMB) and insistence on sameness (IS; Bishop et al., 2013; Harrop et al., 2014; Lidstone et al., 2014; Richler Bishop, Kleinke, & Lord, 2007; Richler, Huerta, Bishop, & Lord, 2010). The RSMBs are composed of behaviours such as repetitive hand and finger movements, repetitive use of objects, and atypical sensory-seeking behaviours and are considered to be lower-order RRBs, as these are often associated with lower functioning in the individual (Leekam, Prior, & Uljarevic, 2011; Turner, 1999). The opposite relation has been found for Insistence on Sameness symptoms,

such as restricted rituals and routines, intolerance towards change, and fixated interests, which has led these to be considered higher-order RRBs. The IS factor is relatively unique, as past research has shown it to be independent of other factors shown to influence RRBs (Hus, Pickles, Cook, Risi, & Lord, 2007). Although many studies have found this two-factor structure, there have been other studies based on the psychometric examination of various established measures of RRBs that yield more factors with finer descriptive differences (e.g., 6 factors: Bodfish et al., 2000; 5 factors: Lam & Aman, 2007; 4 factors: Leekam et al., 2007; 3 factors: Lam, Bodfish, & Piven, 2008). As the 2-factor model of RRBs has the most consistent empirical support, this model will be used in the current study.

The presentation of RRBs in individuals diagnosed with ASD is complex, and there are several factors that need to be considered when measuring them in research. One main complication in the research of RRBs is that manifestation of RRBs in ASD diagnostic cases are heterogeneous and not as well understood as the social and communication symptom sets (Turner, 1999). In addition, RRBs are present across a variety of different mental health diagnostic categories such as intellectual disability, anxiety, and obsessive-compulsive disorder, as well as in typically-developing (TD) children (Bodfish et al., 2000; Harrop et al., 2014; Leekam et al., 2011; Turner, 1999). However, there are aspects of the RRB manifestation in ASD that indicate it is a distinctive feature in this population. The main characteristics that seem to differentiate ASD from the other groups are age at the time of assessment, frequency, and severity of the RRBs. For age, TD children exhibit RRBs when in early childhood, but show a marked decrease in these characteristics at around 4 years of age, but RRBs in children

diagnosed with ASD continue to present largely unabated through later childhood and adolescence (e.g., Evans et al., 1997; Richler et al., 2010; Soke et al., 2011). There is also an abundance of research to indicate that children and youth diagnosed with ASD exhibit more RRB symptoms and higher degrees of severity compared to both TD and other neurodevelopmental diagnostic groups (e.g., Bodfish et al., 2000).

Within the ASD diagnostic group, there are also studies that show differential patterns of RRB presentation depending on age, gender, cognitive function, and comorbid diagnoses. Younger ages, as well as lower cognitive function (typically operationalized as IQ), have been linked to the presence of more RSMBs, whereas older children with higher cognitive function tend exhibit Insistence on Sameness types of symptoms (Turner, 1999; Leekam et al., 2011). In addition, the frequency and severity of RRBs in girls are typically found to be lower than in boys (e.g., Hartley & Sikora, 2009; Frazier, Georgiades, Bishop, & Hardan, 2014; Szatmari et al., 2012). Therefore, these variables should be included to provide contextual information when investigating RRBs in children and youth diagnosed with ASD.

Media as restricted repetitive behaviour. There is a perception in the research and among professionals that certain media use by individuals diagnosed with ASD may be a reflection of RRB symptomology. Despite the lack of research directly linking RRBs and media use activities, there are various examples of how they have been construed as such. There are media use questions in RRB measures such as the RBS-R (Bodfish et al., 2000), Repetive Behaviour Questionnaire (Turner, 1995), and Repetitive Behaviour Questionnaire-2 (Leekam et al., 2007). In addition, members of Council of Communications and Media branch of the American Academy of Pediatrics (AAP)

have endorsed the idea that youth diagnosed with ASD engaging in certain types of media use may be a reflection of symptoms relating to restricted interests (Chassiakos et al., 2016). Although these are examples of the perception of media use as representative of RRBs, the evidence supporting this perception is less clear. The rationale for including items relating to media use in RRB questionnaires was not articulated in the published studies describing the questionnaires' creation. Furthermore, the AAP's endorsement was based on two studies (Mazurek et al., 2012; Mazurek & Wenstrup, 2013), which they claimed used media use as representing restricted interests. However, one study actually conceptualized media as a behavioural addiction rather than an RRB (Mazurek & Wenstrup, 2013) and the other, although proposing that media use may be an RRB in their discussion, did not actually include specific ASD symptomology (either social communication or RRBs) in their investigation (Mazurek et al., 2012). Thus, the justification used by the AAP does not have an accurate basis. The unclear and, potentially misinformed, acceptance of various media use activities as RRBs represents a major gap in the current academic and clinical understanding of ASD. Therefore, the current study will directly investigate the potential connection between the patterns of media use activities and specific RRB symptoms.

Autism Spectrum Disorder and Media

Media is defined as "a channel or system of communication, information, or entertainment" (Merriam-Webster, 2018) and is often considered in terms of mass media, which specifies that media can be broadcasted to many people through a variety of platforms (Merriam-Webster, 2018). Of the many forms of media, some common types are Television (TV), the Internet, and Music. *Media use* is a broad term used to

refer to activities involving some form of media that encompass both active (e.g., playing video games, creating websites) and passive activities (e.g., watching TV, listening to music). It is often operationalized in the research literature as the general amount of time engaged in the various forms of media use (e.g., Hasebrink & Popp, 2006); however, this quantification neglects the many ways individuals use, access, and interact with media. In order to provide a comprehensive account of the media use of North American children and youth diagnosed with ASD, the following sections will provide a review of the research on time spent using media, behaviours associated with media use, and interactions with media.

Group comparisons of media variables. There are mixed reports regarding the amount of screen time that is reported in populations of North American children and youth diagnosed with ASD. The majority of published studies indicate that children and youth diagnosed with ASD spend more time engaged in various forms of media use than their typically developing peers (MacMullin, Lunsky, & Weiss, 2016; Mazurek & Engelhardt, 2013a; Mazurek & Wenstrup, 2013; Must et al., 2014) and other children and youth diagnosed with neurodevelopmental disorders (Mazurek et al, 2012). For example, in Must and colleagues' (2014) study, an American sample of parents of 3- to 11- year-old children that were either diagnosed with ASD (n = 53) or who were typically developing (n = 58) was used to study sedentary behaviour and its relation to weight. Among their findings, significant differences were found for the amount of screen time (i.e., the amount of time spent on a media device with a screen). Namely, children diagnosed with ASD were reported to engage in more screen time than the typically developing comparison group.

In contrast, there are several studies that have indicated that children and youth diagnosed with ASD do not exhibit significantly higher amounts of screen time compared other groups of children and youth (Corvey, Menear, Preskitt, Goldfarb, & Menachemi, 2016; McCoy, Jakicic, & Gibbs, 2016; McManus, Mandic, Carle, & Roberts, 2012; Montes, 2016). For example, Montes' (2016) research compared a large nationally representative American sample of parents of children diagnosed with ASD (n = 1393) and parents of children with no ASD diagnosis (n = 64,163) on their children's reported screen time. No statistical differences were found between the two groups in relation to the number of hours of screen time they engaged in on a typical day.

The primary difference between these two sets of research is that the studies yielding significant differences between TD and ASD diagnostic groups consisted of smaller sample sizes, and the studies finding no significant differences were comprised of large, nationally representative samples. The one exception was the study conducted by Mazurek and colleagues (2012) which utilized a large subsample from the National Longitudinal Transitions Study, which found that children diagnosed with ASD were reported to engage in significantly more media time than TD peers and peers diagnosed with other neurodevelopmental disorders. The significance of this apparent disparity in sample size is that small samples are more likely to either not include an adequate array of or include skewed concentrations of characteristics which can mean significant differences may be attributable to the sample collected but not the population (Schmidt & Brown, 2009). Regardless of the mixed findings, the prevailing perception appears to be that these individuals diagnosed with ASD are prolific users of media and therefore

are at higher risks for addictive/overuse of these technologies (e.g., Montes, 2016; MacMullin et al., 2016; Sidhu, 2016). Indeed, several studies on individuals diagnosed with ASD have provided information to indicate deleterious relations among media use and aspects of psychological and physical health. These will be described in detail in the following section.

Media Psychopathology

Media-based behavioural addiction. One area of specific media psychopathology research has been on compulsive or addictive videogame and Internet use. The bulk of these findings indicate that children and youth diagnosed with ASD tend to show more compulsive or addictive behaviours in their use and/or play through these platforms. For example, MacMullin and colleagues (2016) conducted cross-sectional research of 139 parents of children diagnosed with ASD and 172 parents of typically developing children in Canada assessing various types of media use patterns including "problematic" use of media. They employed a measure of Internet Addiction based on the operational definition of behaviour addiction developed by Griffiths (2000). In this case, addictive use was characterised by items attributed to behavioural addictions, which included media use withdrawal, tolerance of media use, losing control of media use, preoccupation with media, conflict with others (most likely parents in youth samples) regarding media use, using media as a coping tool, and lying about the use of media. Their results indicated that individuals diagnosed with ASD endorsed more symptoms of addictive Internet use than the typically developing sample. In addition, multiple studies conducted by the Mazurek and Engelhardt research group showed similar findings regarding addictive video game play when comparing parental

reports for children and youth diagnosed with ASD and TD individuals. Namely, parents in the ASD group reported significantly more elements of addictive video game play for their child than did parents of TD children (Mazurek & Engelhardt, 2013a; Mazurek & Wenstrup, 2013).

Unfortunately, many of these studies have not provided data on the types of symptoms endorsed for either ASD or behavioural addiction in order to determine what symptom presentations may be more prevalent than others. In this sense, the factors that are driving the higher addiction scores on the measures used in these studies are largely unknown. Only one study reported associations among specific addictive symptoms and diagnostic group. Mazurek and Wenstrup (2013) conducted a cross-sectional research study in the United States using parents of children and youth diagnosed with ASD and parents of TD children. They measured and compared addictive videogame play in their sample. In order to measure addictive video game play in children, they had to modify an existing measure known as the Problematic Video Game Playing Test (PVGT: King, Delfabbro, & Zajac, 2011) into a parent report format prior to their data collection. The modified 19-item PVGT, similar to other measures of behavioural addiction, was based on Griffith's (2005) conceptualization in which symptom domains of activity salience, preoccupation, tolerance, withdrawal, relapse, and conflict were included. Their general findings corresponded to the common pattern (i.e., higher reported addictive symptoms in the ASD versus TD diagnostic group) demonstrated in previous literature.

In addition, group comparisons between ASD and TD diagnostic groups showed significant differences in the average frequency of the reported problematic behaviours between the two groups. For example, parents of boys in the ASD group were shown to

endorse higher instances of items such as “think about video games even when not playing them” and “has a hard time stopping him/herself from playing video games” than the parents of TD boys. In this case, parents of boys in the ASD diagnostic group reported significantly higher scores on 11 out of the 19 addictive symptoms compared to the parents of boys in the TD group meaning that these items were considered to represent greater extents of the problem behaviours. The pattern of differences was slightly less extensive for girls in the ASD and TD groups. Indeed, 9 out of 19 symptoms were significantly different when the two groups were compared. Furthermore, there were different patterns of problem behaviour endorsements for the girls compared to boys diagnosed with ASD. For instance, being upset at not being able to play video games was reported to be more problematic for boys, but not for girls, when compared to their respective TD counterparts. These gender differences in the extent of problematic behaviours related to addiction should be accounted for in studies.

Notably, certain symptoms of behavioural addiction reported by Mazurek and Wenstrup (2013) such as “loss of sleep,” “child feels upset when they are not able to play video games,” and “yells or gets angry if they are interrupted when playing videogames” are very similar to behaviours that have been reported in other studies that do not employ a behavioural addiction framework regarding media use and behaviour in children with ASD (e.g., Dixon, Verenikina, Costley, & Pryor, 2015; Engelhardt, Mazurek, & Sohl, 2013; Nally, Houlton, & Ralph., 2000). As such, these behaviours may be hallmarks of the way youth diagnosed with ASD use media, but they could be equally attributable to factors other than behavioural addiction. Further investigation is warranted to determine whether these behaviours are related to distinct

psychopathologies or if they may be common externalizing components. In addition, the use of the PVGT as a parental report measure has not been psychometrically validated outside of the brief pilot study conducted by Mazurek and Wenstrup (2013) during the course of conducting their primary study. Therefore, using this measure may have produced misleading data, as there are a variety of items asking the parent to rate their child's internal cognitive and affective states. These types of ratings have been shown to be relatively inaccurate relating to youths' actual internalizing symptoms (e.g., Achenbach, 2014; Achenbach, McConaughy, & Howell, 1987; Cantell, Lewinsohn, Rohde, & Seeley, 1997; Salbach-Andrae, Klinkowski, Lenz, & Lehmkuhl, 2009). Further studies need to investigate the use of PVGT as a parent-report measure and, perhaps, operationalize addictive media use as an external behaviour to better assess this particular behavioural addiction.

Media-based ASD symptoms. The burgeoning research into addictive behaviours and media use suggests that there is indeed a connection between the two in youth diagnosed with ASD. However, the research has neglected to determine if the behavioural presentation is truly addictive or if it is due to the neurodevelopmental mechanisms in ASD that drive repetitive behaviours and interests. In order to accomplish this distinction, research examining the relation between symptoms of ASD and media use need to be conducted. To date, few studies have examined the associations between media use and ASD symptom presentation, as well as the potential connection between specific RRB symptoms experienced by individuals diagnosed with ASD and parallel media use activities.

The extant research on the association among aspects of media use and ASD symptoms has demonstrated mixed findings. One research study has suggested the number of ASD symptoms reported is not connected to time spent engaged in media use in clinical samples (Mazurek & Engelhardt, 2013a); however, the meaning of the lack of significance is unclear, as the metric used is often an aggregated symptom score. Another study found an association between the number of ASD symptoms endorsed and the preference for News content (Kuo et al., 2014). Furthermore, MacMullin and colleagues (2016) found that higher numbers of reported ASD symptoms were associated with less knowledge of how to engage in different media use activities. For now, it seems these studies suggest there is some connection between ASD symptoms and media use, but the nature of this association may not be reflected well by an aggregate metric such as total time spent engaged in media use. In addition, combining social communication and RRBs into an aggregate measure may also obscure potential significant findings relevant to media use in youth diagnosed with ASD as the characteristics of these symptoms are fundamentally different (e.g., Frazier et al., 2012; Georgiades et al., 2007; Mandy, Charman, & Skuse, 2012).

Further research has begun to provide examples of certain aspects of media use that could be conceptualized as RRB symptoms. To illustrate, Shane and Albert (2008) found a proportion of children diagnosed with ASD in their sample engaged in repetitive viewing of videos and/or video segments, and there were relatively frequent reports of children becoming fixated with certain content from media. Children's repetitive viewing of TV was also reported by parents in Nally and colleagues (2000) in their small-scale qualitative study. Examples of this theme included "Parent 3: For

hours on end, he'd be rewinding to the same particular part . . . and he'd be giggling away and he'd still be laughing an hour later at the same part" (Nally et al., 2000, p. 334). The repetitive viewing of audiovisual content reported in the research conducted by Shane and Albert (2008) and Nally and colleagues (2000) can be interpreted as an RRB that has manifested in media use activities.

Furthermore, several studies have reported distress exhibited by children diagnosed with ASD when their media use activities are interrupted (Dixon et al., 2015; Nally et al., 2000; Shane & Albert, 2008). To illustrate, "Parent 5: I have actually turned the telly off and put my music on . . . Matthew comes down screaming and he's in the room to try to turn the music off and the telly's gone back on" (Nally et al., 2000, p. 332), was one of several parent comments on the subject of their child's experience of distress related to media interruption. In populations of youth diagnosed with ASD, distress is commonly reported for interruptions of a variety of activities, especially when the activity is related to a highly fixated interest of the child or youth (Sevin, Rieske, & Matson, 2015). Therefore, the distress purportedly experienced in relation to media use interruption may be of a similar nature to the distress reported for interruptions relating to highly fixated interests. In which case, the tantrum behaviour upon media activity interruption is theorized to occur due to RRBs that are related to insistence on sameness.

Other studies have examined psychopathology that is closely related to ASD, such as language impairment and comorbid intellectual disability. These studies found that language impairment related to aspects of media use. For example, in a sample of children diagnosed with ASD it was found that less verbal impairment was linked to a

greater likelihood of watching TV, compared to those with more severe verbal deficits (Orsmond & Kuo, 2011). Similarly, adolescents diagnosed with ASD that had no conversational ability exhibited a greater likelihood for using non-social media and were less likely to use media platforms that required greater language ability such as email and online chat sites (Mazurek et al., 2012). Therefore, language abilities may determine these children and youths' preference for and, potentially, their ability to participation in various types of media activities. In addition, children diagnosed with ASD and comorbid intellectual disability were found to be less likely to use a computer than children without comorbid intellectual disability (Orsmond & Kuo, 2011). In contrast, higher cognitive function was related to greater likelihood of Internet browsing on the computer and video game play (Mazurek et al., 2012). Much like language impairment, cognitive development may also influence preference for and ability to participate in media activities.

Patterns of Media Activity

The patterns of media use among children and youth diagnosed with ASD have not been investigated extensively; however, there have been a few studies to date that have begun to describe the patterns of media use exhibited by these groups. In the earliest study examining media use patterns in this population, Shane and Albert (2008) found their American sample of 90 parents of youth under the age of 18 diagnosed with ASD were reported to largely prefer media use activities, such as watching TV and using the computer, compared to more traditional activities, such as playing outdoor or reading. The higher relative frequency of media activities compared to other activities has been documented in subsequent studies involving children and youth diagnosed

with ASD (Kuo, Orsmond, Cohn, & Coster, 2011; Kuo et al., 2014; Mazurek et al., 2012; Orsmond & Kuo; 2011). For example, the findings of another study by Orsmond and Kuo (2011) on American adolescents diagnosed with ASD demonstrated that these adolescents spent the majority of their days engaged in activities of their own choosing, and the most popular of these activities were related to media. The top two most frequently reported discretionary activities were TV and computer use. The frequency of these discretionary activities were different on the weekends compared to the weekdays. Specifically, TV, computer use, shopping, reading, and visiting friends and relatives were more likely to occur on the weekends. Indeed, the overarching pattern appeared to be that children and youth diagnosed with ASD devoted a greater percentage of their overall time to media use activities. However, this is a fairly common pattern of activity exhibited by children and youth across the board (e.g., Montes, 2016; Rideout et al., 2010). Thus, it is difficult to say if this is a pattern unique to children and youth diagnosed with ASD.

Perhaps other patterns may be distinctive when examining youth diagnosed with ASD. In addition to greater relative time spent engaged in media use activities, compared to other types of activities, there appears to be patterns of preference for different levels of social interaction relating to their media use. For example, Mazurek and colleagues (2012) found that when compared to children and youth diagnosed with other neurodevelopmental disorders (e.g., learning disabilities, intellectual disability), children and youth diagnosed with ASD preferred participating in more non-social types of media use such as watching TV and playing videogames, rather than engaging in social media platforms such as emailing and using online instant messaging/chat

rooms. This non-social trend was supported by the findings of Kuo and associates (2014): non-social TV viewing, videogame play, and computer use were frequently reported. However, their study suggested there remains instances of social media use such as co-viewing of TV and peer-to-peer video game play, although scenarios were endorsed at a much lower rate. In another study conducted by Kuo and associates (2011), they found that videogame play and TV viewing were reported as the top social activities chosen by youth diagnosed with ASD and their peers. Although social play related to media has been evidenced in both ASD and TD diagnostic groups, the primary difference appears to be the frequency with which youth engage in these activities. That is, youth with ASD may still engage in social use of media with their peers, but they may do so less frequently than a TD youth would.

Children and youth diagnosed with ASD also appear to gravitate towards certain types of media content. Cartoons and animated content have been reported as the most popular type of TV content in two studies (Kuo et al., 2014; Shane & Albert, 2008). This preference for animated/cartoon content was also shown to extend to other media platforms such as movies, educational software, and websites (Shane & Albert, 2008). In addition to TV content, videogame content has also been examined in this population. Kuo and colleagues (2014) found that action games accounted for almost half of types of videogames played, followed by simulation and role-playing games. Kuo and colleagues (2014) also reported that a majority of the websites accessed by these adolescents were those accessed for research or information gathering purposes. However, the content of these websites used for research frequently pertained to both video games and anime. In combination, these research findings suggest there may be

patterns of preferred media content that children and youth diagnosed with ASD access across different platforms. However, the underlying reasons behind these preferences were unclear and no further research has explored mechanisms related to content preferences for youth diagnosed with ASD. Attempting to discern patterns of content preference as it relates to certain symptoms of ASD may enable researchers to identify their underpinnings.

Media Use Correlates

Sleep. There are several psychological and physiological factors that, although not directly occurring during the media use, have been found to be related to media use in samples of children and youth diagnosed with ASD. The first major correlate is sleep; studies show time spent playing videogames and in-room access to media (Engelhardt et al., 2013), as well as exposure to violent media content before bed and media use during bedtime routines (Mazurek, Engelhardt, Hilgard, & Sohl, 2016), were related to decreased hours spent sleeping. In addition, bedtime media use and exposure to violent media content were associated with greater delays in sleep onset (Mazurek et al., 2016).

Externalizing behaviours. Another variable that has been shown to be connected to media use is externalizing behaviours. To date, two studies have investigated these behaviours as part of their main analyses (Engelhardt & Mazurek, 2014; Kuo et al., 2015). In-room access to video game consoles by boys was found to be related to higher amounts of oppositional behaviours (Engelhardt & Mazurek, 2014). In addition, parental mediation strategies of media were related to the prevalence of oppositional behaviours in both boys and adolescents. Specifically, having no rules

regarding media use was related to higher amounts of oppositional behaviours exhibited by adolescents (Engelhardt & Mazurek, 2014). On the opposite end of the spectrum, another study found that higher amounts of oppositional behaviours by boys were related to greater reported use of restrictive rule setting for TV and videogame use by parents (Kuo et al., 2015). The findings of these two studies relate to two extremes for parental mediation: restrictiveness and permissiveness. Overall patterns of parental indulgence, which would include lax or no rule setting, have been linked to greater instances of problem behaviour in children (Lamborn, Mounts, Steinberg, & Dornbusch, 1991), but research suggests the same is not true for overall parental restrictiveness (for a review, see Rothbaum & Weisz, 1994). The potential incongruent findings relating to restrictiveness in the case of media use may be related to the nature of the antecedent behaviour (i.e., restrictive and inflexible), which could be leading to more conflict interactions in the course of media restriction if the media activity is indeed a form of RRB.

Parental mediation. Parental mediation, on its own, is another variable of interest as it has consistently been found to be an influential factor relating to various media use behaviours in a diverse array of child and youth populations (e.g., Nikken & Jansz, 2006, 2014; Livingstone & Helsper, 2008). Parent mediation refers to parental management behaviours that are intended to regulate their children's use of media in order to ensure the child is having positive experiences with media content and avoiding perceived negative or harmful media content (e.g., Livingstone & Helsper, 2008). Research has found three distinct types of parental mediation style (Nathanson, 1998 as cited in Nathanson, 1999; Nikken & Janz, 2006; Valkenburg, Krcmar, Peeters &

Marseille, 1999). *Restrictive mediation* style refers to patterns of rule-setting behaviours intended to decrease time the child spends engaged with media and the imposition of limits regarding the types of content the child can access. *Active mediation* (sometimes referred to as instructional or evaluative mediation) style is characterized by parent-child communication relating to media content for the purposes of contextualizing portrayals of certain behaviours, facilitating the child's understanding of the content, and/or expressing their perceptions of the content. Finally, the *Co-viewing/Co-playing mediation* style is characterized by the parent and child accessing the media content together without discussions related to the content during the shared media experience.

Research has shown that parent mediation styles can moderate the associations among various types of media content and negatively valenced psychological variables (e.g., aggression). A comprehensive meta-analysis of parental mediation styles and media access outcome for children provided several major findings that can be characterized as examples of parental mediation style as a moderator variable (Collier et al., 2016). For instance, the meta-analysis found that the commonly found positive association between sexualized media content and subsequent sexual behaviours in adolescent samples was different when including parental restrictive mediation as a primary variable. Namely, the aggregated study data indicated that restrictive mediation predicted later onset and less sexualized behaviour, which represents a decrease in the positive association reported in other studies not accounting for parental mediation style (e.g., Braun-Courville & Rojas, 2009). In addition, the aggregated studies demonstrated a negative association between active mediation and aggression. This finding runs contrary to the positive association commonly reported in the literature on aggression

and media use that do not account for parent mediation style (e.g., for a review, see Anderson & Bushman, 2001; Bushman, Gollwitzer, & Cruz, 2015). These findings demonstrate that parental mediation can influence the degree of association between media and psychological variables. Several moderator mechanisms are discussed by Collier and colleagues (2016): (a) The restriction of time spent accessing media content as in restrictive mediation; (b) making and changing the meaning of media content to change the child's perception/interpretation of the content as in active mediation; and (c) the subtle signalling of acceptable behaviour through a parent's non-reaction to potentially negative content as in co-viewing/co-play. Due to the potential for parental mediation style to impact the associations between even the most well established links (e.g., aggression and aggressive media) found in research, these styles need to be considered in the proposed study.

In sum, sleep, externalizing behaviour, and parental mediation of media activities have been shown to be related to media use activities in populations of youth diagnosed with ASD. Sleep was found to be negatively impacted by media use before bed, exposure to violent media content before bed, and bedroom media access. Greater reported instances of externalizing behaviours were also related to in-room access of video games (Engelhart & Mazurek, 2014). In addition, parental mediation relating to either restrictive or permissive limit setting for the youths' media use was associated with greater oppositional behaviours (Engelhart & Mazurek, 2014; Kuo et al., 2015). Finally, because parental mediation has shown to moderate potential media relationships, it will need to be accounted for in the proposed study.

Theoretical Orientation

Media-related theory. To date, the research relating to media use activities in samples of youth diagnosed with ASD have been descriptive and/or atheoretical (e.g., Mazurek & Wenstrup; Kuo et al., 2014; Shane & Albert, 2008). The lack of a theoretically driven approach makes it difficult to make predictions about and interpret the findings generated from research studies (Kazdin, 2017). Although the current study has exploratory elements, it will still be useful to adopt a more focused approach provided by theoretical guidance.

There are many different media theories that attempt to explain or describe the selective media practices of the individual or audience. One of the most popular media theories in the scientific literature is the Uses and Gratification Theory (UGT: Katz, Blumler & Gurevitch, 1973). The UGT approach has been widely applied to the study of media in the field of psychology (e.g., Gudelunas, 2012; Raacke & Bonds-Raacke, 2008; Sheldon & Bryant, 2016). Essentially, this theoretical approach posits that individuals are motivated to access media through internal needs, and that by accessing certain media they can satisfy these needs. As their needs are satisfied through the use of media, these users gravitate towards whatever platform or content that satisfies those needs. To illustrate, a user that has needs relating to social validation would be more likely to seek out media platforms that would enable them to gain social validation. Media platforms such as social networking sites (SNS; e.g., Facebook, Instagram, etc.) would be likely to satiate these social needs; therefore, the user would seek these out and engage in a pattern of behaviour that would be consistent with their needs. In line with this example, there have been many research studies that have examined a wide variety of media behaviours on SNS platforms through the lens of UGT theory (e.g.,

Chen, 2011; Raacke & Bonds-Raacke, 2008). However, the main limitation of UGT is that the typical scope of research using this approach is restricted to investigating behaviour occurring on one media platform or one type of platform ("single-media bias": Hasebrink & Domeyer, 2012, p. 758; Hasebrink & Popp, 2006). The assumption that individuals prefer one media platform to the exclusion of others is highly unlikely given the modern media landscape, which is composed of a diverse array of media platforms that can be used to access a variable smorgasbord of content. That is, the lines between different media are becoming blurred as the same content can be disseminated and accessed through different media platforms in today's age of technological advancement. This phenomenon is known as media convergence. A salient example of this convergence is the ability to access TV shows online through video game consoles, computers, smartphones, and, of course, traditional TV broadcasting. Thus, much of the information about media use is ignored by limiting research to one platform.

UGT is not the only media theory that adopts this single-media approach. Theories such as Self-Presentation Theory (Goffman, 1956) and Cultivation Theory (Gerbner, 1969) also appear in research studies that largely restrict focus to one platform at a time. For example, self-presentation theory (or impression management theory as it is sometimes referred to) has been used extensively to investigate the array of behaviours found on SNSs (for a review, see Boyd & Ellison, 2007), but many of these studies have focused on a single platform, like Facebook. As an example, the study conducted by Rosenberg and Egbert (2010) focused on impression management tactics on Facebook, personality traits, and goal-oriented thought processes. Here the study findings do not provide a generalizable pattern that can apply to impression

management in other modalities such as texting, site/content sharing, or even the use of other SNS platforms, as these constitute different contexts with different communication tools available to the individual. Therefore, the data generated from single-platform studies do not provide a holistic understanding of the individual's thoughts, motivations, and behaviours in relation to their wider digital world consisting of many different technologies.

As the modern media landscape is composed of many different media sources and access to different platforms over the course of a given day is likely, a more generalized theoretical approach is required to satisfactorily provide a comprehensive account of an individual's actual media use. A recently proposed theory may provide the necessary generality. The Media Repertoires approach (Hasebrink & Domeyer, 2012; Hasebrink & Popp, 2006) outlines both a theoretical framework consisting of relevant social and individual factors to consider during research, as well as an approach for analyzing data. In their theory, Hasebrink and Popp (2006) propose an analysis of wider patterns of media use that attempt to include all of the media use activities and platforms of the users. Furthermore, they indicate these patterns will be determined by three major societal and individual bases; *structural factors*, *positional variables*, and *individualized constructed meaning* of the media use. The structural factors refer to societal and technological processes that determine the nature of the media landscape for a given person. For example, the crossover between media platforms, such as watching TV on the Internet, shapes the types of media activities and content the individual can engage in, and this would be considered a structural variable. Positional variables are those that indicate where the individual is "located" within a society or

group and how this position may relate to the patterns of media use exhibited by particular audiences. As stated by Hasebrink and Popp (2006), examples of positional variables are age, gender, educational status as these factors relate to how the individual is viewed by society at large, which would then determine their position within that society. Finally, the individualized constructed meaning of media use occurs at the individual level and manifests in how individuals perceive, respond to, and use media in their everyday life. The Media Repertoires approach does not create a hierarchy for these three factors and posits that research of patterns at any level is important to understanding media use as a whole (Hasebrink & Popp, 2006).

In the current study, both the diagnostic label and the presenting symptoms of ASD may affect how the individual interacts with and functions in society. Therefore, the diagnosis of ASD would be a positional variable that must be considered in order to understand how these individuals may engage with the digital world. Their youth is also a factor that determines how the individual is positioned in society; social norms and the extent of autonomy are different for youth than for adults in wider society. Therefore, age is another factor to be considered in relation to media use. Finally, gender is a factor that influences an individual's position within society, which can be reflected in both the way ASD and media use may be perceived and encouraged/discouraged. The primary advantage of the Media Repertoire approach is that it provides a framework that accounts for biases inherent to studying one platform and may result in a more accurate account of media use, given the technological convergence phenomenon. Overall, the Media Repertoires approach provides an extremely flexible research

framework that is conducive to conducting exploratory studies of media use by both audiences and individuals.

Behavioural theory. Behavioural theories have been central to research and clinical understanding of ASD. These theories have not been able to describe a clear etiology of behavioural symptoms such as RRBs, but they do provide an explanatory framework regarding the maintenance of behaviours like RRBs (Turner, 1999). The behavioural understanding of RRBs is based on operant conditioning principles. Operant conditioning refers to Skinner's (1963) theory that the consequences of behaviour serve to shape and maintain it depending on how it is experienced by the individual. Behaviours that result in some form of rewarding experience become reinforced. In ASD, stereotypies and motor behaviours have been conceptualized as reinforcing some form of perceptual need (Lovaas, Newsom, & Hickman, 1987). These repetitive behaviours occur outside of the individual's conscious thought (i.e., automatically) and result in reinforcement; thereby serving to maintain the behaviour without conscious control. The research literature on these lower-order behaviours largely maintains that this automatic reinforcement process seems to drive these actions (e.g., Rapp & Vollmer, 2005). In contrast, the behavioural "function" of higher-order behaviours such as rigid routines, rituals, and/or interests is not well understood. Indeed, the research lacks a clear consensus on the reinforcement mechanisms that contribute to their maintenance. It has been proposed that these more complex behaviours may have a variety and/or a combination of reinforcement such as automatic (e.g., object characteristic; Rodriguez, Thompson, Schlichenmeyer, & Stocco, 2012), negative (e.g., avoidance conditioning; Wolff, Hupp, & Symons, 2013) and social reinforcements (e.g.,

attention; Rodriguez, Thompson, Stocco, & Schlichenmeyer, 2013).The primary method of determining the nature of the reinforcement obtained by certain behaviours is functional behavioural analysis, which is an in-depth systematic observational method of determining antecedents and consequences of behaviours. Unfortunately, functional analysis fell outside the scope of the current study; however, the principles of operant conditioning may be used to assist in the interpretation of results rather than measure the potential media RRBs.

Contributions of the Current Study

The proposed study will draw from and address gaps in the empirical research conducted to date on media use by youth diagnosed with ASD. In line with past studies, the current study will focus on children, but the age range (i.e., 4 to 11 years of age) will represent an extension to a sample of younger children, as their media use has not been studied previously.

To date there have been no studies that have looked at how specific symptoms and how symptom sets related to the distinct structure of ASD may relate to overall media use and media use activities. A few studies have used aggregate numbers of symptoms endorsed to investigate potential relations of ASD to media use; however, this does not provide much information about the nature of the associations. In order accurately investigate media use in this population, the unique symptom structures (i.e., Social Communication and RRB) must be separated as they account for different aspects of behaviour and impairment. Furthermore, there are different components within symptom structures such as RRBs that, when viewed as distinct, could reveal potential patterns of media use. In addition, certain studies researching both ASD, in

general, and ASD in relation to media use have operated under the assumption that the way these individuals utilize media is a reflection of RRB symptoms; however, this has not been explicitly studied. Thus, media use behaviours that may represent potential RRBs must be identified and the extent these behaviours relate to corresponding ASD symptoms must be determined. The current study will address this gap by translating traditional RRB behaviours to parallel media use behaviours and, subsequently, exploring their prevalence and association with traditional RRB symptoms. The identification of relevant potential media RRBs was accomplished through an extensive literature review and consultation with both clinical professionals specializing with ASD populations (N. Koushik, 2018, personal communication; C. Phillips, 2018, personal communication) and a parent advisor of a child diagnosed with ASD. This more direct line of inquiry will begin to clarify the nature of the reported behaviours from previous studies and may serve as a basis for attempting to distinguish between addictive and ASD psychopathology.

In addition, there are some methodological issues that represent gaps in the extant literature. Namely, all of the studies on ASD and media to date have been constructed without theoretical frameworks (e.g., MacMullin et al., 2016; Mazurek et al., 2012; Orsmond & Kuo, 2011). Although descriptive empirical studies were useful to initiate the process of observing media use phenomena in ASD populations, a theoretical framework can expand the understanding of the phenomena under study. Theory can be used to identify factors that may influence the presentation of the phenomena, identify mechanisms that may explain these presentations, and connect potential findings about the phenomena to the real world (Kazdin, 2017). Thus, the use

of a theoretical framework, in this case the Media Repertoire approach, can extend the existing knowledge on media use and ASD.

There are also several gaps related to measurement aspects of media use in the studies conducted on media use by individuals diagnosed with ASD. For instance, some of these studies have operationalized media use as an aggregate total amount of time (e.g., Mazurek & Engelhardt, 2013a); however, this ignores what activities and behaviours are occurring within this time, which may yield more clinically useful information. The current study will address this by including a wide variety of media use activities and behaviours for study and examine how these variables fit together without arbitrarily grouping them together. Also, recent studies regarding ASD and media use have failed to account for technological convergence (i.e., the advancement of technology that enables multiple platforms to access the same content), which has led to the investigation of a limited number of media platforms and/or media devices. In turn, focusing on a restricted number of platforms and/media devices necessitates the neglect of others which does not contribute to a holistic understanding of an individual's media use. This relates to yet another gap in the research that pertains to the neglect of wider patterns of media for analysis. Although a few studies examined parts of media use independently of one another to attempt to describe media use by individuals diagnosed with ASD, no attempts have been made to incorporate more comprehensive patterns of media use exhibited by individuals diagnosed with ASD. Attempts to investigate a variety of platforms, devices, and content as they may relate to each other may provide more realistic and representative information regarding these individuals' media use. As the Media Repertoire approach advocates for this holistic

approach, the current study will attempt to investigate a wide variety of media use activities and behaviours in the context of a diverse array of media use platforms and media devices to develop patterns of media use in youth diagnosed with ASD. The proposed research study will provide further information on media use in youth diagnosed with ASD by adopting a new perspective and addressing existing gaps in the research literature.

The proposed online study will follow the progression of survey research conducted by Shane and Albert (2008) and Kuo and colleagues (2014). Namely, the current work will shift the focus away from aggregate amounts of media time to involve a more detailed and descriptive breakdown of media use and media use activities to provide enough information to establish general patterns of media use by individuals diagnosed with ASD. The proposed study will extend the description of the general patterns from proportions of time spent engaged in each activity to profiles of media engagement. In addition, technological convergence will be accounted for in the construction of the media survey to produce a more accurate and comprehensive description of media use. Furthermore, potential RRB behaviours in media use activities have been identified through a review of the research literature and through consultation with several clinical psychologists and a parent advisor with a child diagnosed with ASD. These potential media manifestations of RRBs will be included in the survey to attempt to provide quantitative data about media use as a potential RRB.

Hypotheses and Exploratory Research Question

The primary goal of the proposed research is to investigate the potential connection between media behaviours and traditional RRB symptoms related to ASD.

Based on the limited research conducted to date (e.g., Nally et al., 2000; Shane & Albert, 2008), these media behaviours may actually be RRB symptoms that have manifested in the context of digital media. Therefore, these proposed media RRBs should demonstrate similar patterns and differences that have been established in past research on classical RRBs.

Hypothesis 1: Media RRBs group differences. As the literature indicates that traditional RRBs are present in typically developing children and that the distinguishing aspects of RRBs in ASD are their number, intensity, and development, Hypothesis 1 was developed to investigate the likelihood these media RRBs are a unique feature of ASD. Hypothesis 1 predicts that compared to children without ASD, children diagnosed with ASD will display greater degrees of daily behavioural frequency (i.e., intensity) of media RRBs.

Hypothesis 2: Connection between media RRBs and classical RRBs in ASD. As mentioned above, media RRBs may be a unique feature of ASD. One conceptualization of the proposed media RRBs is that these behaviours are simply an extended presentation of traditional RRBs into media contexts and activities. If that is indeed the case, then the intensity of media RRBs and, by extension, their number should be associated with the intensity of traditional RRBs. Therefore, Hypothesis 2 predicts that the endorsement of higher frequencies of classical RRBs, as determined by the child's CAST score, will be related to higher frequencies of media RRBs in children diagnosed with ASD.

Hypothesis 3: Media RRBs and age. Previous research has provided evidence to suggest RRB behaviours are present in both typically developing children and

children diagnosed with ASD at younger ages. However, these RRB behaviours begin to decline around the age of 4 in typically developing children while RRB behaviours do not change as the child diagnosed with ASD ages. Media RRBs may follow a similar trajectory of development. Therefore, Hypothesis 3 predicts that older ages will relate to lower levels of media RRB intensity for children without ASD. In contrast, older ages should not be significantly associated with media RRB intensity for children diagnosed with ASD.

Hypothesis 4: Media RRBs and adaptive function. The components of Hypothesis 4 are based on preliminary research suggesting that lower levels of function have been linked to greater severity of ASD symptoms, especially lower-order RRBs, in children diagnosed with ASD. In addition, research has also shown that children diagnosed with ASD demonstrate lower levels of adaptive function than their typically developing peers. Therefore, Hypothesis 4a predicts that children exhibiting lower levels of adaptive functioning will endorse greater degrees of intensity for media RRBs. In contrast, children exhibiting higher levels of adaptive function will endorse lower levels of media RRB intensity. Furthermore, Hypothesis 4b predicts the magnitude of the positive correlation between adaptive function level and media RRB intensity should be greater for the ASD compared to the non-ASD group. In a similar vein, research on media use and ASD has suggested that children diagnosed with ASD that demonstrate lower levels of functioning exhibit limited variety in the devices used to access media use. One possible reason for the link between low levels of function and restricted number of media devices used to access media is that certain devices with more complex functions may be inaccessible to these youths. Therefore, Hypothesis 4c

predicts that lower levels of adaptive function will be related to a lower number of media devices used to access media content.

Hypothesis 5: Levels of media RRB and adaptive function in ASD. Previous literature has indicated that there is an intersection between traditional RRBs and adaptive functioning level. The existing research has provided evidence to suggest that RRB symptoms are characterized by two overarching factors, Repetitive Sensory and Motor Behaviours and Insistence on Sameness. The Repetitive Sensory and Motor Behaviour factor is considered to be comprised of lower-order RRBs, characterized by simple repetitive actions that require little complex planning and organization, which are more prevalent in lower functioning individuals. In contrast, the Insistence on Sameness factor is comprised of higher-order RRBs, characterized by more complex levels of cognitive processing, which are more prevalent in higher functioning individuals. Based on these findings, Hypothesis 5 states: children diagnosed with ASD that demonstrate lower functioning, as determined by their adaptive functioning scores, will exhibit more low-order media RRBs. In contrast, children diagnosed with ASD that demonstrate higher functioning will exhibit more high-order media RRBs.

Hypothesis 6: Parental mediation as a media moderator. Finally, the data on parent mediation styles suggests the strategies parents use to monitor and control their children's media use can the impact relationships found between media use and psychological correlates. Even in associations as well established as those between aggressive media content and children's aggressive behaviour have been shown to change depending on parents' media mediation style. However, minimal research has been conducted to determine the influence of parental mediation styles on media use

patterns in samples of children diagnosed with ASD. Of the minimal evidence that exists, the research involving restrictive parental mediation styles in samples of parents of children diagnosed with ASD indicated that they were related to greater numbers of oppositional behaviours. Therefore, parental mediation style is a variable that needs to be considered in the proposed study. Hypothesis 6a states: parental endorsement of restrictive mediation, as measured by scores on the generalized technology mediation questionnaire, will moderate the association between age and intensity of media RRB. For the children in the non-ASD group, the magnitude of the inverse association between age and intensity of media RRBs will be larger for those who have parents who use a more restrictive mediation style, compared to those whose parents use a less restrictive mediation style. The same moderating relationship should be evidenced by active mediation. However, Hypothesis 6b predicts that the same moderating influence of restrictive mediation should not be true for the ASD group. RRBs are quite difficult for parents to manage (e.g., Harrop, McBee, & Boyd, 2016) and, by extension, media RRBs should be too. The anecdotal evidence (e.g., Nally et al., 2000) regarding examples of simple restriction strategies show these were not maintained when faced with the child's extreme distress in response. Thus, media RRBs should not be influenced by restrictive mediation. In this case, co-viewing and active mediation styles should not influence the association between age and media RRB intensity as they do not involve the interruption or restriction of potential media RRBs. Finally, restrictive parental mediation style may involve limiting the type of device used to access media. Therefore, Hypothesis 6c predicts that restrictive mediation style will moderate the

association between adaptive functioning level and variety of media devices, such that the magnitude of the positive relation in the ASD group should be stronger.

In addition to the investigation of specific hypotheses, the proposed study will also conduct exploratory analyses of the media repertoires in children diagnosed with ASD. There is a lack of empirical research related to these repertoires and how they might differ from those of children without ASD. The exploratory component of the proposed study will be guided by the research question: To what extent do children diagnosed with ASD exhibit distinct patterns of media use across various media platforms? Variables such as age, gender, socioeconomic status, adaptive function, and ASD symptom severity will serve as positional variables to examine the exploratory profiles as outlined by the media repertoire approach.

CHAPTER 3

METHOD

Participants

The participants recruited for the current sample were Canadian parents and legal guardians of both children with and without a diagnosis of ASD, ages 4 to 11. The final study sample was composed of a total of 36 parent respondents, with 25 indicating they were a parent of a child with ASD and 11 indicating their child did not have ASD. These participants were recruited Canada-wide using online survey tools. To be eligible for final inclusion in the study analyses, these parents were required to currently live in Canada and have a child between the ages of 4 to 11. In addition, the child being reported on had to have used media within the last month, and not received an intervention targeting their media use. Participants meeting the eligibility criteria were entered into a draw to receive one of twenty $10 e-gift certificates to a selection of retailers. Fifty-nine parents initially responded to the online survey. Of these respondents, four did not qualify, as they indicated their child had received an intervention targeting their media use, and one was eliminated as they reported their child had not used media within the last month. From the remaining 55 respondents, 19 left a significant number of questions blank and had to be removed due to the absence of usable data.

The demographics (e.g., age, gender, ethnicity) of the final sample of 36 parents and their children can be found in Table 1. The final sample consisted of 2 fathers and 23 mothers between the ages of 24 to 52 (M = 38.19 years, SD = 7.65 years) in the ASD group and the non-ASD group consisted of 11 mothers between the ages of 27 to 47 (M = 34.44 years, SD = 5.73 years). The parents in both group were primarily Caucasian

(ASD = 84%; non-ASD = 82%), were part of households with incomes starting at $60,000 and above (ASD = 56%; non-ASD = 73%), and had some level of university education or higher (ASD = 48%; non-ASD = 82%). Approximately 56% of the respondents were from Ontario, 22% were from the prairie provinces (i.e., Alberta, Saskatchewan, Manitoba), 14% were from the maritime provinces (i.e., New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador), 5% were from Quebec, and one respondent reported living in Canada without specifying a province.

The children reported in the ASD group were between the ages of 4 to 11 (*M* = 6.52 years, *SD* = 2.18 years) and the majority were boys (boys: 68%, girls: 32%). All children in this group were reported to have a diagnosis of ASD and 56% were reported to have at least one comorbid disorder. The most commonly reported comorbid diagnosis was a communication disorder (27%), followed by an Intellectual Disability (20%), an anxiety disorder (20%) and Attention-Deficit/ Hyperactivity Disorder (12%). Parents also filled out the Childhood Autism Spectrum Test (CAST) to screen the child's level of autism symptoms. Four children were reported to have CAST scores under the recommended cut-off of 15 (ranging from 10 to 13) suggesting lower levels of autism symptoms; however, given the consistency of reported restricted repetitive behaviours with the remainder of the ASD sample, these children were retained in the ASD group and deference was given to the parent's report that a diagnosis of ASD was provided by a psychologist or multidisciplinary team.

One child's total CAST score could not be calculated due to one unanswered question; however, their total score without this item was still greater than the cut-off score, thus they were retained in the ASD group.

The children reported in the non-ASD group were also between the ages of 4 to 11 (*M* = 6.67 years; *SD* = 3.04 years). This group of children was primarily composed of girls (girls = 64%; boys = 36%). Most of the children were reported to have no psychological diagnoses; however, one child was reported to have a comorbid diagnosis of a communication disorder and another child was reported to have a comorbid diagnosis of a communication disorder and an Intellectual Disability. Reports about these two children were retained, as the parent-report CAST indicated that their behaviours that might be consistent with ASD were well below (i.e., 5 and 6) the cut-off for concern (score of 15), reports of their adaptive function level did not indicate marked deficits compared to other children in this group, and observations of behaviours considered media RRBs were not elevated compared to their peers. In this case, these children were retained in this group to minimize any loss of power related to the group comparisons conducted in the data analysis portion of this study.

Measures

All the measures employed in the current study relied on parent reports of their child's behaviours. Parent report questionnaires are frequently used both in general research involving young children (e.g., Achenbach et al., 1987) and children's media use specifically (e.g., MacMullin et al., 2016; Mazurek & Wenstrup, 2013). However, the caveat with the use of these measures is that the child's behaviour is not directly and systematically observed by the researcher. Therefore, the language used when reporting

Table 1
Demographic Information

Variable	ASD (n = 25)	non-ASD (n = 11)
Parent gender		
Male	2	0
Female	23	11
Parent age	M = 38.19	M = 34.44
Parent's ethnicity		
Aboriginal	0	1
Filipino	1	0
Latin American	1	0
South Asian	1	0
White	21	9
Multiple ethnicities	1	1
Household income		
less than $30,000	4	0
$30,000-$60,000	5	2
$60,000-$90,000	6	2
above $90,000	8	6
Child's age	M = 6.52	M = 6.67
Child's ethnicity		
Aboriginal	0	0
Filipino	0	1
Latin American	1	0
South Asian	1	0
White	21	9
Multiple ethnicities	2	1
Child's gender		
Male	17	4
Female	8	7
Child's diagnosis		
A communication disorder	7	2
Intellectual Disability/GDD	5	1
Attention-Deficit/ Hyperactivity Disorder	3	0
Anxiety Disorder	5	0
Obsessive-Compulsive Disorder	2	0
A genetic syndrome	2	0
A medical disorder or condition	1	0
Other	1	0
Never been diagnosed	0	9

Note. GDD = Global Developmental Delay. Three participants did not disclose their income.

the results related to these measures will reflect the fact that the data are being derived from secondary sources rather than direct methods.

Child Autism Spectrum Test (CAST: Scott et al., 2002). The CAST is a 37-item parent-report measure of ASD developed for use as a screening measure for general populations of children age 4 to 11. The CAST was initially developed based on DSM-IV-TR criteria for Autistic Disorder; however, it should still be suitable for use as a screener in current populations as the symptoms of ASD have not changed. Rather, the DSM-5 has shifted the structure of the diagnostic criteria and the age of onset for the presentation of these symptoms. Indeed, even after the publication of the DSM-5 the CAST continues to be used as a screener for ASD (e.g., Holmboe et al., 2014; Colvert et al., 2015).

Of the 37 items, 31 are used to generate the scale score for ASD symptom endorsement. The remaining six items gather information regarding general developmental characteristics and are not included in the scoring process because they will not contribute to the understanding of the study hypotheses. The items' response options are a dichotomous yes or no scale, in which a response of "yes" equals a score of "1" for that item. The dichotomization allows the researcher to calculate the total number of ASD symptoms observed by the parent. The final scale score consists of the total sum of each "yes" item (i.e., 1 point responses) and can range from 0 to 31. A clinical cutoff score of 15 was established in the initial development of the measure (Scott et al., 2002) and has been used in follow-up psychometric studies (Williams et al., 2005, 2006). The acceptance of the clinical cutoff is supported by its use in subsequent research studies (e.g., Barnes et al., 2008; Sofronoff, Attwood, & Hinton,

2005). These studies have shown the CAST exhibits good psychometric qualities. The CAST has both sound content validity and concurrent validity demonstrated by the CAST's alignment with ASD diagnostic criteria and its high correlations with other psychometrically validated measures such as the Social Communication Questionnaire. The CAST also demonstrated good sensitivity and specificity (Sensitivity = 0.82 and Specificity = 0.99; Scott et al., 2002; Sensitivity = 1 and Specificity = 0.97; Williams et al., 2005). In addition, it has been shown to have good test-retest reliability (Kappa = .70; Williams et al., 2006) and moderate inter-rater reliability (Kappa = .54; Williams et al., 2005). Furthermore, 97% of individuals classified as probable cases of ASD did not change classifications (i.e., ASD to non-ASD groups or vice versa) after a second administration when using the cutoff score of 15, which also supported the reliability of the CAST (Williams et al., 2006). In the current study, Cronbach's alphas indicated that the CAST demonstrated excellent overall internal consistency ($\alpha = .93$) and good internal consistency within the ASD group ($\alpha = .72$). The internal consistency was lower for the non-ASD group ($\alpha = .47$); however, this is not unexpected as alpha coefficients are not reliable in very small samples (Samuels, 2015).

Demographics Questionnaire. The demographics questionnaire was developed specifically for the current study, and covers a variety of participant characteristics (see Appendix A). The demographics questionnaire consists of a total of 27 items; 25 items were for both parents of children with and without a diagnosis of ASD and an additional two questions were asked if the parent indicated their child was diagnosed with ASD. Of the 27 items, 4 items were included to determine if the child met criteria for inclusion in the study (i.e., residing in Canada, age between 4 to 11, used media in the

last month, and underwent intervention targeting their media use). Twenty-one items assessed the child's age, gender, and current ASD diagnostic status, the reporting parent's age and gender, household income (i.e., socio-economic status), and ethnicity. Previous studies have indicated these are variables both relating to the parents and the children that can influence the relations found among the other variables of interest within the study such as media use (e.g., Mazurek et al., 2012), parental mediation of media use (e.g., Kuo et al., 2015), and overall ASD symptoms (e.g., Mayes & Calhoun, 2011). The remaining two questions were only presented to parents who indicated their child was diagnosed with ASD to gather data on age of diagnosis and which type of professional provided the diagnosis. Therefore, the demographics served two purposes: (a) to describe the sample for the purposes of understanding the generalizability of the study findings; and (b) to provide potentially important covariates to include in the study analyses.

Generalized Parental Mediation Questionnaire. To date, no parental mediation measures have been developed to assess mediation style across the wide variety of electronic media devices that a child has access to in their daily lives. As many parental mediation measures are specific to one platform they do not provide information relating to what strategies the parent may use to monitor and control their child's media use in the context of other platforms. Therefore, restricting these measures to one platform limits the ability of researchers to assess the role and impact of parental mediation in the complex daily media use patterns of children. As an array of media devices are being investigated in the current study, the Television Mediation Scale (TMS) developed by Valkenburg and colleagues (1999) was modified to enable

the measurement of parent mediation styles that may be exhibited in relation to devices other than TV. The TMS was chosen for modification as it is a psychometrically validated measure and will provide a foundation for assessing more generalized parental mediation of media. The original TMS is composed of 15 items measuring instructive, restrictive, and social co-viewing mediation styles. The language of these items has been changed slightly to allow these items to assess mediation style across different media devices. For example, item 1, "how often do you try to help the child understand what s/he sees on TV," was modified to be, "how often do you try to help the child understand the media content s/he accesses." The core concept of facilitating the child's understanding of the media content is preserved in the reformulated item. In addition, the modified item removes "sees" and "TV," as these indicate a specific mode of sensation and a specific media device used to access media content. The modified language generalizes the item so that it can be used to assess the parental behaviour relating to different types of content that may require different sensation (e.g., listening) and different media devices.

Four qualitative questions were included at the end of the questionnaire. The purpose of these qualitative questions was two-fold: (a) to provide further information about parental mediation of a wide array of electronic media; and (b) to determine the congruence of the parents' self-reported behaviours and the modified generalized mediation items to provide an indication of the content validity of these new items (examples of similar procedures can be found in studies conducted by Groenvold, Klee, Sprangers, and Aaronson [1997] and Lederman and O'Malley [1990]).

The original TMS was shown to have good content validity given the congruence between its factor structure and parental mediation themes identified in the research literature (Valkenburg et al., 1999). In addition, the three subscales of the TMS have been shown to have good internal consistency both in the original measurement study (Instructive Mediation: α = .80; Restrictive Mediation: α = .79; Social Co-viewing Mediation: α = .79; Valkenburg et al., 1999) and in subsequent studies utilizing the measure (e.g., α = .77 to α = .73 across the three subscales: Starr & Ferguson, 2012). Given that the language of the items was modified and no major departures were made from the meaning of the original items, the subscales from the traditional TMS were maintained in the current generalized version. The items within each subscale are scored from 0 (*Never*) to 3 (*Often*) and summed to create the subscale scores as in the original TMS version. Therefore, each of the subscale scores can range from 0 to 15 in the current Generalized Parental Mediation Questionnaire. The GTMQ was found to have good consistency overall (α = .84) and for both the non-ASD (α = .85) and ASD (α = .85) groups.

GO4KIDDS Adaptive Behavior Scale (Perry, Taheri, Ting, & Weiss, 2015). The GO4KIDDS Adaptive Behaviour Scale is an 8-item parent-report measure assessing skills necessary to effectively participate in activities of daily living and was developed for use with individuals, ages 3 to 20. Each item is rated on a 5-point Likert-type scale, ranging from 1 to 5, each with anchor points unique to each question. For example, Item 1 asks “What level of help or support is needed for your child (e.g., toileting, dressing, eating, etc.)? This item’s response scale ranges from 1 (*requires support for almost all aspects of life*) to 5 (*does not require support*). These ratings are

summed to yield a total scale score, ranging from 8 to 40, with lower scores indicative of lower levels of adaptive behaviour. The psychometric data generated from the scale development study indicated the Go4KIDDS Adaptive Behaviour Scale demonstrated adequate concurrent validity (r = .81) with the Scales of Independent Behavior-Revised Short Form, another psychometrically validated measure of adaptive behaviour, and the internal consistency of the scale was high (α = .87). Furthermore, the scale demonstrated good internal consistency in another research study involving a different sample (α = .93; Ncube, Perry, & Weiss, 2018). In the current study, this scale demonstrated excellent overall internal consistency (α = .88), which was consistent with previous studies. In addition, the internal consistency was good for both the ASD (α = .85) and non-ASD groups (α = .79).

Media Use Patterns Survey. The Media Use Patterns survey was developed specifically for the proposed study. It consists of a total of 66 items assessing types of media engagement, frequency, duration, context, genre, and devices used to access media (see Appendix B). Items were based on surveys constructed by Shane and Albert (2008), as well as Kuo and colleagues (2014), to create a foundation for the current survey. Many items were added or updated to reflect the technological advances and the changing landscape of media available to children in the home. That is, many different media devices and platforms offer access to the same content (e.g., TV shows available both through traditional cable and online through streaming sites like Netflix) in a phenomenon known as technological convergence. Thus, questions needed to reflect both the variety of devices available now and the many different kinds of content that can be accessed through these devices. For example, one of the items in the Shane and

Albert (2008) survey assessing the types of electronic media devices in the home only included options for TV, Computer, and DVD/VCR. In the current study survey, this question was updated to include additional electronic media device options such as smartphones, digital cameras/drones, handheld video game devices, and virtual reality headsets. Another example of updated response options constructed for the current study's survey include the media genres identified by Kuo and colleagues (2014). Based on the categories employed by the Internet TV platform Netflix (2018), Romance, Thriller, Mystery, Crime, Horror, and Sci-Fi/Fantasy were new genres added to Kuo and colleague's (2014) original TV media genre response options. The Media Use Patterns Survey includes several broad categories of questions. These subgroups are the Behaviours During Media Activities, Media Genre and Devices, Media Literacy Behaviours, and Time Spent in General Activities.

The Media Genre and Devices category is composed of 9 survey items inquiring about the types of devices used, media content accessed by the child, and the frequency the content was accessed (e.g., "Item 48. Please rank the top 3 types of audio content your child accessed using the first drop-down option. Then use the drop-down options to the right to show how often your child accessed the audio content."). The response options for these questions are primarily drop-down lists and textboxes. The drop-down lists consisted of the devices types (e.g., *Smartphone, TV*) and frequency options that consisted of Likert-type scales ranging from 1 (*Never*) to 7 (*Several Times an Hour*).

The Media Literacy category is composed of 7 survey items requesting information about the ability of the child to use various types of media on their own or through some degree of support (e.g., "Item 39a: How able is your child to use the

media devices on their own?"). The response options for these questions consist of two ranges of Likert-type scale options: (a) 1 (*Not At All*) to 5 (*Needs No Support*), and (b) 1 (*Never*) to 7 (*Several Times an Hour*), as well as checkbox options.

The Time Spent in General Activities category consist of a single item asked about the number of hours the child was observed in 12 activities ranging from Playing Alone Outside Without Media Devices to Accessing Electronic Visual Media such as Images or Articles. The time was indicated on a Likert-type scale ranging from 1 (*None*) to 7 (*Greater than 6 hours*).

Behaviours During Media Activities category is composed of 49 questions assessing behavioural characteristics of media engagement that are predicted to reflect characteristics of traditional RRBs in the media context. These behaviours can be considered as media RRBs. To date, there is little research on media RRBs and there are no psychometrically validated measures to assess them. Thus, the survey items assessing behaviours considered media RRBs were generated through literature review of both classical RRBs (e.g., Leekam et al., 2007) and observed media use behaviours in youth ASD samples (e.g., Nally et al., 2000; Shane & Albert, 2008). In addition, clinical experts engaged in work with ASD populations and a parental advisor were consulted to determine if there were any other behaviours that were similar to classical RRBs that might take place in the media context. These advisors agreed that the items have face validity and were used to explore the existence of media RRBs in ASD populations. These items cover a wide variety of potential media RRBs (e.g., "Repeatedly watches the same part of a show, movie, or video") and raters are asked to indicate the frequency the behaviour occurred over the past 30 days on Likert-type

scales that range from 1 (*Never*) to 7 (*Several Times an Hour*). There was also a subset of questions assessing distress experienced as a result of interrupted or prevented media use (e.g., "Becomes upset if interrupted when accessing media content or using a media device") which were rated on 3 kinds of Likert-type scales, with one measuring frequency of distress over the past 30 days ranging from 1 (*Never*) to 7 (*Several Times an Hour*), another measuring duration of distress ranging from 1 (*None*) to 9 (*Greater than 3.5 hours*), and another measuring intensity of distress ranging from 1 (*Not At All*) to 7 (*Overwhelmingly Upset*).

For the purposes of hypothesis testing, survey responses were aggregated to create single scores for statistical analysis. The preliminary scales related to media RRBs were constructed and scored based on the scoring methods used by the RBQ-2 and previous factor analytic studies demonstrating a 2-factor structure for RRB symptoms. First, an overall scale total for the frequencies of parent-reported media RRBs was calculated using items 7-10, 13-15, 17-25, 26-33, 36, and 37. These unweighted scores ranged from 26 to 182 with higher scores delineating greater frequencies of media RRBs. This scale score demonstrated excellent internal overall (α = .92) and for both groups (Non-ASD α = .83) and (ASD α = .86). In addition, subscales relating to the factor structure of RRB symptoms can be developed and scored to analyze Hypothesis 3. Collectively, MUPS item 8 and media RRB items 6, 17-25, 36, and 37 describe behaviours that are repetitive, involve routines, and are inflexible, which likely reflect the Insistence on Sameness factor found in classical RRBs. A total unweighted sum was calculated for this media RRB subscale with a possible minimum of 12 and a maximum of 84. The internal consistency of this subscale was found to be

excellent overall (α = .90) and was good for both groups (Non-ASD α = .75) and (ASD α = .83). In addition, the summation of media RRB items from 26 to 33 likely reflect the Repetitive Sensory and Motor Behaviours factor found in classical RRBs. A total unweighted sum can be calculated for this media RRB subscale with a possible minimum of 7 and a maximum of 49. The internal consistency of this subscale was found to be high overall (α = .86) and was good for the ASD group (α = .84), but could not be calculated accurately for the non-ASD group given the limited response variability (i.e., most items were rated as not being observed in this sample).

In addition to content updates, the readability of the existing and newly constructed items was revised to ensure the survey was understandable. Research indicates that reading levels that are too high can lead to poor comprehension of questions and questionable validity of participant answers (e.g., McHugh et al., 2014). Studies on readability suggest the language of survey items should be below an 8th grade reading level (Shankar, Davenport, Woolen, Carlos, & Maturen, 2018), optimally, striving for a 5th or 6th grade reading level to ensure participants' comprehension of the items (e.g., McHugh et al., 2014). The Media Use Patterns Survey items were assessed using Readable.io, an online readability assessment tool that applies 6 established formulas (e.g., Flesch-Kincaide algorithm) and averages the findings for an overall grade level estimate. Based on the report generated from this tool, the Media Use Patterns Survey demonstrated an average of a 7th grade reading level. Therefore, the readability of the survey is acceptable for the purposes of the current investigation.

Repetitive Behaviour Questionnaire-2 (RBQ-2: Leekam et al., 2007). The RBQ-2 is a revised form of the original Repetitive Behaviour Questionnaire developed

by Turner (1995). It is a 20-item parent-report measure assessing repetitive behaviours and interests that are typically demonstrated by individuals diagnosed with ASD and was developed for use in populations of two-year-old children. However, a recent study extended psychometric data of the RBQ-2 to children and adolescents ages 2 to 17 and found it retained desirable psychometric qualities (Lidstone et al., 2014). The scale uses a mixed rating system of 3- and 4-point Likert-type scales. The first six items are rated on a 4-point Likert-type scale from 1 (*Never or Rarely*) to 4 (*30 or more times daily or twice hourly*). Thirteen items are rated on a 3-point Likert-type scale ranging from 1 (*Never or Rarely*) to 3 (*Marked or Notable*). The remaining single item is a multiple choice option assessing the child's level of flexibility relating to their voluntary activities and is not included in the overall scale score. The multiple choice has been excluded in psychometric studies (e.g., Leekam et al., 2007; Lidstone et al., 2014); therefore, the current study did not include the multiple choice item in the calculation of the total RRB score.

The RBQ-2 is scored by summing the response options. The 4th response option for the first 6 items are scored as a 3 in order to keep the item values consistent throughout the scale. The total score on the measure can range from 19 to 57, with higher scores indicating greater prevalence of RRB behaviours (Lidstone et al., 2014). The RBQ-2 has both 4-subscale and 2-subscale configurations. As there is robust evidence for a 2-factor structure of RRB symptoms in ASD, the 2-subscale configuration reflecting the 2-factor structure was utilized. The Motor and Sensory Behaviours subscale is composed of items 1 to 9, which are characteristics of the Repetitive Sensory Motor Behaviours (RSMB) factor established in the research

literature (e.g., Item 8: “Does your child like to look at objects from particular or unusual angles?”). The Rigidity/Routines/Preoccupation with Restricted Interests (RRPRI) subscale is composed of item 11 and items 13 to 19, which denote behaviours that characterize the Insistence on Sameness factor (e.g., Item 15: “Does your child insist that aspects of daily routine must remain the same?”)

Overall, two studies have been conducted on the psychometric properties of the RBQ-2, which have shown it exhibits strong internal consistency for the total scale (α = .85: Leekam et al., 2007; α = .86: Lidstone et al., 2014), the 4-subscale version validated for 2- to 3-year-old children (α = .80 to α = .66; Leekham et al., 2007), and the 2-subscale version validated for 2- to 17-year-old youth (the Motor and Sensory Behaviours subscale was α = .79 and the Rigidity/Routines/Preoccupation with Restricted Interests subscale was α = .83; Lidstone et al., 2014). Both studies indicated the RBQ-2 yielded a good theoretical structure based on factor analyses (Leekam et al., 2007; Lidstone et al., 2014). In the current study, the RBQ demonstrated excellent internal consistency related to the overall scale and sample (α = .92) and for the ASD group (α = .89). However, the internal consistency for overall scale in the non-ASD group was low (α = .28), which may be explained by the small sample size and greater number of items compared to responses (Samuels, 2015). The overall internal consistency for the RSMB (α = .88) and RRPRI subscales were both high (α = .85). Good internal consistency was also demonstrated for both subscales in the ASD group (RSMB α = .88; RRPRI α = .79), but was found to be low for both in the non-ASD group (RSMB α = .39; RRPRI α = .36) due to the very small sample size (Samuels, 2015).

Procedures

The present research study received approval from the University of Windsor's Research Ethics Board (REB) prior to conducting data collection. The measures were transferred into an online survey format using Qualtrics. To distribute the survey, a wide variety of organizations both related to ASD (e.g., Autism Canada) and more generally to parents (e.g., Toronto Family Network) were contacted for permission to send the survey link, survey information, and recruitment material for the purposes of posting these materials on their website and/or sending the survey information to their members. Once permission was obtained from the organization, the investigator requested the organization post and/or distribute online advertisements about the survey to members/subscribers who were parents of children within the target age range and study inclusion criteria. Parents were able to access the survey through an electronic link that redirected them to the survey web domain. The study survey link was embedded in these advertisements. In addition, parents were encouraged to share the survey link with other parents in their local peer network.

When the participants accessed the survey link, they were redirected to the Qualtrics platform. First, they were presented with a consent form outlining the research, the requirements of the survey, confidentiality, and the compensation opportunity should they choose to participate. After the participants provided their informed consent, they were presented with the screening portion of the Demographics Questionnaire to determine their eligibility to participate in the remainder of the study. If the respondent satisfied inclusion criteria, they were presented with the rest of the Demographic Questionnaire, followed by the CAST, RBQ-2, Go4KIDDS Adaptive

Function Scale, Media Use Patterns Survey, and, finally, the Generalized Parental Mediation Questionnaire. At the end of their participation, the respondents were presented with a debriefing page that briefly summarized the research project and gave the participant a final opportunity to withdraw their data from the study.

Incentive. For the purposes of the current study, the parents were offered the opportunity to be a part of a draw for one of twenty Amazon, Starbucks, or Walmart e-gift cards valued at $10 Canadian. The draw winners were decided at the end of data collection. To select the winners, the researcher conducted a draw in two phases. First, the random number function on SPSS 26 was used to assign random numbers to each participant ID. Then, 20 numbers were selected randomly using the Random.org online tool and matched to the corresponding participant number. These individuals received their e-gift cards via the email addresses the provided at the end of the survey.

Survey security. Several protective procedures were used in the construction and dissemination of the online survey to guard against potential invalid responding by electronic and human sources. These recommendations were based on previous research conducted on fraudulent responding (Teitcher et al., 2015). In the current study, the draw was selected to de-incentivize "fraudsters" due to the lack of immediate reward. There was also a restriction to one response per computer/phone IP address to counteract potential multiple responding that may arise to increase the probability of winning the lottery-style compensation. Although not included in Teitcher and colleague's (2015) recommendations, the compensation information was embedded into all recruitment material as an image to decrease potential fraudsters' ability to readily find this information using electronic search functions that are coded to target keywords

and/or phrases related to monetary incentives on websites. Finally, CAPTCHA was used at the beginning of the survey and response-time data analysis at the end of the study were incorporated into the current study to determine the likelihood of robot (i.e., "bot") responses. CAPTCHA bars most bots from accessing and responding to the survey; however, these can be hacked in rare cases (Teitcher et al., 2015). Therefore, examining response times for extremely fast survey completion times prior to data analysis was conducted to ensure bot responses were not have missed by the CAPTCHA (Teitcher et al., 2015). No exceedingly fast times were found amongst the completed data.

CHAPTER 4

RESULTS

Outline

This chapter will be organized as follows: (1) descriptions of the basic characteristics of the raw data set to orient the reader to the variables of interest; (2) an account of missing data decisions and procedures; (3) an outline of the data cleaning methods; (4) summaries of hypothesis testing; and (5) summaries of the exploratory analyses. These subsections provide the framework for a comprehensive description of the statistical methods employed in the current study and the subsequent findings.

Data Characteristics

The variables of interest within the current study are those included in the five main hypotheses: (1) Child age; (2) total reported frequency of classic restricted repetitive behaviours (RRBs); (3) total reported frequency of media restricted repetitive behaviours (media RRBs); (4) scores of adaptive functioning; and (5) the number of digital literacy skills displayed by the child. Variables potentially related to the variables of interest or those that would be explored in secondary analyses were also identified. For example, the children's number of comorbid diagnoses was considered to be a potential covariate for primary variables such as adaptive function (e.g., Rao & Landa, 2014; Rodriguez, Bruce, Pagano, & Keller, 2005; Storch et al., 2016). See Table 2 for descriptive statistics.

To establish which preliminary and corrective analyses to use, frequency distributions of each of the relevant study variables were examined for both the ASD and non-ASD groups. As traditional visual displays of distribution (e.g., histograms) can be misleading or inconclusive when sample sizes are small (Weissgerber, Milic,

Winham, & Garovic, 2015), deference was given to normality tests to determine the nature of the data's distribution. In this case, the Shapiro-Wilk test was chosen, as this normality statistic has been shown to be more accurate in small samples (Mendes & Pala, 2003; Pituch & Stevens, 2016; Ruxton, Wilkinson, & Neuhauser, 2015). In the ASD group, Shapiro-Wilk values ranged from .78 to .98 (*ps* from <.001 to .92) and indicated that 11 of the 17 variables under consideration exhibited non-normal distributions. In contrast, many of the variables in the non-ASD group had normal distributions. In the non-ASD group, Shapiro-Wilk values ranged from .54 to .98 (*ps* from <.001 to .96) and indicated 7 of the 17 variables examined showed non-normal distributions. No corrections such as transformations were undertaken at this stage given the likelihood that missing data procedures would need to be employed later.

Bivariate correlations were run with the variables of interest and a variety of auxiliary variables. These correlations were important for establishing construct validity for primary variables such as the prevalence of media RRBs, as well as for making decisions about missing data models and identifying potential covariates. As the distributions of the primary and auxiliary variables were a mixture of normal and non-normal, a combination of Pearson's Product-Moment and Spearman's Rho coefficients were generated. In this case, Spearman's Rho was reported when one or both variables had non-normal distributions, as it has been shown to be robust to these departures from typical parametric assumptions (Abdullah, 1990; deWinter, Gosling, & Potter, 2016). In comparison, the Pearson Product-Moment coefficients was used only if both variable distributions were normal. These correlations are displayed in Tables 3 and 4.

Missing Data

An investigation of missing data was conducted prior to assessing the data for outliers as recommended by Tabachnik and Fidell (2007). Overall, approximately 5% of the data were missing. Although the overall proportion of missing data was considered to be within an acceptable level, proceeding with conventional methods of addressing these missing responses (i.e., listwise deletion) would have resulted in the loss significant proportions of data in every analysis. In some cases, as many as 27% of cases in the non-ASD group would be eliminated on certain primary variables and as many as 50% on exploratory variables. Ultimately, variables with large proportions of missingness were eliminated as described in further detail in subsequent sections; however, corrective procedures were pursued as certain variables of interest still exhibited missingness that would result in the elimination of as many as 11% of cases in the total sample. As the sample size was small, steps were taken to preserve as much of the sample, and the subsequent power of statistical tests, as possible. Therefore, the nature of the missing data needed to be determined in order to select an appropriate method for preserving these cases.

Enders (2010) has recommended that various levels of investigation should be adopted to assess the extent and potential mechanisms of missingness (i.e., missing completely at random [MCAR]; missing at random [MAR]; or missing not at random [MNAR]) present in the data. All relevant study variables, including auxiliary variables, were included in these analyses. Little's MCAR test was non-significant, $\chi^2(4075, N = 36) = 3426.57$, $p = 1.00$, which indicated that the missingness was completely at random. However, there are times when data sets have multiple missingness

Table 2

Descriptive Statistics of Main Study Variables

Measure	ASD (*n* = 25)				Non-ASD (*n* = 11)			
	M	*SD*	Min	Max	*M*	*SD*	Min	Max
Symptoms of ASD	18.63[a]	4.48	10	27	3.18	2.09	0	7
Number of restricted repetitive behaviours	35.83[b]	8.37	21	51	23.70[c]	2.31	21	29
Number of repetitive motor and sensory behaviours	15.35[b]	4.86	9	25	10.50[c]	1.43	9	14
Routines and rigid behaviour	16.17[a]	3.83	9	23	10.64	1.69	8	14
Adaptive function	28.08[a]	6.95	12	36	36.73	3.52	29	40
Media restricted repetitive behaviour	89.84	22.09	63	140	52.20[c]	10.99	36	70
Media repetitive motor and sensory behaviours	18.84	11.47	8	44	8.18	0.41	8	9
Media routines and rigid behaviours	55.36	13.53	32	83	32.50[c]	6.93	22	42
Household media devices	9.92	4.53	3	20	7.91	3.42	4	15
Child-owned media devices	1.96	1.40	0	7	1.27	1.19	0	4
Number of digital media skills	15.40	13.79	2	56	18.82	16.67	4	52

Note. [a] *n* = 24 due to missing data. [b] *n* = 23 due to missing data. [c] *n* = 10 due to missing data.

mechanisms present for different variables of interest (Enders, 2013). Thus, further investigation of the missingness was undertaken.

Unfortunately, MAR and MNAR mechanisms are not able to be tested with specific statistics as the distribution of the values that missing is inherently unknowable (e.g., Enders, 2010), but indirect methods can be employed to formulate an educated guess about which mechanism may be present within the data. Both visual inspection of missing data patterns and the use of individual *t*-tests comparing response and non-response on variables of interest were used to gain an understanding of potential missingness mechanisms for the data (Enders, 2010). Variables exhibiting a 5% minimum proportion of missing values were recoded into groups of those with complete data and those with missing data for each variable. These groups were then used to assess mean differences on other variables to see if they could account for systematic patterns of missingness. These *t*-tests yielded consistent patterns of significance that indicated there were systematic differences in means between questions about media content and participant characteristic variables such as the respondent's age and the child's age (*t*-values ranged from 0.1 to -6.4, *ps* ranged from .008 to .92).

Visual inspection indicated systematic patterns of missingness were present among the media content and devices questions. In some cases, the missingness on these questions was as much as 50%. Several explanations could account for these non-responses: (1) Content of the questions were not applicable to the children being described (e.g., skipping questions about audio content, as this was not in their child's behavioural repertoire or content preference); (2) fatigue from answering subsequent questions; (3) complexity of the drop-down and text-box entry interfaces, which has been indicated in previous survey methodology research (e.g., Healey, 2007; Heerwegh & Loosveldt, 2002); (4) some latent factor related to child or

Table 3

Combined Pearson and Spearman Correlation Table of Primary and Auxilary Variables for the non-ASD Group (n = 11)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Parent age		-	-.357	.150	**.705***	.539	.083	-.444	**-.613***	.453	-.422	-.319	.063	.272	-.427	-.381	**.697***	.208	.546
2. Parent gender	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Number of parent diagnoses	-.204	-		-.359	-0.43	-.226	-.069	.404	.175	-.237	.593	.221	**.701***	**.710***	.430	**.775****	.087	-.102	-.309
4. Education level	.257	-	-.249		-.193	-.410	.452	-.274	-.386	.066	-.303	-.226	-.234	.021	-.200	-.183	-.102	**-.664***	-.236
5. Household income	**.659***	-	-.252	-.277		.580	-.116	-.528	-.146	.435	-.444	-.154	-.237	-.377	-.525	-.407	.426	.367	.458
6. Child age	.594	-	-.274	-.247	**.776****		.273	-.315	.016	.447	-.288	-.306	.025	-.107	-.365	-.087	.354	**.769****	**.957****
7. Child gender	.030	-	-.069	**.611***	-.033	.126		-.334	-.164	.230	-.354	-.600	-.181	.092	-.356	-.017	-.269	-.015	.365
8. Number of child diagnoses	-.498	-	.428	-.421	-.573	-.405	-.355		.478	**-.886***	.420	.287	.374	.231	**.938****	.487	-.123	-.236	-.301
9. Symptoms of ASD	**-.641***	-	.182	**-.682***	-.078	-.095	-.251	.537		-.495	.420	.520	.021	.352	.549	.508	-.333	.018	-.036
10. Adaptive function	.409	-	0	.059	.484	.506	.060	**-.682***	-.367		-.392	-.329	-.086	-.165	**-.874***	-.376	.214	.329	.409
11. Number of restricted repetitive	-.520	-	**.638***	-.514	-.244	-.418	-.326	.454	.363	-.081		**.855****	**.679***	**.689***	**.638***	.610	.231	-.081	-.245
12. Number of repetitive motor and	-.339	-	.073	-.627	.047	-.300	**-.745***	.268	.508	-.084	**.673***		.319	.449	.551	.361	.207	-.155	-.294
13. Routines and rigid behaviours	-.042	-	**.733***	-.345	-.207	-.037	-.182	.528	.102	.126	**.694***	.153		**.684***	.399	**.694***	.600	-.095	.058
14. Media restricted repetitive behaviours	-.302	-	**.731***	-.177	-.291	-.208	.114	.320	.306	-.025	**.667***	.168	**.673***		.350	**.940****	.296	-.153	-.051
15. Media repetitive motor and sensory	-.490	-	.430	-.401	-.569	-.432	-.356	**.995****	.547	**-.679***	.488	.320	.530	.348		.532	-.059	-.321	-.336
16. Media routines and rigid behaviours	-.296	-	**.733***	-.362	-.285	-.164	-.076	.512	.436	-.185	.589	.191	**.706***	**.948****	.524		.197	-.096	-.074
17. Household media devices	**.681***	-	.059	-.275	.490	.423	-.333	.021	-.285	.193	.198	.214	.464	.116	.038	.163		.228	.407
18. Child-owned media devices	.187	-	-.271	-.281	.447	**.703***	.094	-.324	-.065	.305	-.019	-.053	-.166	-.108	-.350	-.131	.214		**.708***
19. Number of digital media skills	.219	-	-.261	-.280	.443	**.770****	.210	-.278	-.043	.434	.012	-.099	.130	.085	-.300	.034	.375	**.841****	

Note. ASD = Autism Spectrum Disorder; Pearson Product-Moment Coefficients are above the diagonal and Spearman's Rho Coefficients are below the diagonal. All bolded values indicate statistical significance.

* $p < .05$. ** $p < .01$.

Table 4

Combined Pearson and Spearman Correlation Table of Primary and Auxilary Variables for the ASD Group (n = 25)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Parent age		.039	.069	.004	.153	**.627****	-.196	.276	**.432***	.168	.326	.279	.326	.373	.183	.363	.095	.193	.221
2. Parent gender	.010		.144	.152	-.079	-.029	.202	-.011	.198	.107	.214	.075	.268	-.086	-.088	-.119	.271	**.439***	.329
3. Number of parent diagnoses	.056	.232		.058	-.092	-.155	.138	.163	.096	.265	.149	.112	.169	.241	.203	.085	-.057	.238	.086
4. Education level	-.082	.146	.011		**.512****	**-.470***	.365	-.100	.001	-.091	-.188	-.107	-.145	.025	.031	.087	-.128	-.321	-.277
5. Household income	.045	-.157	-.249	**.520****		-.061	-.178	-.250	.219	.039	-.018	.055	-.060	.033	.061	.009	.173	-.197	-.019
6. Child age	**.666****	-.073	-.054	**-.449***	-.073		**-.434***	.280	.247	.235	-.003	-.015	.010	.001	-.112	.014	.278	.325	**.499***
7. Child gender	-.292	.202	.155	.371	-.170	**-.503***		.102	.020	-.056	.302	.273	.224	.260	.242	.355	-.090	.230	.033
8. Number of child diagnoses	.321	-.011	.321	-.060	-.311	.253	.101		**.501***	-.103	.100	-.086	.336	.175	-.028	.281	-.332	.263	.188
9. Symptoms of ASD	.340	.131	.234	-.049	.131	.214		0	**.484***		-.323	**.660****	**.525***	**.595****	**.585****	**.467***	**.566****	-.015	.249	.101
10. Adaptive function	.161	.131	.134	-.092	-.012	.243	.026	-.039	-.265		-.141	-.184	-.047	-.308	-.365	-.355	.251	.115	**.460***
11. Number of restricted repetitive	.192	.198	.218	-.233	-.068	-.070	.299	.095	**.710****	-.072		**.844****	**.809****	**.664****	**.577****	**.608****	.189	.396	.128
12. Number of repetitive motor and	.103	.035	.133	-.178	0.057	.014	.181	-.083	**.604****	-.049	**.836****		.384	**.750****	**.823****	**.549****	.200	.292	.219
13. Routines and rigid behaviours	.234	.241	.273	-.158	-.106	-.114	.200	.315	**.610****	-.095	**.815****	**.446***		.372	.154	**.482***	.091	.353	.007
14. Media restricted repetitive behaviours	.308	-.041	.232	.103	-.008	.0670	.208	.240	**.666****	-.238	**.621****	**.570****	.379		**.869****	**.892****	-.152	.090	-.047
15. Media repetitive motor and sensory	.056	.051	.145	.067	-.001	-.003	.167	-.042	**.475***	-.139	**.502***	**.740****	.076	**.675****		**.620****	-.045	.039	.025
16. Media routines and rigid behaviours	.226	-.113	.146	.048	-.076	.033	.339	.351	**.605****	-.191	**.611****	**.452***	**.505***	**.899****	**.423***		-.258	.089	-.155
17. Household media devices	.080	.196	-.211	-.165	.255	.227	-.138	**-.446***	-.116	.385	.064	.110	-.040	-.200	-.010	-.240		**.532****	**.566****
18. Child-owned media devices	.004	.110	.261	**-.466***	-.243	.261	.204	.157	.237	.041	.348	.305	.199	.170	.193	.211	.373		**.690****
19. Number of digital media skills	.280	.072	.098	-.368	-.100	**.541****	-.137	.072	.056	**.491***	.038	.231	-.237	.024	.289	-.046	**.421***	**.414***	

Note. ASD = Autism Spectrum Disorder; Pearson Product-Moment Coefficients are above the diagonal and Spearman's Rho Coefficients are below the diagonal. All bolded values indicate statistical significance.

* $p < .05$. ** $p < .01$.

respondent characteristics that was not readily identifiable; and (5) some combination of all four possibilities. There was some evidence for factors 1, 2, and 3. For example, visual inspection of the data indicated a proportion of parents did not report their child having any preferences for audio media content (e.g., music, podcasts) when they did not rank their child as being skilled with music players, which provided some support for factor 1. In addition, although the questionnaire had since been simplified, fatigue and question complexity were frequently reported in the initial piloting of the survey. Therefore, there appears to be some combination of question and participant characteristics impacting the responses to these questions.

Given the likelihood that some of the questions themselves were likely contributing to missingness in combination with participant characteristics, the data were assumed to be MNAR, to be conservative. As these data were likely influenced by systematic non-response, it was also probable that the missingness on the Generalized Technology Mediation Questionnaire (GTMQ), which followed the media content and device questions in the survey order, was also impacted by the factors that resulted in this non-random missingness (Enders, 2010). Furthermore, the quality of the responses following the systematic non-response was likely reduced and the validity questionable. Therefore, the media content and device questions and the GTMQ were not subjected to statistical testing, given the high likelihood of bias and error. As these items formed the basis for the variables central to Hypothesis 6, this hypothesis was unable to be tested given the current data.

The remainder of the survey questions were examined again with the above mentioned questions removed. Re-analysing the survey questions presented before the media content and device questions was possible given the standardized order of the items in the survey. Little's MCAR test was non-significant, $\chi^2(493, N = 36) = 0.00$, $p = 1.00$. As the remaining variables

displayed proportions of missingness that were approximately 3% (i.e., $n = 1$), *t*-tests could not be calculated between variables to test differences in response/non-response rates. Visual inspection of the patterns of missingness indicated that the small number of missing patterns were arbitrary in nature. Following the recommendations of Osborne (2013) and examples of the explorations of missingness (e.g., Collins, Schafer, & Kam, 2001), missingness was turned into a variable of interest by dummy coding the primary study variables into response/non-response dichotomies, in which non-response was set equal to 1 and responses were set to 0 (Osborne, 2016). Unfortunately, the rate of missingness and the small sample size were not conducive to conducting logistic regressions to determine if a particular characteristic could predict non-response (Osborne, 2016). Thus, correlations with bootstrapping were conducted to investigate potentially meaningful associations of various factors to non-response.

Correlations were run between various study variables (e.g., child age, child gender) and dichotomized missing/not missing response characteristics for each of the primary variables to determine if there may have been potential child or respondent characteristics that might relate to the non-response. There were no significant correlations among characteristics of respondents or children and missing values on primary variables (e.g., total parent-reported media RRBs). The absence of patterns of statistically significant patterns associated with missingness decreased the likelihood that a potential latent factor was driving missingness (i.e., a characteristic of MNAR); thus, further support was provided to indicate the remaining data were, at the very least, MAR. Overall, the non-significant Little's MCAR test and arbitrary nature of the missing data patterns provided support that the remaining missingness was likely MAR.

Addressing missingness. Missing data needed to be processed in some manner prior to proceeding with the main statistical analyses. Given the likely MAR mechanism, conventional

corrective measures such as listwise deletion would have produced biased parameters for subsequent statistical tests (e.g., Enders, 2010). In addition, a method such as listwise deletion would result in the loss of 4 cases or nearly 11% of the total sample. The loss of these cases in an already small sample would result in a further reduction of statistical power in the analyses and likely increase the potential for bias in the parameters of the test statistics used (e.g., Enders, 2010; McNeish, 2017). Therefore, methods such as Maximum Likelihood Estimation and Multiple Imputation were considered instead. The performance of these methods in small sample sizes was reviewed to determine the optimal method for the current study. Maximum Likelihood Estimation has been found to introduce bias into test parameters under small sample size conditions, whereas Multiple Imputation performs reasonably well (e.g., Barnes, Lindborg, & Seaman Jr., 2006). Multiple Imputation was selected to address missingness in the current study.

Multiple imputation. Multiple imputation rests on three major assumptions (Collins et al., 2001; Enders, 2010; Horton & Lipsitz, 2001). First, the data must be MAR. Second, the variables included must meet multivariate normality. Finally, the imputation model must be specified to include variables and relationships that will be analysed, and the subsequent analyses must not involve variables and relationships not included in the imputation model (Collins et al., 2001; Schafer, 1999).

As the data were likely MAR, the first assumption of multiple imputation was satisfied. Multivariate normality was unlikely as univariate normality, a requirement of the multivariate normal condition (Looney, 1995), was violated by a variety of study variables. Typically, it has been suggested that transformations should be applied to fit the data to this assumption; however, this corrective measure suffers from barriers to the interpretation of subsequent statistical findings and the introduction of bias into test statistics (e.g., Lee & Carlin, 2016; von Hippel,

2013). In actuality, multiple imputation has recently been found to be robust to violations of the normality assumption depending on the type of algorithm selected to impute the missing data points (e.g., Lee & Carlin, 2016). Therefore, the Predictive Mean Matching algorithm was applied to correct for potential non-normality because it has the additional benefit of also performing relatively well in small samples (Barnes et al., 2006). The final assumption regarding the imputation and analysis models will be described in greater detail below.

Imputation model. The choice of imputation model is important, as discrepancies between the imputation models and analysis models can result in biases within statistical tests (Collins et al., 2001; Enders, 2010; Nguyen, Carlin, & Lee, 2017). For instance, an imputation model that does not include interactions that will be included the subsequent analysis will likely be inaccurate. Generally, either a restrictive or an inclusive imputation model can be selected (Nguyen et al., 2017). A restrictive model will endeavour to include the smallest number of variables possible whereas an inclusive imputation model attempts to maximize the available information that can be used for imputation by including as many auxiliary variables as possible. Inclusive models have generally been found to be a better approach (Enders, 2010; Collins et al., 2001). Indeed, when variables associated with missingness are included in the imputation model, the accuracy of the subsequent statistical parameters can be improved (Enders, 2010). Thus, an inclusive strategy for variable selection was used to construct the imputation model for the present study.

The convergence of the imputation model, (i.e., the extent that the statistical parameters of interest stabilize across iterations; Raghunathan, 2016) can be impacted by the number of variables included. That is, including too many variables in the imputation model may cause convergence failure or distorted parameters (Azur, Stuart, Frangakis, & Leaf, 2011; Enders,

2010). In order to avoid problems with the stability of statistical parameters during imputation, Enders (2010) recommended that the number of variables should not exceed the number of cases (i.e., the sample size) in the dataset. Therefore, the number of variables included in the current study imputation model cannot exceed 36.

Optimally, the imputation method would account for missingness by adopting an item-by-item imputation strategy in order to capture the most information about missingness present in the data set within the imputation model (Gottschall, West, & Enders, 2012), rather than discarding available data to treat an entire scale sum as missing for a case containing a limited proportion of non-responses. However, the restrictions of the model size meant that item-level variables could not be used for imputation, as this would result in a model that included over 80 item-level variables in addition to potential auxiliary variables. Rather, scale totals were used to reduce the size of the imputation model and prevent convergence problems. Scale totals are still able to be used without introducing additional bias into the imputation models; however, it is acknowledged that, given an adequately large sample size, an item-by item level would enable more information to be included in the imputation model, thereby enhancing the power of the imputation statistics (Gottschall et al., 2012).

In order to decide what variables to include in the imputation model, the three-part recommendations of Collins and colleagues (2001) were used. First, variables correlated with missingness and the primary outcome variables were identified. In this case, no variables were significantly associated with missingness on primary outcome variables. Next, variables correlated with the outcome measures, but not missingness, were identified. These variables were child age, respondent educational achievement, number of days per week spent with the child, number of respondent diagnoses, and number of comorbid diagnoses for children

diagnosed with ASD. Finally, variables that did not appear to be correlates, but provided contextual information were identified. It is important to note that the inclusion of these apparently unrelated variables does not bias the imputation model and these variables may account for a parameter or set of parameters for inter-variable relationships that were not considered initially (Collins et al., 2001). These auxiliary variables were approximate household income and the total score on the Child Autism Spectrum Test (CAST).

In addition to three main types of variable considerations proposed by Collins and colleagues (2001), variables that were of interest within exploratory analyses also needed to be included. These variables were the two subscale totals of the overall media RRB scale (i.e., the media Repetitive Motor/Sensory Behaviours subscale and media Rigidity/Routines/Preoccupations/Restricted Interests subscale), the number of household and personal media devices, and three variables measuring the frequency, intensity, and duration of distress reported when media restricted repetitive behaviours were interrupted. The final imputation model included 21 variables.

Imputation phase. There are several steps involved in multiple imputation. As multiple imputation necessarily generates different numbers every time it is conducted, thereby reducing the possibility of reproduction by others, a fixed seed number of 950 was provided to allow statistical reproducibility (as recommended by Heymans & Eekhout, 2019). The 21 variables were inputted into the multiple imputation model and the Predictive Mean Matching procedure was selected. Finally, the number of iterations for the imputations was selected. Generally, it has been recommended that the number of iterations should be equal to or exceed 40 (Graham, Olchowski, & Gilreath, 2007). Using larger numbers of iterations requires more computing time, but does not introduce bias or power problems (Graham et al., 2007). Therefore, 50 iterations, as

proposed by Heymans and Eekhout (2019), was selected in order to ensure adequate stability of the imputation model parameters.

Once the imputed datasets were generated, the convergence of the imputed data was assessed through examination of means and standard deviations among the original and new datasets (Heymans & Eekhout, 2019). These statistics were plotted graphically to determine convergence trends. However, due to the large numbers of iterations, only a selection of the imputations was investigated for convergence. All variables that were selected for visual inspection demonstrated adequate convergence across iterations. Therefore, the pooled variance across each of the 50 data sets was used for subsequent statistical testing procedures.

Data Processing

Following multiple imputation and prior to conducting inferential statistics, the study variables needed to be assessed for outliers and the extent to which they met statistical assumptions (Tabachnik & Fidell, 2007). Both *t*-tests of group means, as well as regression analyses, were proposed for the current data analysis. Tabachnik and Fidell (2007) recommends univariate outliers should be assessed first, followed by multivariate diagnostics, if applicable. All data processing was conducted on the imputed data as these pooled datasets would serve as the basis for all inferential testing.

Outliers. The data were explored for potential outliers that could influence mean comparison and regression statistics conducted for hypothesis testing. Univariate outliers were identified on relevant variables (i.e., child age, total classical restricted repetitive behaviours, adaptive function, media restricted repetitive behaviours, and number of digital literacy skills) for both the ASD and non-ASD groups. The *z*-score method using extreme value cut-offs of $z = \pm 3$ (Bakker & Wicherts, 2014; Cousineau & Chartier, 2010) was selected to identify these

outliers. *Z*-scores were derived from the raw data values for mean comparisons and *z*-scores based on externalized residuals were used for regressions (Cohen et al., 2003). Index plots of externalized residuals were also visually inspected to provide additional information related to the extremeness of the value relative to the other data points for potential regression outliers (Cohen et al., 2003).

Additional outlier detection methods were used based on the proposed regression analyses to identify extreme values for predictor variables and potential influential outliers. Mahalanobis Distance statistics with a conservative *p*-value of .001, a more robust cut-off for these diagnostic metrics (Leys, Klein, Dominicy, & Ley, 2013), were applied to the predictor variables. Finally, influential outliers were identified using standard cut-off of values greater than ± 1 for DFFIT and DFBETA statistics calculated for each model (Cohen et al., 2003). Once these cases were identified, residual plots of the standardized predicted and standardized residuals were visually inspected to determine whether the outlier was exerting leverage (Cohen et al., 2003).

Assumptions. Data characteristics were examined to determine whether the assumptions of mean comparison and regression statistics were met. The *t*-test is a parametric test that assumes that the data are normally distributed, homoscedastic, and that the groups/variances are roughly equal (de Winter, 2013). Assumptions were checked for the first proposed *t*-test comparing total reported media RRBs between ASD and non-ASD groups. The assumption of homoscedasticity was met by the data for both groups. However, the assumptions of normality and equal groups/variances was violated. That is, total reported media RRBs was non-normal for the ASD, but not for the non-ASD group, and the group size/variances were equal (i.e., both approximately 2:1).

Assumptions were checked for the second proposed *t*-test comparing the frequency distribution of the overall number of digital literacy skills exhibited by the children in the ASD and non-ASD groups. The assumption of homoscedasticity was met. In addition, although the group sizes were different, the variance ratio did not exceed 2:1 the assumption of equal groups/variances could be considered met. The digital literacy skills data were non-normal for both the ASD and non-ASD groups. Thus the assumption of normality related to the distribution of digital literacy skills data was not met.

The following assumptions of regression were assessed: 1) IVs and DVs share linear relations with one another; 2) normally distributed residuals; 3) homoscedastic residuals; 4) independent residuals; 5) correctly specified models; 6) the absence of multicollinearity and singularity (Cohen et al., 2003; Tabachnik & Fidell, 2007). No non-linear associations were found in bivariate scatterplots of the various combinations of the variables for each group (i.e., ASD and non-ASD): child age, total classical RRBs, adaptive function, media restricted repetitive behaviours, and number of digital literacy behaviours.

The assumption of normality was assessed for both univariate and multivariate residuals across regression models (Looney, 1995; Pituch & Stevens, 2016). Shapiro-Wilk normality statistics indicated that univariate residual distributions among the various model variables appeared to be normally distributed with the exception of the multiple regression model for child age, adaptive function, and total parent-reported frequencies of media RRB in the ASD group, which demonstrated non-normal positive skew. As univariate normality is necessary but not sufficient for determining multivariate normality (Looney, 1995; Pituch & Stevens, 2016), multivariate tests of normality were also conducted for each model's set of residuals using DeCarlo's SPSS macro (Decarlo, 1997). Small's omnibus test was interpreted to determine the

overall multivariate normality of the data (Romeu & Ozturk, 1993). Multivariate normality was demonstrated for all regression models with the exception of two regression models in the ASD group involving age, adaptive function, total parent-reported frequencies of media RRB and number of digital literacy skills.

Homoscedasticity was also assessed through graphical plots of predicted and residual values associated with each regression model (e.g., Astivia & Zumbo, 2019; Cohen et al., 2003). Systematic patterns of association (i.e., clustering in certain directions) was suggested for the residuals associated with the child age, adaptive function, and total media RRB frequency model in the ASD group, but all other models appeared to satisfy the assumption of homoscedasticity.

The assumption of independent observations was assumed have been met based on the design of the study. Namely, each respondent was only allowed to report on one child. Therefore, the fourth assumption was met because the data and the residuals can be considered independent.

The assumption of model specification refers to entering the correct variables and variable associations into the model to accurately capture the associations of interest in the multiple regressions (Cohen et al., 2003). The sample size requirements needed to achieve adequate power for more comprehensive regression models exceeded the size of the current study sample (e.g., Pituch & Stevens, 2016); therefore, simplified models that did not include more than two predictors were used to explore the associations of interest. Although assumption five was likely not met as all potentially relevant variables were unable to be included in the models, the current regression analyses will still provide preliminary data on important associations among the variables of interest.

Finally, assumption six was evaluated through the assessment of variable correlations and multicollinearity diagnostic statistics (i.e., Tolerance and Conditioning Index; Tabachnik & Fidell, 2007). Bivariate correlations were scanned for values over $r = .9$ among the variables of interest in the regression models. No correlation values were above the $r = .9$ threshold. In addition, multicollinearity statistics were conducted for each model as an additional check. Statistics were scanned for Tolerance values below .10 and Conditioning Index values below above 30 (Tabachnik & Fidell, 2007). As Tolerance values and the Conditioning Index values were not available for the pooled imputed regression data set in SPSS, each imputation was examined to get a sense of the range of values. All models exhibited Conditioning Index values of approximately 10 and Tolerance values from .94 to .96. Therefore, the models did not have issues with multicollinearity.

Overall, the data indicated there were no problems related to linear relations among variables or multicollinearity/singularities; however, there were mixed degrees of concern related to violations of multivariate normality, heteroscedasticity, and model specification.

Corrective procedures. As some of the parametric assumptions of the *t*-test were violated and outliers were present, there was a risk of inflated Type 1 error for the test statistic (Wilcox, 2017). In this case, transformation was not used, as it can be problematic for interpretation of the data (Tabachnik & Fidell, 2007). Instead, the robust Welch's *F* statistic was chosen to replace the independent samples *t*-test for the current analyses. The Welch's *F* correction is able to account for outliers, non-normality, and unequal variance ratios (Bakker & Wisherts, 2014; Cribbie, Fiksenbaum, Keselman, & Wilcox, 2012). Therefore, the Welch's *F* was used to account for the data characteristics of the primary variables better than the independent samples *t*-test.

Alternative and corrective statistical procedures were considered to address the violations of regression assumptions present in the current data. Transformations were not undertaken as they severely limit the interpretability of the data (Tabachnik & Fidell, 2007). Given both lack of robust alternative statistics on SPSS and small sample sizes, standard multiple regression analyses were conducted instead as these were the best statistics available. The regression models were analyzed with regression outliers left in and with outliers eliminated based on various methods described by Aguinis, Gottfredson, and Joo (2013) to account for potential impacts on the models and statistical parameters. The model utilized will be reported on a test-by-test basis.

Hypothesis Testing

Hypothesis 1: Comparison of media RRB frequencies between ASD and non-ASD groups. Hypothesis 1 was tested using a Welch's *F*-test, comparing the mean frequency of parent-reported media restricted repetitive behaviours (media RRBs) of the ASD and non-ASD groups. This analysis was conducted on the multiply imputed data sets; however, SPSS was not able to create a pooled estimate of variance so each imputation iteration was scanned for patterns of statistically significant values to provide information about the stability of the imputation findings across iterations. Of the 50 imputed data sets, 100% reached statistical significance for the Welch's *F*-test comparisons. In this case, imputed data set 50 was selected to report the test statistics given the convergence on the posterior distribution achieved through progressive imputation iterations, which yielded $F(1, 29) = 31.98$, $p < .001$, *est.* $\omega^2 = .46$. These findings suggested that children in the ASD group were reported by parents to have exhibited greater frequencies of media RRBs ($M = 89.84$, $SD = 22.09$) than what was reportedly observed by

parents for the non-ASD group (M = 55.09, SD = 14.17) and that 46% of the variance attributed to the frequency of media RRBs was explained by the diagnostic group.

Hypothesis 2: RRB as a predictor of media RRB in the ASD sample. Hypothesis 2 posited that greater numbers of classic RRBs would predict greater numbers of media RRBs. This proposed association was tested using hierarchical multiple regression in the ASD sample. Child age was entered as a covariate in the first step due to previous research that indicated RRB are expressed differently as children age (e.g., Evans, 1997; Richler, 2010). Total summed scores for the parent-reported frequency of RRBs that have traditionally been observed and associated with ASD symptomology were positioned as the predictor variable in the next step. Total summed scores for parent-reported frequencies of media RRBs were used as the outcome variable.

Overall, child age, on its own, did not explain a statistically significant amount of variance within the sample, $F(1, 23) = <.001$, $p = .99$, $R^2 <.001$, $R^2_{adjusted} = -.04$, $f^2 <.001$. Entering the total classical RRB score resulted in a statistically significant change to the model, $F(1, 22) = 16.03$, $p = 001$. The final model explained a statistically significant amount of the variance within the sample, $F(2, 22) = 8.15$ $p = .002$, $R^2 = .43$, $R^2_{adjusted} = .37$, $f^2 = .75$. The total classical RRB score reported by parents was a statistically significant predictor of parent-reported media RRBs, $\beta = .65$, $t = 4.00$, $p = .001$. In contrast, child's age was not a significant predictor, $\beta = .03$, $t = .16$, $p = .88$. The final model explained 43% of the variance within the sample, which was equivalent to a moderate effect. These findings indicated that higher total parent-reported frequencies of classical RRBs were associated with higher total parent-reported frequencies of media RRBs, independent of child age.

Hypothesis 3: Child Age as a predictor of media RRBs in the non-ASD sample.

Hypothesis 3 predicted that child age would be associated with fewer parent-reported media RRBs in the non-ASD sample, whereas there should not be a significant association between these variables for the ASD group. Child age was already tested and found to not predict parent-reported media RRBs in the previous regression model conducted on the ASD sample; therefore, the remaining part of Hypothesis 3 was tested using a simple regression conducted on the non-ASD sample. Child age was the predictor variable and the parent-reported frequency of media RRBs was the outcome variable. The regression did not explain a statistically significant amount of the sample variance, $F(1, 9) = .39$, $p = .55$, $R^2 = .04$, $R^2_{\text{adjusted}} = -.07$, $f^2 = .04$. Child age was not a statistically significant predictor of parent-reported media RRBs based on the pooled imputed data, $\beta = -.20$, $t = -.62$, $p = .55$. These findings indicated that, although older children were reported to exhibit fewer media RRBs by their parents, the association between child age and parent-reported media RRBs was statistically non-significant for non-ASD children.

Hypothesis 4: Adaptive Function as a predictor of media RRBs and number of media devices in ASD and non-ASD groups. Hypothesis 4 was split into three parts. In part A, lower scores on adaptive function were hypothesized to predict higher frequencies of parent-reported media RRB, regardless of group. Part B stated that the magnitude of the association would be greater in the ASD compared to non-ASD group. Finally, part C posited that lower levels of adaptive function would predict lower numbers of personal media devices.

Hypothesis 4a was tested using a hierarchical multiple regression. Child age was entered into the model first as a covariate. Adaptive function was the predictor and the parent-reported total frequency of media RRBs was the outcome variable. In this analysis, the regression analyses included the outliers, as this model preserved statistical power and the outliers did not

exhibit strong influence over the regression parameters for both regressions conducted on the ASD and non-ASD samples.

In the ASD sample, overall, child age on its own did not account for a significant amount of variance in parent-reported media RRBs, $F(1, 23) < .001$, $p = .99$, $R^2 < .001$, $R^2_{adjusted} = -.04$, $f^2 < .001$. Entering the adaptive function score did not result in a statistically significant change to the model, $F(1, 22) = .52$, $p = .48$. In addition, the final model did not explain a statistically significant amount of the sample variance, $F(2, 22) = .26$, $p = .78$, $R^2 = .02$, $R^2_{adjusted} = -.07$, $f^2 = .02$. Neither child age ($\beta = .03$, $t = -.15$, $p = .88$) nor adaptive function ($\beta = -.15$, $t = -.72$, $p = .48$) were statistically significant predictors of parent-reported media RRBs. These findings indicated that 2% of the sample variance was explained by the model, which was consistent with a small effect. Although higher adaptive function scores were associated with lower reported numbers of media RRBs by parents, after accounting for child age as a covariate in the ASD sample, this association was non-significant. In addition, the general degree of association between these two variables, when holding child age constant, was small, $r_p = -.15$.

In the non-ASD sample, overall, child age on its own did not account for a significant amount of variance in parent-reported media RRBs, $F(1, 9) = .39$, $p = .55$, $R^2 = .04$, $R^2_{adjusted} = -.19$, $f^2 = .04$. Entering the adaptive function score did not result in a statistically significant change to the model, $F(1, 8) = .06$, $p = .81$, and the final model did not explain a statistically significant amount of the sample variance, $F(2, 8) = .20$, $p = .82$, $R^2 = .05$, $R^2_{adjusted} = -.19$, $f^2 = .05$. Neither child age ($\beta = -.16$, $t = -.41$, $p = .69$) nor adaptive function ($\beta = -.10$, $t = -.25$, $p = .81$) were statistically significant predictors of parent-reported media RRBs based on imputed data. Although lower adaptive function scores were associated with higher reported frequencies of media RRBs by parents after accounting for child age in the non-ASD group, this relation was

small and non-significant. In addition, the general degree of association between these two variables when holding child age constant was also small, r_p = -.11.

Hypothesis 4c was tested using a hierarchical multiple regression with the data of the ASD sample. Child age was entered into the model first as a covariate. Adaptive function scores were the predictor, and the child's number of personal devices was the outcome variable. In this case, the regression analyses with the outliers maintained reported, as the identified outliers did not appear to exhibit strong influences over the associations between adaptive function and the number of personal devices.

Overall, child age on its own did not account for a significant amount of variance within the ASD sample, $F(1, 23) = 2.72$, $p = .11$, $R^2 = .11$, $R^2_{adjusted} = .07$, $f^2 = .12$. Entering the adaptive function score did not result in a statistically significant change to the model, $F(1, 22) = <.001$, $p = .99$ and the final regression model did not explain a statistically significant amount of the sample variance, $F(2, 21) = 1.30$, $p = .29$, $R^2 = .11$, $R^2_{adjusted} = .02$, $f^2 = .12$. Neither child age ($\beta = .33$, $t = 1.58$, $p = .11$) nor adaptive function ($\beta = -.001$, $t = -.006$, $p = .99$) were statistically significant predictors of the reported number of the personal media devices used by children diagnosed with ASD, based on the imputed data. These findings indicated that 11% of the sample variance was explained by the model, which was consistent with a small effect. Although these findings indicated older children were reported to have more personal devices and lower adaptive function predicted greater numbers of personal devices, both these predicted associations were small and not statistically significant. In addition, the general association between higher adaptive function and the lower numbers of personal devices when child age was held constant, was very small, r_p = -.001. Similarly, the general association between older child

age and greater number of personal devices used when adaptive function was held constant was small, r_p = .32.

Hypothesis 5: Comparisons of sub-types of media RRBs in the ASD sample by lower and higher adaptive function scores. Hypothesis 5 predicted that parent-reported frequencies of lower-order media RRBs would be greater for children with lower adaptive functioning scores and parent-reported higher-order media RRBs would be greater for children with higher adaptive functioning scores within the ASD group. Hypothesis 5 was tested by conducting two Welch's *F*-tests to compare mean differences on sum totals of media RRB subscales for Repetitive Sensory and Motor Behaviours (i.e., lower-order RRBs) and Insistence on Sameness (i.e., higher-order RRBs) between children with lower adaptive function scores and higher adaptive function scores in the ASD sample.

In the first analysis, parent-reported frequencies of Repetitive Sensory and Motor Behaviours were compared between the low and high functioning groups using a Welch's *F*-test. None of the Welch's *F*-tests were statistically significant among the 50 imputed data sets. An example of a typical *F*-test drawn from imputation 50 yielded, $F(1, 20.23) = .92$, $p = .35$, . $\omega^2 = 0.003$.

In the second analysis, parent-reported frequencies of RRB consistent with Insistence on Sameness were compared between the lower and higher adaptive functioning groups, also using a Welch's *F*-test. In this case, 38% of these Welch's *F*-tests were statistically significant among the 50 imputed data sets. An example of a typical *F*-test drawn from a significant imputation yielded, $F(1, 18.49) = 7.15$, $p = .015$, *est.* $\omega^2 = .20$. These findings suggested that the frequencies of media use behaviour characterized by Insistence on Sameness were reportedly greater in the group with lower adaptive function scores ($M = 62.17$, $SD = 14.44$), compared to the group with

higher adaptive functioning (M = 49.08, SD = 9.26). In contrast, a typical F-test drawn from a non-significant imputation yielded, $F(1, 2.94) = 20.32$, $p = .10$, *est.* $\omega^2 = 0.07$, which indicated that there were no differences between the behaviours reported by parents in either group (Low: M = 60.45, SD = 13.81; High: M = 51.36, SD = 12.33).

The primary difference between the two sets of findings appeared to be related to the imputation of values for adaptive functioning. That is, in cases where the imputed adaptive function score resulted in the child being classified in the higher functioning group, there were non-significant differences between the groups. However, if the child's reported adaptive function score placed them in the lower functioning group then there was a significant difference indicating greater reported frequencies of higher-order media RRBs by parents for the lower functioning group. These statistical findings must be interpreted with caution as they suggest that the imputed data for adaptive functioning are driving group differences in the current sample, which may indicate that findings are not generalizable.

Exploratory Analyses

The purpose of this section was to investigate potential patterns within the data on media activities, types of content accessed, time spent engaged in media activities, and other relevant media behaviours not considered in the primary analyses. These potential patterns may contribute to a burgeoning understanding of media use in ASD populations. The analyses undertaken in this section were guided by the research question: To what extent do children diagnosed with ASD exhibit distinct patterns of media use across various media platforms? To address this question, all descriptive and exploratory analyses were conducted without the use of imputation for two reasons: (1) imputation of types of media content accessed and media devices used would have been arbitrary and likely would have resulted in inaccuracies (e.g., imputing

use of home streaming device as the most used media device when the family does not own this type of device); and (2) as the exploratory analyses were driven by the data (i.e., a bottom-up approach), specification of an imputation model that accounted for primary and auxiliary variables was not practical . Therefore, all exploratory analyses were conducted using the non-imputed original data.

Activity description. There were eight general activities engaged in without media devices (e.g., playing with others outside, reading, chores) and four general media use activities (e.g., accessing audio-visual media, doing school work with a media device) surveyed in the current study. Similar to the ordinal-to-ratio scale conversion procedure used by MacMullin and colleagues (2016), the hours reported for each activity were estimated from the ranges reported from the associated ordinal Likert-type scales. These estimates were created by taking the mid-point value of each range and using this numerical value to create a ratio scale (e.g., one hour intervals typically ranging from 0 to 5 hours). For example, converting the Likert range 7 = *4.5 to 5.5 hours* to 5 hours, or the Likert range 5 = *2.5 to 3.5 hours* to 3 hours.

In both groups, parents reported that a large percentage of their children's time spent engaged in activities outside of school day were spent sleeping (ASD = 41%; non-ASD = 42%). Examining daytime activities outside of the school setting and excluding the time devoted to sleep, the ASD group was reported to spend the highest percentage of hours devoted to audio-visual media use (22%), compared to other activities. In contrast, the non-ASD group was reported to spend the highest proportion of their average day playing with others indoors without media use (17%). Indeed, the two groups differed in the overall proportion of hours they reportedly spent engaged in various types of media use (ASD = 36%; non-ASD = 16%). Parents in both groups reported that the second highest proportion of daily activity hours were spent

playing alone indoors without media (ASD = 14%; non-ASD = 17%), and that the third highest proportion of daily activity hours were spent playing with others outside (ASD = 13%; non-ASD = 17%). Because these were the most common activities, they were compared to determine if there were statistically significant differences.

These common activities could be categorized into three types of non-school activities (i.e., social play without media, non-social play without media, and media activity). Potential differences in the amounts of time children were reported to devote between types of play without media and media activities were explored for the ASD and non-ASD groups. Given the non-normal distribution and heterogeneity of variance of these variables, Welch's corrected one-way ANOVAs were conducted for each group. In the ASD group, the average time spent engaged in general media use activities reported by parents was not found to be statistically different from the reported times spent in social or non-social play without media devices, Welch's $F(2, 44.02) = 1.30$, $p = .28$, *est.* $\omega^2 = .004$. However, there were parent-reported differences in the time spent between media use and social and non-social playtime without media for the non-ASD group, Welch's $F(2, 17.29) = 4.99$, $p = .02$, *est.* $\omega^2 = .11$. Post-Hoc testing using the Games-Howell pairwise comparison (a robust statistic when heterogeneity is present within the data; Shingala & Rajyaguru, 2015) yielded differences between time spent engaged in media use and time spent engaged in social play without media devices. In this case, parents of in the non-ASD indicated their children spent more time playing with others than using media, $M_{diff} = 1.93$, $p = .02$, 95% Bca CI [.26, 3.60].

Time comparison. To examine the time spent engaged in media use between ASD and non-ASD groups, data were drawn from parent responses to a question assessing ranges of time spent in media on an average day. These ordinal Likert-type scale time ranges were also

converted to a ratio scale by taking the median of the time ranges (procedure described in analyses above). Statistically significant differences in the parent observations were shown between the ASD and non-ASD groups, Welch's $F(1, 31.87) = 5.14$, $p = .03$, *est.* $\omega^2 = .14$. On average, children diagnosed with ASD were reported to have spent a greater number of hours per day engaged in media use ($M = 3.68$, $SD = 2.35$) than did children without an ASD diagnosis ($M = 2.27$, $SD = 1.27$).

Time spent using Assistive Technology (AT) was also examined in the non-ASD and ASD groups. As expected, the majority of children in the non-ASD group were reported to not use any AT (91%) by their parents. Indeed, only one child was said to use AT in the non-ASD group, and the time spent engaged with AT was minimal (i.e., less than 30 minutes). Overall, a majority of children diagnosed with ASD were reported to not use AT (68%). The remaining 32% of parents in the ASD sample indicated their child exhibited varying degrees of AT use, but these proportions seemed to be divided into low and high amounts of time. That is, 20% of the total sample of children in the ASD group reportedly spent between less than 1.5 hours engaged in its use. Twelve percent of the total ASD sample reportedly spent between 4.5 or more hours engaged in AT use.

Further exploration of the parent-reported allocation of time spent engaged in AT in relation to lower and higher adaptive function scores within the ASD group children yielded different trends. Namely, more than half of children in the ASD group with lower adaptive functioning scores were reported to have spent some amount of time using ATs (54%) by their parents. Of the children that were reportedly using ATs in the group with lower adaptive functioning scores by their parents, three groups of equal proportions emerged related to the time spent engaged in AT: (1) children who used AT for less than 30 minutes (18%); (2) children who

used AT between 0.5 to 1.5 hours (18%); and (3) children who used AT for longer than 6 hours (18%). The remaining proportion of children in the ASD group with lower adaptive functioning were reported by their parents to not use any ATs (46%). In contrast, all but one of children in the ASD group with high adaptive functioning scores were not parent-reported spending any time using ATs (92 %).

Media content frequencies. The current study survey included a variety of questions meant to assess the types of media content parents reportedly observed their children accessing over the past month (e.g., TV cartoons, Youtube videos, etc.), the devices used to access this content (e.g., Smartphones, Tablets), and their apparent preferences for certain types of content compared to others. The extent of exploratory analyses that could be conducted on the data generated from the survey's questions about media content was limited due to systematic and extensive missing data. There were a few questions with minimal missing data (maximum of 2 cases, which represented 18% missing for the group composed of parents in the non-ASD group and a maximum of 4 cases which represented 16% missing for the group of parents in the ASD group.

Within the questions assessing the types of content accessed by the children, two broad patterns emerged. First, across various media platforms -- such as TV, videos, and pictures – parents reported that cartoons and animations represented the most frequently reported types of content accessed by the children in both groups. These percentages are demonstrated in Figure 1 to 6. The second pattern related to parent observations for audio media content that indicated music was the most frequently reported type of content accessed by the children in both the non-ASD and ASD groups (see Figure 7 and 8).

No reliable information could be gathered about different types of game content across platforms such as traditional consoles, web browsers, or handheld videogame devices, as there were high proportions of missing data. Similarly, information regarding the types of devices used to access audio, visual, and audio-visual content could not be analysed due to high degrees of missingness.

Digital literacy.

Digital literacy skills in children both with and without an ASD diagnosis were investigated for patterns of device-specific skills reported by their parents. Overall, children diagnosed with ASD and children without an ASD diagnosis did not exhibit statistically significant differences between the overall parent-reported number of digital literacy skills they were seen to perform, Welch's $F(1, 16.31) = 0.36$, $p = .56$, *est.* $\omega^2 = .02$. Further examination was conducted for the breakdown among parent ratings of the devices they considered to be the top 3 their child was most skilled at using. Analysis of these rankings indicated that for both children with and without ASD, tablets received the most consistent top 3 parent rankings for child device skill, followed by TVs, and, finally, smartphones. These parent rankings appeared to indicate children in both groups were seen to be most skilled with devices that could be considered relatively new technology (e.g., tablets and smartphones).

Parent reports of children's digital skills were explored to determine if there might be differences in skill level for "Traditional" and "New" device types. That is, tablets and smartphones represent relatively new advancements in media technology, compared to TVs and computers. When the parent-reported number of digital skills was compared between these two types of media devices (New versus Traditional), statistically significant differences were discovered within both groups. In the ASD group, the total counts of particular skills (e.g.,

turning devices on/off, adjusting device settings) parents reported their child demonstrated for New media devices (M = 8.80, SD = 6.38) were greater than for Traditional media devices (M = 3.88, SD = 4.74), Welch's $F(1, 44.28) = 9.58$, $p = .003$, $\omega^2 = .26$. Similarly, parents of in the non-ASD group indicated they saw their children exhibit more skill with New (M = 9.81, SD = 6.61) compared to Traditional (M = 4.64, SD = 4.30) media devices, Welch's $F(1, 17.17) = 4.92$, $p = .04$, $\omega^2 = .26$.

In addition, the potential influences of overall time spent engaged in media use, the number of media devices present in the home, and the number of media devices considered the child's for personal use on digital literacy skills were explored. Spearman's rho correlations were used to determine the degree of these potential relationships given the non-normal distributions of certain variables. Given the small sample sizes, bootstrapping was applied to the original data using 2000 iterations (Hesterberg, 2015) to stabilize the coefficients.

Results suggested that for the ASD group, the greater the number of devices present in the home, the greater the overall number of digital skills, $r_s = .42$, $p = .04$, Bca CI 95% [.04, .72]. However, neither the overall amount of time engaged in media use reported by parents (r_s = .08, $p = .72$, Bca CI 95% [-.54, .62]) or the number of personal devices the child was reported to have ($r_s = .08$, $p = .70$, Bca CI 95% [-.40, .50]) yielded statistically significant associations with the number of parent-reported digital skills seen in the children diagnosed with ASD. New media devices (M = 8.80, SD = 6.38) were greater than for Traditional media devices (M = 3.88, SD = 4.74), Welch's $F(1, 44.28) = 9.58$, $p = .003$, $\omega^2 = .26$. Similarly, parents of in the non-ASD group indicated they saw their children exhibit more skill with New (M = 9.81, SD = 6.61) compared to Traditional (M = 4.64, SD = 4.30) media devices, Welch's $F(1, 17.17) = 4.92$, p = .04, $\omega^2 = .26$.

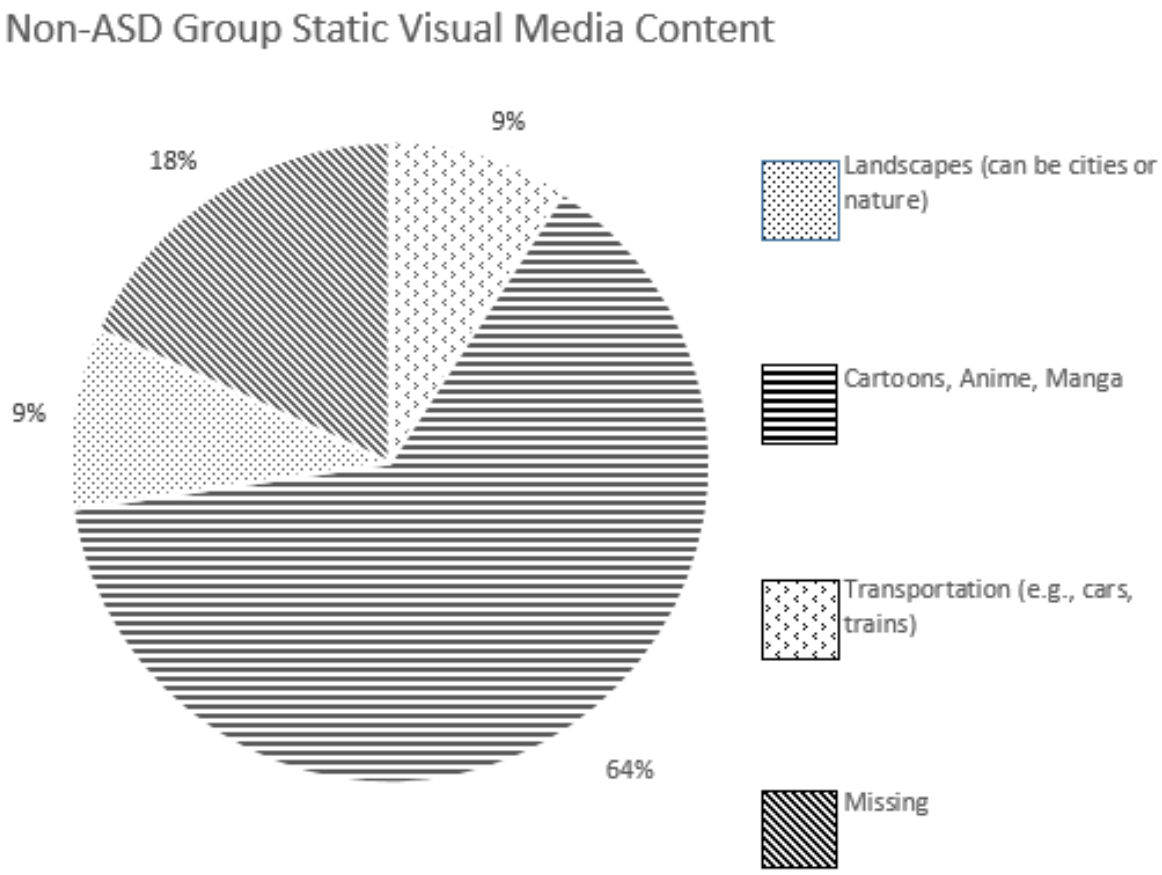

Figure 1. Percentage of respondents that indicated types of static visual media content (e.g., picture, website) their child accessed most often. Due to missing data, $n = 9$.

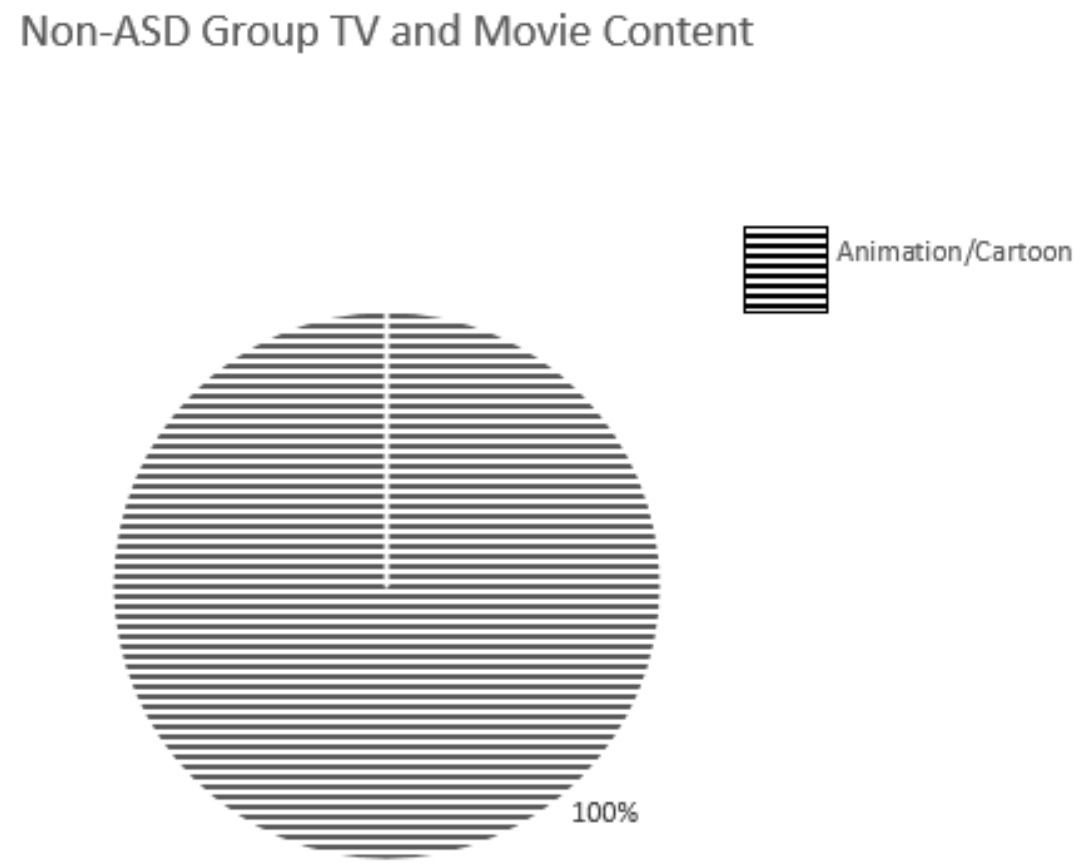

Figure 2. Percentage of respondents that indicated types of TV and movie content their child accessed most often.

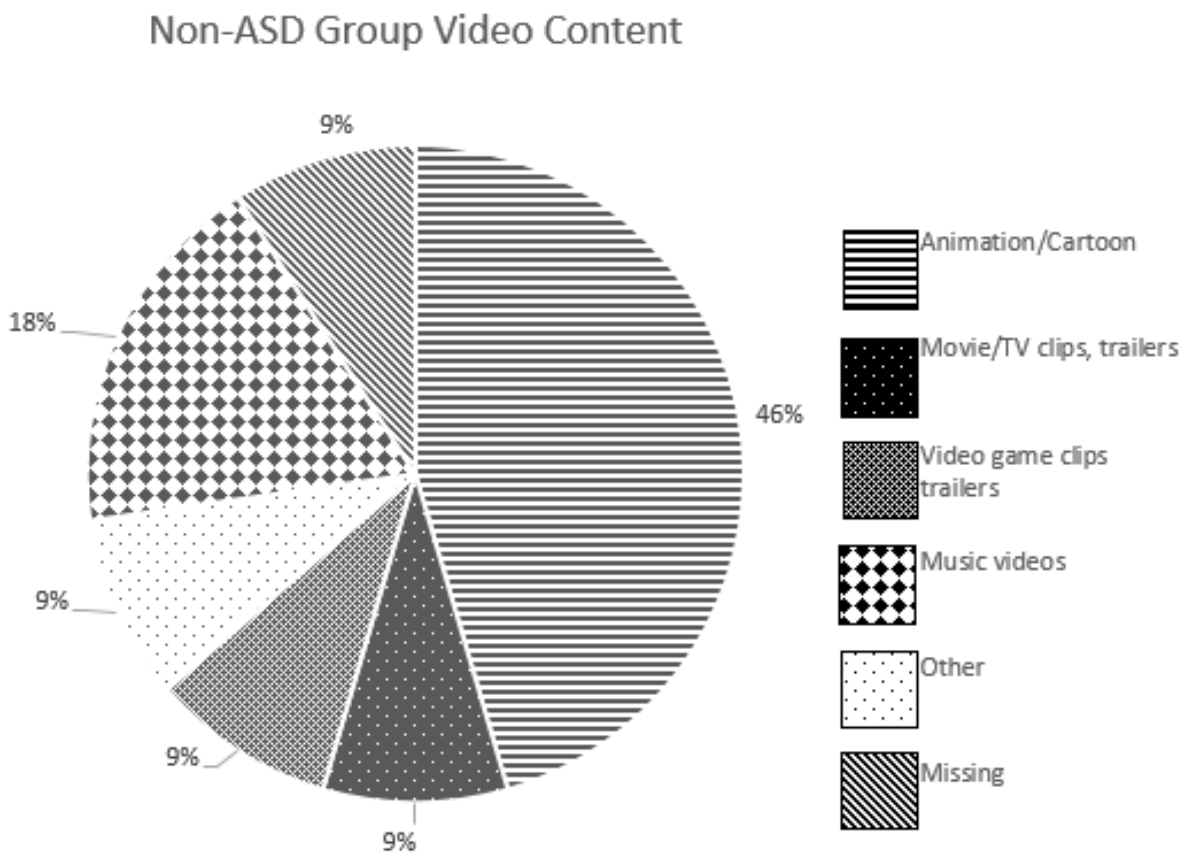

Figure 3. Percentage of respondents that indicated types of video content their child accessed most often. Due to missing data, $n = 10$.

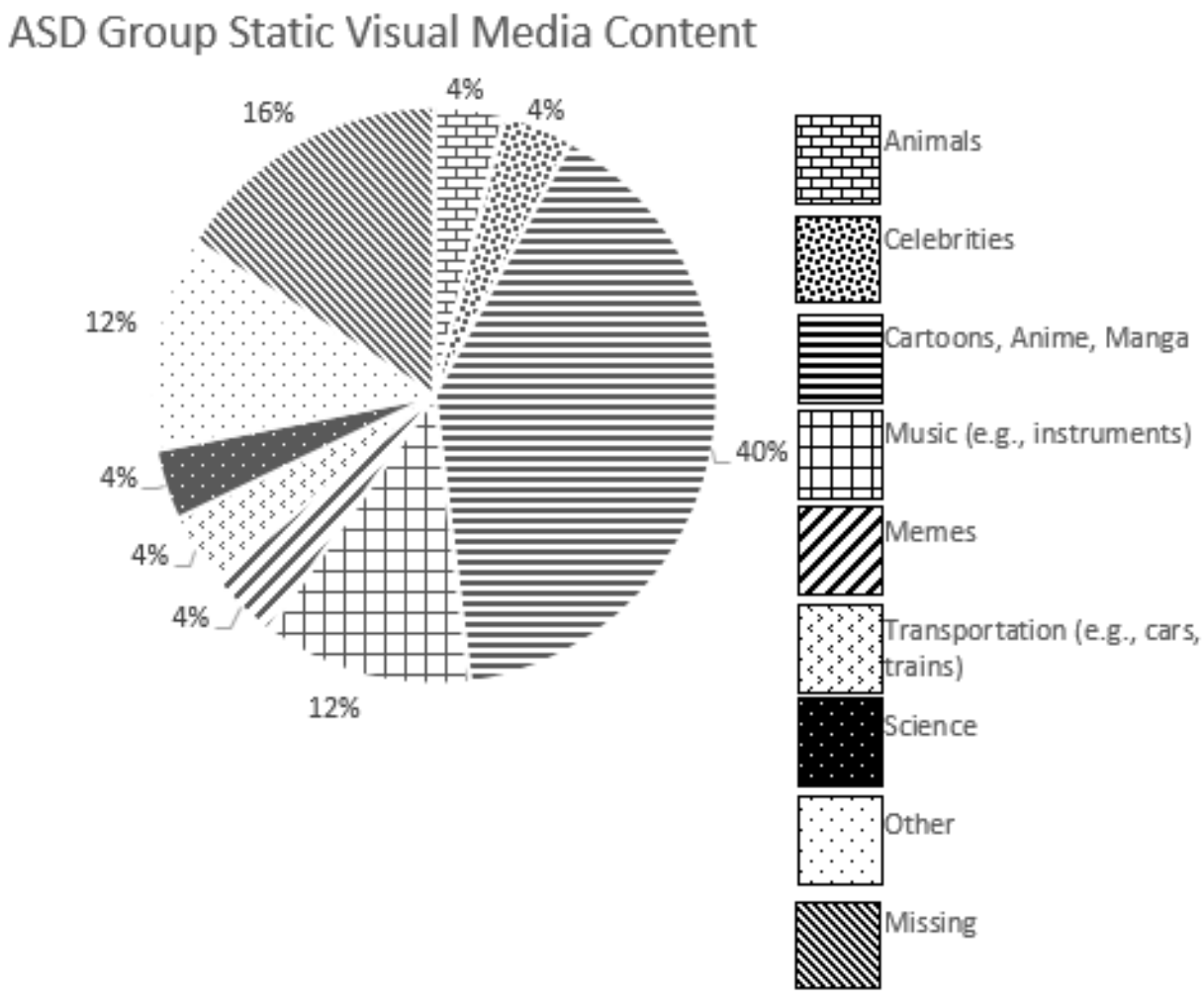

Figure 4. Percentage of respondents that indicated types of static visual media content (e.g., picture, website) their child accessed most often. Due to missing data, $n = 21$.

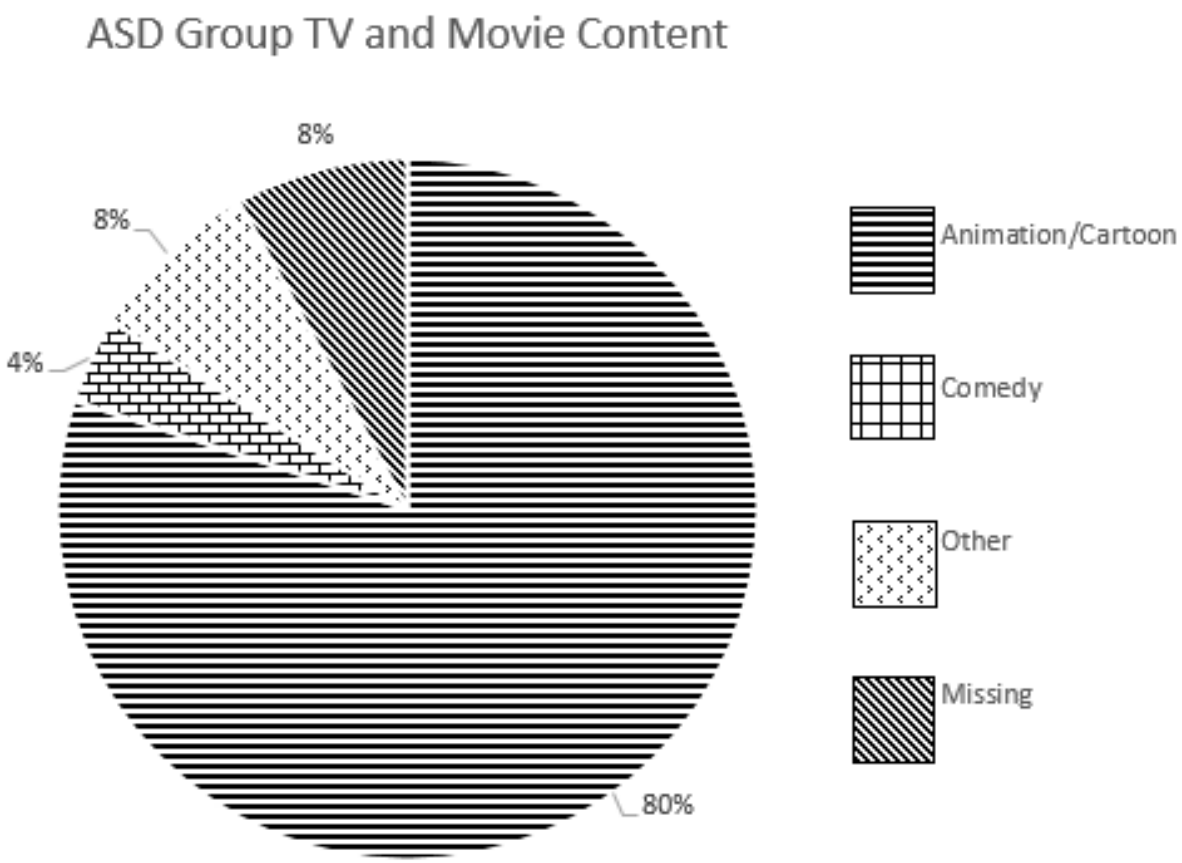

Figure 5. Percentage of respondents that indicated types of TV and movie content their child accessed most often. Due to missing data, $n = 23$.

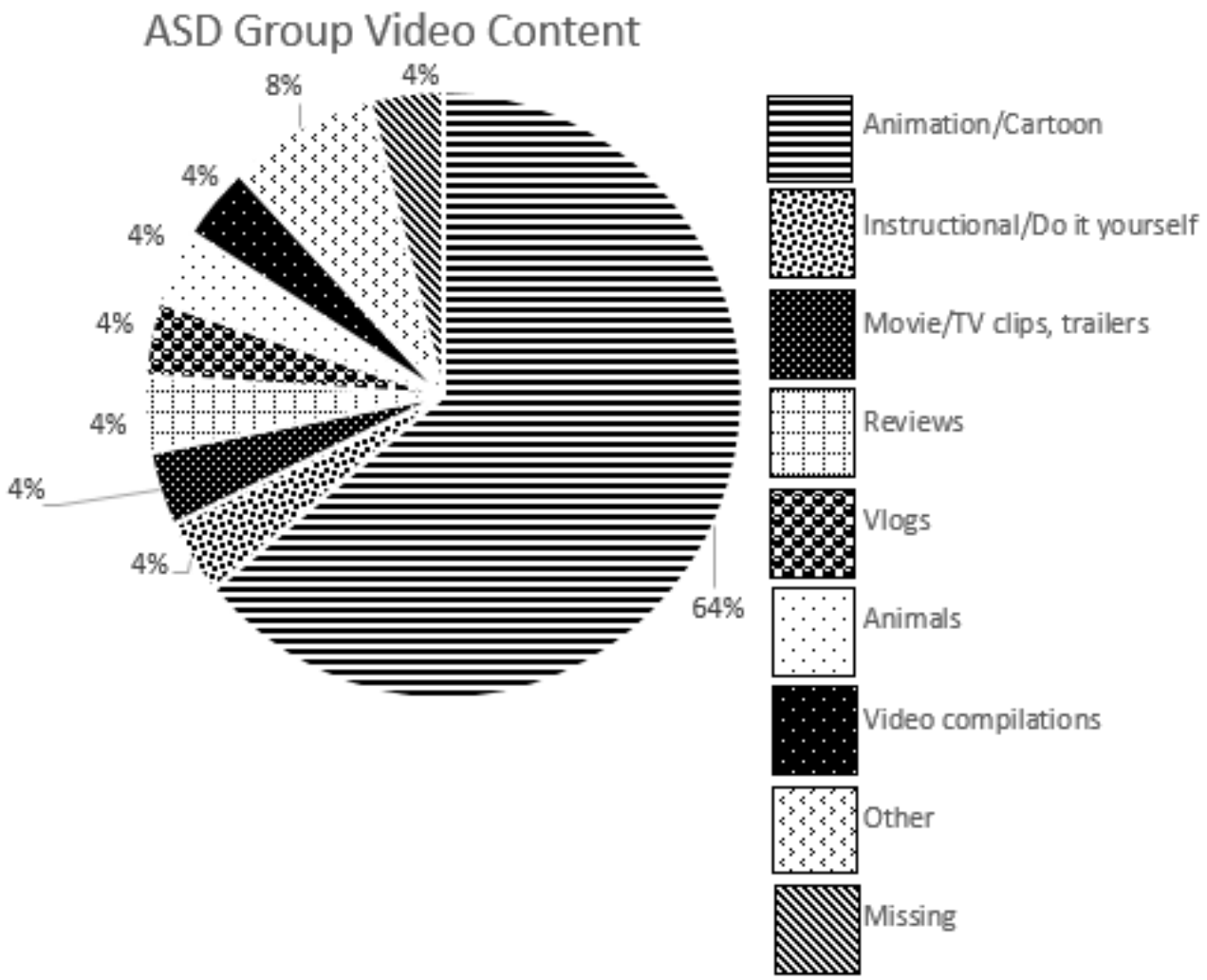

Figure 6. Percentage of respondents that indicated types of video content their child accessed most often. Due to missing data, $n = 24$.

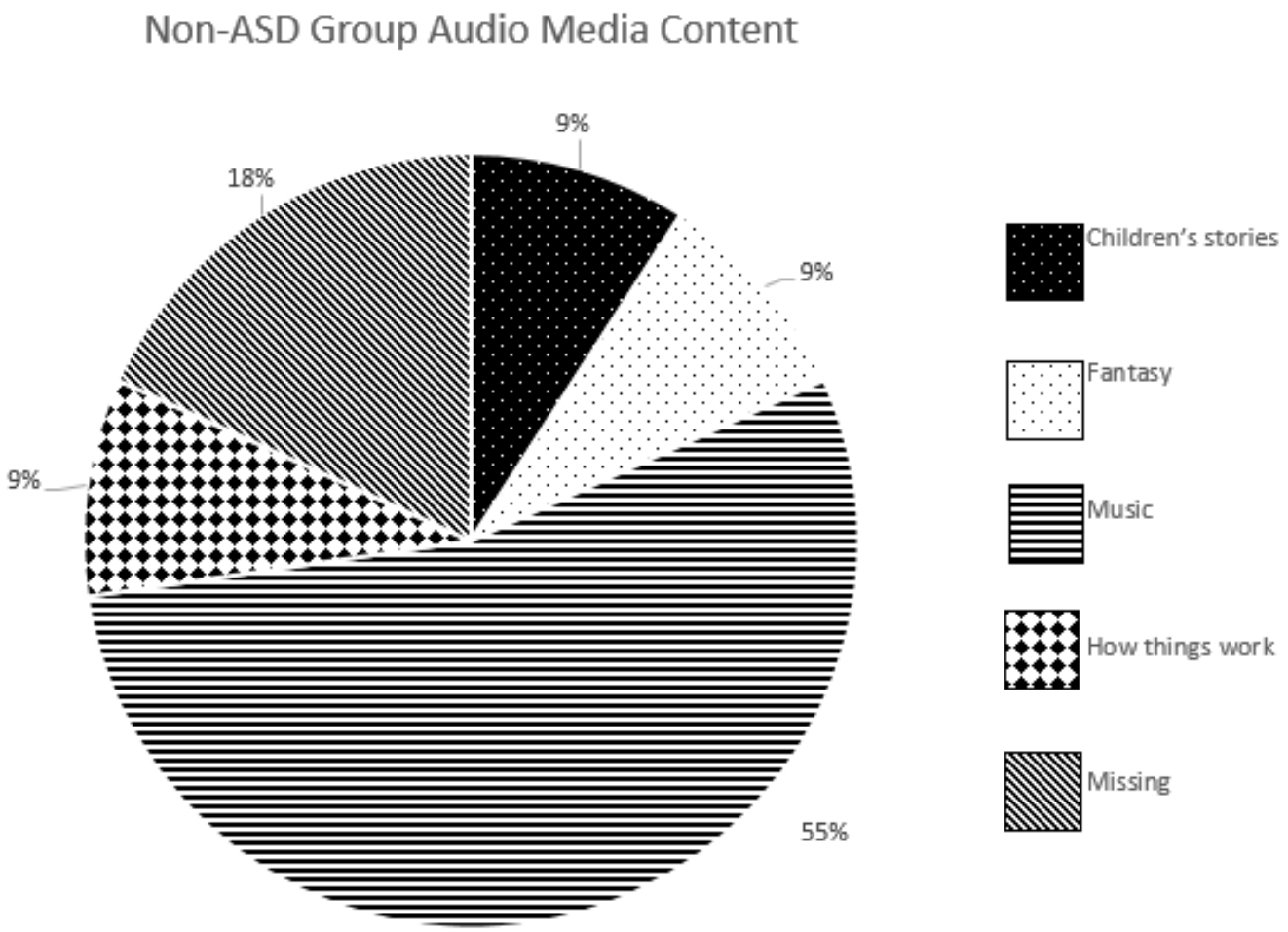

Figure 7. Percentage of respondents that indicated types of audio content their child accessed most often. Due to missing data, $n = 9$.

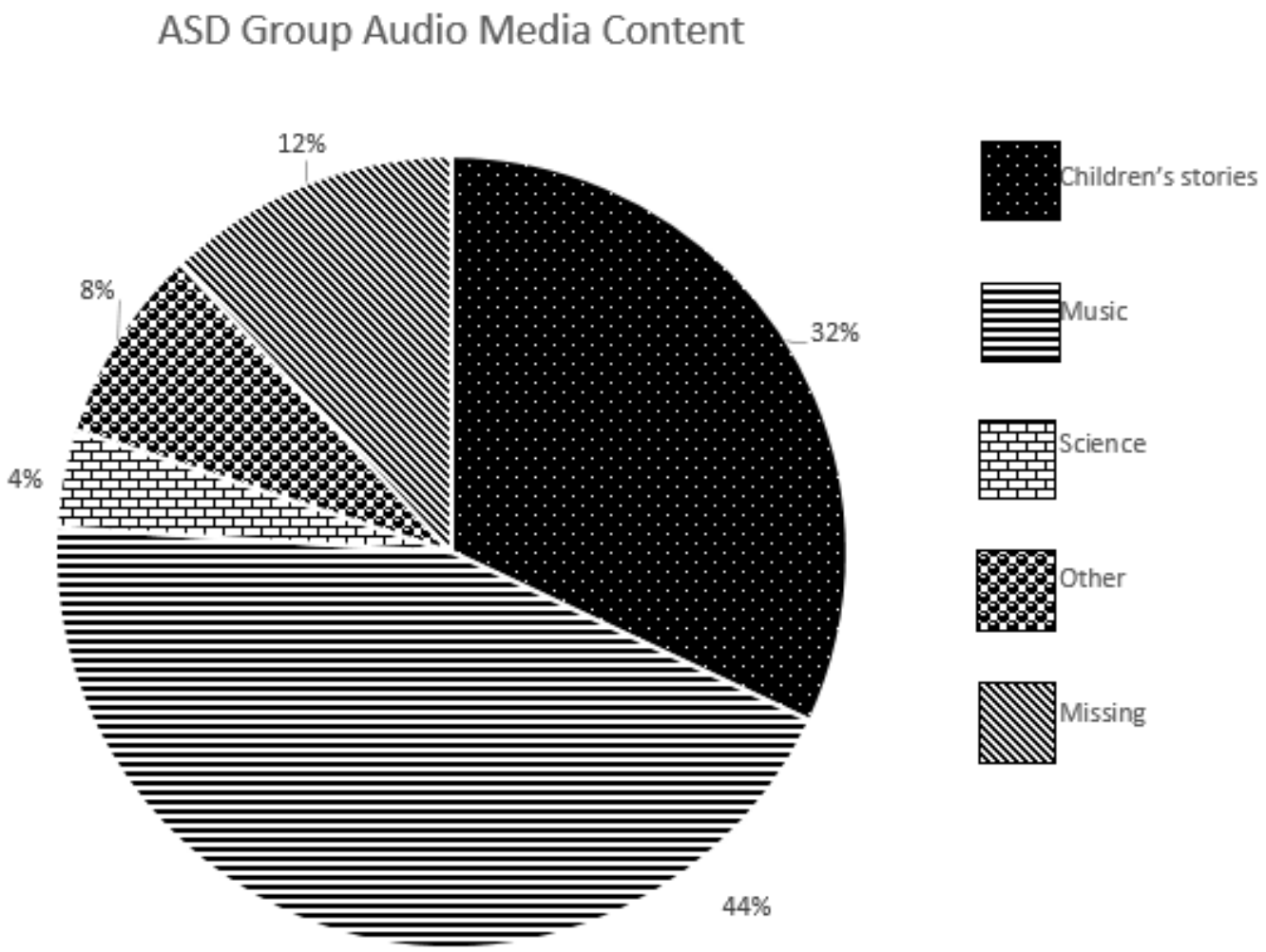

Figure 8. Percentage of respondents that indicated types of audio content their child accessed most often. Due to missing data, $n = 23$.

In addition, the potential influences of overall time spent engaged in media use, the number of media devices present in the home, and the number of media devices considered the child's for personal use on digital literacy skills were explored. Spearman's rho correlations were used to determine the degree of these potential relationships given the non-normal distributions of certain variables. Given the small sample sizes, bootstrapping was applied to the original data using 2000 iterations (Hesterberg, 2015) to stabilize the coefficients.

Results suggested that for the ASD group, the greater the number of devices present in the home, the greater the overall number of digital skills, r_s = .42, p = .04, Bca CI 95% [.04, .72]. However, neither the overall amount of time engaged in media use reported by parents (r_s = .08, p = .72, Bca CI 95% [-.54, .62]) or the number of personal devices the child was reported to have (r_s = .08, p= .70, Bca CI 95% [-.40, .50]) yielded statistically significant associations with the number of parent-reported digital skills seen in the children diagnosed with ASD.

In contrast, the digital literacy skills of children without an ASD diagnosis showed a statistically significant relation with the number of personal devices the child was reported to own, r_s = .84, p = .001 Bca CI 95% [.66, .93]. Notably, the correlations between digital literacy skills and the variables of time spent engaged in media use (r_s = .48, p = .14, Bca CI 95% [-.16, .92]) and the number of devices in the home (r_s = .38, p = .26, Bca CI 95% [-.21, .81]) exhibited moderately sized positive correlation coefficients, but these did not reach statistical significance.

Media behaviours. The frequency, intensity, and duration of distress a child was reported to experience by their parents when the child's access to a preferred media device or type of content was blocked or interrupted was also explored. Statistically significant differences were found for all three measures of parent-reported distress between children diagnosed with ASD and children without an ASD diagnosis using three separate one-way ANOVAs. Namely,

the frequency of distress reported by parents over the past month, the parent' subjective rating of the intensity of the child's distress, and the amount of time in hours the child was said to have been distressed were all shown to be greater in children diagnosed with ASD compared to non-ASD children (see Table 5).

Further exploration of the parent reports of the frequency, intensity, and duration of child distress that occurred in response to prevented or interrupted media use was conducted to identify potential associations with parent-reported media RRBs. Correlational analyses were conducted using the imputed dataset in the ASD group, as these variables had been addressed in the multiple imputation model. Statistically significant associations were found in the pooled dataset. Namely, greater frequencies of distress (r_s = .55, p = .006), higher intensity levels of distress (r_s = .50, p = .01), and longer durations of distress (r_s = .46, p = .02) were associated with greater numbers of overall parent-reported media RRBs based on the parent reports in the ASD group.

Given the apparent connection between rigidity and distress upon interruption of preferred activities, the potential associations between parent observations of media RRBs characterized by insistence on sameness and the three facets of distress were also examined. Greater frequencies of distress (r_s = .62, p = .001), higher intensity levels of distress (r_s = .51, p = .009), and longer durations of distress (r_s = .52, p = .007) were each significantly associated with more media RRBs characterized by insistence on sameness based on the parent reports. Age and adaptive function did not yield statistically significant relations to these types of media distress.

Table 5

Welch's F-Test Statistics for Group Differences in Media-Related Distress

Measure	ASD (n = 25)		non-ASD (n = 11)			
	M	*SD*	*M*	*SD*	W_F *(df)*	*est.* $\omega 2$
Media Interruption: Frequency of Distress	11.92	4.15	7.27	1.62	23.28 (33.77)**	0.38
Media Interruption: Intensity of Distress	11.52	5.69	6.45	1.29	17.71 (29.00)**	0.32
Media Interruption: Duration of Distress	7.76	1.59	6.45	1.29	6.74 (23.39)*	0.14

Note. All subscales were derived from the Media Use Patterns Survey. The statistics in the table were taken from imputation iteration number 50. All significant differences were demonstrated in 100% of the imputation iterations.

*$p < .05$. **$p < .001$.

Table 6

Summary of Results

Hypothesis	Main Findings	Conclusion
1: Children diagnosed with ASD will exhibit higher numbers of media RRBs compared to children without a diagnosis of ASD.	• Parent-reported frequencies of media RRB were greater in children diagnosed with ASD compared to those not diagnosed with ASD.	Supported
2: Greater frequencies of classical RRBs will predict greater frequencies of media RRBs for children diagnosed with ASD.	• After accounting for child age, greater frequencies of classical RRBs were statistically significant predictor of greater frequencies of media RRBs.	Supported
3: Age will not be related to media RRBs for children diagnosed with ASD. Older ages will be associated with lower frequencies of media RRB for children without an ASD diagnosis	• Age was not a significant predictor of the frequencies of media RRBs for the ASD group. • Older age was not a significant predictor of lower frequencies of media RRBs for the non-ASD group.	Partially Supported
4a: Lower levels of adaptive function will be related to greater frequencies of media RRB for both ASD and non-ASD groups.	• Lower levels of adaptive function were not significant predictors of great media RRB frequencies for either groups.	Not Supported
4b: The magnitude of the association between lower adaptive function and media RRBs will be greater for the ASD compared to non-ASD group.	• Not tested given the statistically non-significant difference between adaptive function and media RRB frequencies in either the ASD or non-ASD group. • The standardized beta-weight coefficient for adaptive function was slightly larger in the ASD sample, but the difference between coefficients was very small (i.e., 0.05).	Not Supported

4c (ASD group only): Lower levels of adaptive function will be related to the use of less media devices.	• Lower levels of adaptive function were not statistically significant predictors of lower numbers of child owned devices.	Not Supported
5a (ASD group only): Children with lower adaptive function scores will engage in greater frequencies of lower-order media RRBs. Children with higher adaptive function will engage in greater frequencies of higher-order media RRBs.	• There were no statistically significant differences between adaptive level for lower-order media RRBs. • There were mixed findings of statistically significant mean differences between adaptive level of higher-order media RRBs. However, the differences appeared to be primarily related to imputed values.	Not Supported
6: Parental style of mediating child technology use will influence the association between child age and media RRBs in the non-ASD group, but not for the ASD group.	• Due to systematic missingness related to these questions, this hypothesis was not tested.	N/A

CHAPTER 5

DISCUSSION

Media Behaviours in Children Diagnosed with ASD: A Reflection of Classical RRBs

One of the overarching goals of the present study was to explore the connection between repeated and highly fixated behaviours reported by parents in their children's interactions with media (media RRBs) and the repeated and restricted behaviours that traditionally comprise one of the symptoms of Autism Spectrum Disorder (ASD). In the current study, classical RRBs and media RRBs were found to be closely related in the group of children with ASD diagnoses, such that higher ratings of classical RRBs were related to higher ratings of media RRBs, based on what was reported by parents. This finding supports the idea that media RRBs may actually be a reflection or extension of classical RRBs in the context of media use for children.

RRBs have several other unique characteristics that may be used to examine their similarity to behaviours in media contexts (i.e., media RRBs). First, if these media behaviours are linked to the psychopathology of ASD, then there should be distinct patterns of differences between the children with and without ASD diagnoses. In this study, children diagnosed with ASD were reported by their parents to exhibit more media RRBs than children without an ASD diagnosis. The degree of frequency of classical RRBs has been found to be a defining characteristic for ASD (e.g., Bodfish et al., 2000). Namely, children without ASD have been found to exhibit significantly lower levels of RRBs than children diagnosed with ASD -- a finding mirrored here in parents' reports of their children's media RRBs.

In addition, classical RRBs have been found to follow different trajectories as children develop. RRBs in children with ASD have been found to peak around the age of 3 or 4 and exhibit a relatively stable trajectory across early childhood (e.g., Harrop et al., 2014; Richler et

al., 2010). In contrast, RRBs found in typically developing children peak and then decrease dramatically after the age of 4, across early childhood. In the current study, children with ASD did not exhibit a statistically significant association between their age and frequencies of media RRBs based on their parent's reports, suggesting a pattern of behaviour consistent with the trajectories of classical RRBs demonstrated by children with ASD. Although the non-ASD group also did not demonstrate a significant association between age and media RRBs, based on the reports of their parents, it was in the expected direction that suggested that the frequency of media RRBs was lower for older children. This correlation may not have reached statistical significance due to the small sample size of this group.

Another dimension that was examined was the relation of adaptive function to RRBs. In preliminary research examining classical RRBs demonstrated in ASD samples, individuals with lower adaptive function tended to exhibit both more RRBs in general (Kraper, Kenworthy, Popal, Martin, & Wallace, 2017) and RRBs characterized by simple motor and sensory behaviours (i.e., lower-order RRBs; Szatmari et al., 2006). In contrast, the same relationship between adaptive function has typically not been found in individuals for RRBs characterized by the insistence of sameness for daily routines, environments, and interactions (i.e., higher-order RRBs). In the present study, the association between parent-reported media RRBs and adaptive function in the ASD group was not statistically significant, as would have been expected for RRBs. Furthermore, the frequency of lower-order media RRBs characterized by motor and sensory behaviours reported by parents were not found to be statistically different between children exhibiting low adaptive and high adaptive functioning among the ASD group. Although this difference was not statistically significant, the mean parent-reported frequencies of these types of media RRBs were greater for the children demonstrating lower adaptive function, which

is consistent with existing research (e.g., Szatmari et al., 2006). Similarly, parent-reported frequencies of higher-order RRBs consisting of inflexible behaviours and restricted interests were not significantly different when groups that exhibited low and high adaptive functioning score were compared for the ASD group. Although the difference was nonsignificant, the mean parent-reported frequencies of these types of higher-order media RRBs were also greater for children demonstrating lower adaptive function.

A combination of factors may explain the deviation of the current study findings from the expected patterns of differences and associations. The ASD sample primarily consisted of verbal children which is typically indicative of higher general functioning (e.g., Anderson, Oti, Lord, & Welch, 2009; Venter, Lord, & Schopler, 1992); therefore, the group with lower adaptive functioning scores likely reflected the lower end of overall higher functioning children. In addition, the adaptive function measure was both brief and new which may have restricted its similarity with previous adaptive functioning measures used in previous RRB research (e.g., Vineland Adaptive Behavior Scales).

Sequelae of interrupted media RRBs were also explored in the current study as previous research has indicated that distress is often expressed by children with ASD when repetitive behaviours are interrupted. The current study conducted group comparisons related to parent reports of child distress reactions in the context of media use. Children diagnosed with ASD were reported to demonstrate higher frequencies of upset, greater intensity of the distress, and longer durations of distress in response to various interruptions of access to devices and content than children without an ASD diagnosis. Greater reported levels of these distress reactions were also highly correlated with elevated frequencies of parent-reported media RRBs characterized by inflexibility and insistence on sameness (e.g., devices, content, media set-up). These findings

suggest that the distress children with ASD experience when their media use is interrupted or prevented in some way shares similarities with the presentation of classical RRBs in ASD. Indeed, behavioural research studies have consistently found that disruption of repetitive behaviours often leads to some expression of distress (e.g., aggression, crying; Fisher et al., 2019; Reese, Richman, Belmont, & Morse, 2005; Rodriguez, Thompson, Stocco, & Schlichenmeyer, 2013). If these media RRBs are similar to classical RRBs, then the interruption of media use likely disrupts some automatic reinforcement process (e.g., Fisher et al., 2019) that can then lead to significant amounts of distress in children with ASD, above and beyond the irritability that would be expected in similar situations involving typically developing children. These findings also offer a more specific view about how some problematic interactions between parents and their children with ASD related to media may occur compared to previous research that simply correlated challenging behaviour and media use activities (e.g., Mazurek & Engelhardt, 2013b). These findings provide further support to suggest media RRBs share similarities with classical RRBs.

In combination, these findings suggest that parents observe behaviours that share features with classical RRBs typically found in ASD when their child interacts with media. These behaviours are posited to be media RRBs. The extent of the association between media RRB and classical RRBs has implications for future research directions studying RRB in the context of media and clinical applications of this information for diagnostic and treatment consideration of media RRBs in children with ASD.

Application of theory. Media restrictive repetitive behaviours seem to occupy an interesting theoretical space as they are both behaviours and ways of using electronic media. The Media Repertoires (MR) approach was useful to orient the current line of inquiry towards measuring a

variety of media behaviours across various content and devices and promoted the consideration of positional variables such as child age, diagnostic status, and level of adaptive functioning in the current study. However, the combination of small sample size and missing values did not enable the extension of MR to the creation and analysis of behavioural profiles for specific devices. Therefore, theories based upon behavioural principles were more useful for understanding the current findings.

Behavioural theories have frequently been relied upon to understand the symptoms of ASD and have been extended into the development of gold standard treatments for children with the diagnosis (i.e., Applied Behavioural Analysis; Wong et al., 2015). The central component in these behavioural theories is that of operant conditioning. Although behavioural theories involving operant conditioning are not able to describe the core etiology of RRBs (as with many other theories; Turner, 1999; Happe et al., 2014), operant conditioning and the recent integration of neurobiological mechanisms of reward activation can be used to understand the propagation and maintenance of the repetitive and inflexible behaviours (Lanovaz, 2011).

As the current study shows a high degree of similarity between classical RRB and media RRB in the ASD group, operant conditioning can also be used to understand the nature of the current study findings. First and foremost, the increased frequencies of media RRBs reported in the group of children with ASD, compared to the group of TD children, is consistent with the notion that these behaviours satisfy some unique reward function that leads to greater reinforcement in youth ASD populations. Indeed, the perceptual characteristics of objects have been posited as particularly salient operants (e.g., Lovaas et al., 1987) that relates to differential responsivity of cortical reward circuits in ASD compared to TD groups (e.g., Lanovaz, 2011) forming a pathway for the development of stereotypies in ASD. In the context of the current

study, media devices and content may offer particularly powerful sensory stimulation involving a combination of lights, colours, movements, and sounds that likely results in reinforcement through the activation underlying cortical reward circuits. Thus, higher rates of media RRB in the group of children with ASD can be explained in part due to the likely operant reinforcement of repetitive use of media through its sensory elements supported by the activation of the cortical reward system.

Media RRBs were also likely elevated in the ASD group because of the reinforcement value of restricted and inflexible behaviours and interests. To date, research has not shown a clear relationship between these higher-order behaviours and operant conditioning (Turner, 1999). However, recent studies combining experiments and neuroimaging have suggested that circumscribed/fixated interests result in higher activation of cortical reward systems both compared to TD children and compared to other stimuli unrelated to the circumscribed/fixated interests within ASD groups (e.g., Kohls, Antezana, Mosner, Schultz, & Yerys, 2012; Watson et al., 2015).

In addition, both routines/inflexible behaviours (Boyd, McDonough, & Bodfish, 2012) and media use (Eversole et al., 2016) have been found to be pleasurable activities, which likely reflect some underlying activation of cortical reward circuits (e.g., Kohls, Yerys, & Schultz, 2014). Therefore, media RRBs that involve rigidity and routine likely also act as more salient operants for children with ASD compared with their TD counterparts. In combination, these findings suggest the media RRBs may satisfy restricted reward schemes encoded the brain's reward system based on their variations of perceptual characteristics, higher-order informational features (related to highly fixated interests), and sequences of behaviour.

Media and Digital Skills

With the increasing prevalence of media in the home, it was important to understand the factors that might influence the child's opportunities to interface with media devices and their abilities related to working these devices. One of the hypotheses in the current study predicted that lower adaptive functioning would be associated with children with ASD having fewer personal devices. The analyses in the current study found that adaptive function was not associated with the number of devices considered to be the child's. This finding runs counter to what would be expected based on other research that has found less diverse use of digital technology for individuals with different conditions (e.g., severe communication deficits, intellectual disability) that are typically associated with lower adaptive function (e.g., Orsmond & Kuo, 2011). One explanation for this findings is that the current sample of children with ASD were all verbal and may have been relatively high functioning compared to previous research samples; therefore, there may not have been as many barriers to using media devices and accessing media content. Indeed, some of the exploratory findings support the notion that these children were relatively able to use media. Based on the parent reports, children with and without a diagnosis of ASD did not demonstrate statistically significant differences between the number of skills related to operating devices and using specific functions of media (i.e., digital literacy skills) they could perform. Thus, children with ASD did not show a specific gap in their repertoire of media skills.

As digital skills (e.g., turning on various devices, adjusting device settings such as volume, using search functions) are foundational behaviours that help children access media, they are necessary for effective participation across a variety of settings such as school and home. Parent observations of digital skills showed a pattern of association with the presence of technology in the household. That is, children with ASD that come from households with more

media devices reportedly demonstrated higher numbers of digital literacy skills. Similarly, those children reported to have more personal media devices (i.e., devices that are considered theirs) also demonstrated higher numbers of digital literacy skills.

In addition, potential differences in the parent-reported digital skills related to both new (e.g., smartphones and tablets) and traditional (e.g., TV and computers) media devices were explored considering the potential differences in device capabilities due to technological advancement. Children both with and without a diagnosis of ASD were reported by their parents to show more skills with using new media devices than traditional media devices.

One potential explanation for the associations of the reported number of digital devices in the environment and numbers of parent-reported digital literacy skills may be that media use is frequently being modelled by others (e.g., parents, caregivers, siblings) in the home, which has been demonstrated in previous research (e.g., Bleakley, Jordan, & Hennessy, 2013; Notten, Kraaykamp, & Konig, 2012). In addition, the differences in the reported number of digital skills between new and traditional media devices may be explained by modelling. That is, new media devices such as smartphones may be related to greater opportunities for parental modelling of their functions compared to other devices given the general popularity of these types of devices compared to other technologies (e.g., Lauricella, Wartella, & Rideout, 2015; Nevski & Siibak, 2016). Given the unique cortical reward circuitry associated with ASD, these children may be particularly motivated to imitate the digital skills they observed for media use. In combination, these findings suggest that the access to digital media in the home may facilitate the acquisition of digital skills by children with ASD and these digital skills may be posed as particular strengths among their other behaviours needed for effective participation in their daily life.

In addition, the lower adaptive function may not be related to lower numbers of personal devices given the utility of personal media devices to access assistive technologies (AT; e.g., apps such as Proloquo2Go for tablets; Ok, 2018). Indeed, more than half the children with ASD that had lower adaptive function were reported by their parents to have used assistive technologies (AT) for some period of time on an average day. In turn, these devices may even help facilitate higher levels of adaptive function (e.g., see Odom et al [2015] for review). As AT may be perceived by parents as beneficial for children with ASD, these children may be provided devices considered theirs for personal use because these devices are equipped with supports for them.

Children with ASD were also reported by their parents to have demonstrated media preferences, skills, and time investments in media use that provided information about their developmental level. In the current study, accessing animated/cartoon content was the most popular type of media parent-reported by parents of these children across a variety of media platforms such as TV and videos. This finding was consistent with previous findings about the content preferences reported for children with ASD (e.g., Shane & Albert, 2008; Kuo et al., 2014). This general preference for animated/cartoon content was also reported by parents of children without ASD in previous studies (e.g., Valkenburg & Vroone, 2004). Taken together, it appears that children with ASD are more interested in particular types of content, and these interests are at least somewhat consistent with the kinds of content children are expected to like (e.g., cartoons).

There were patterns of similarities and differences associated with the types of activities in which children both with and without a diagnosis of ASD engaged. Overall, parent reported indicated that children with ASD spent more time engaged in media use on an average day (a

little over three-and-a-half hours) compared to children without an ASD diagnosis (a little under two-and-a-half hours). These average daily media times for both groups are over the two-hour daily maximum amount of screen time previously recommended by the American Academy of Pediatrics (e.g., AAP, 2001). However, the AAP has recently softened its firm restriction on media hours for children 5 to 17 because of large bodies of research suggesting that these guidelines were not realistic (e.g., AAP, 2016). The hours reported for children with ASD were consistent with the estimates from a population level survey in which parents reported their children with ASD spent just under three and a half hours engaged in media use (e.g., Montes, 2015). Although, the children without ASD in the current study reported less time spent engaged in media use than the sample used for comparison in the survey conducted by Montes (2015).

In addition, the breakdown between media use and social and non-social leisure activities without media use were explored in the sample. Based on the parent reports, children with ASD did not allocate a significantly different amount of time to any one activity across the types of leisure activities; however, children without an ASD diagnosis spent more time engaged in social play without media devices than in either media use or non-social leisure activities. The reported differences shown within these groups of children is somewhat consistent with what would be expected, as children without ASD typically express more interest in social interactions and have more social skills to support these interactions during social play than children with an ASD diagnosis (see Davis & Carter [2014] for review).

These findings related to pathological and more adaptive behaviours found in relation to media use may have implications for clinical considerations and future research, which will be described in the subsequent section.

Clinical Implications

The current research findings related to the existence of potential media RRBs have implications for the current conceptualizations of behavioural addictions in ASD populations. The importance of interpreting these results in relation to the conceptualization of behavioural addiction is two-fold: (a) Research suggests individuals diagnosed with ASD show a proclivity for excessive media use that has been conceptualized as pathological (e.g., Mazurek et al., 2012) and may indeed meet criteria for a diagnosis of technology-based behavioural addiction (e.g., MacMullin et al., 2016; Mazurek & Engelhardt, 2013b; Mazurek & Wenstrup, 2013); and (b) there is considerable debate within the field of addiction about the validity of behavioural addictions (e.g., Aarseth et al., 2016; Kardefeldt-Winther et al., 2017; Starcevic, Billieux, & Schimmenti, 2018; Van Rooij & Prause, 2014).

The current results add to the debate about the validity of behavioural addiction because of their alignment with the criticism that research on behavioural addiction has not adhered to differential diagnostic criteria, which stipulates that the behaviour cannot be better explained by another disorder (Kardefeldt-Winther et al., 2017). Namely, the patterns of findings related to repetitive and fixated use of media presented in the current study indicated that these behaviours resembled the classical RRBs that form a cardinal feature of ASD. The connection between these behaviours suggests that the ways youth with ASD engage with media may actually be an expression of existing symptoms germane to the psychopathology of ASD, rather than a separate behavioural addiction.

As diagnoses serve as guides for subsequent treatment, the distinction between ASD and behavioural addiction becomes especially important given they are treated differently. That is, addictive behaviour is primarily addressed through the lens of elimination/abstinence (Grant, Potenza, Weinstein, & Gorelick, 2010), whereas RRBs are typically trained to enhance flexibility

and increase the variety of the behavioural repertoires of the child (e.g., see Boyd et al., 2012; Rodriguez & Thompson, 2015, for a review).

There are also facets of children's media use that are not pathological. Indeed, in a society that is increasingly technology-based, knowing how to operate various media devices can be an adaptive skill that enables effective participation in a variety of settings (e.g., school, home, stores, etc). The increasing recognition of the importance of competent media use has even resulted in the Ontario Ministry of Education creating mandatory curriculum related to teaching digital media skills (e.g., Ontario Ministry of Education, 2006). As the current study showed that children with ASD were reported to have roughly similar numbers of digital media skills compared to peers without a diagnosis, their ability to use media may be a relative strength compared to skills associated with other domains of adaptive function. Children with ASD may even be in a better position to learn these skills, given the organization of their cortical reward circuitry that may favour many aspects of both media devices and content. In addition, proposed media RRBs may also serve some sort of precursor to more advanced behaviour as the child develops, acting as a practice function for these skills (e.g., similar to Thelen's [1981] interpretation of the function of normative repetitive motor behaviours in infants). Therefore, dimensions of media use may be considered non-pathological and even adaptive. In light of these considerations, more balanced assessments of media use would need to be undertaken when considering how these behaviours may fit with particular psychopathologies, as there are potential adaptive functions that could be considered strengths in certain dimensions of this media use.

Limitations and Future Directions

There were several limitations of the current study. First and foremost, the sample size was small compared to previous media studies (e.g., MacMullin et al., 2016; Mazurek & Wenstrup, 2013) and had unequal numbers of participants for the ASD and non-ASD groups. Statistical methods meant to preserve power and mitigate potential error inflation were employed to counteract the detrimental statistical influences of small sample sizes as much as possible. Although small sample statistics generate valid results, these had to be used in place of optimal statistics, such as multiple regression, that have more comprehensive model specifications that require larger sample sizes for reliable results. In addition, the small sample size restricts the generalizability of the findings, regardless of the statistics used. Further research studies should gather larger samples to study these behaviours.

One of the major contributing factors to the small sample size in the current study was the controversy and discontent among parents of children diagnosed with ASD regarding the provincial government's changes to the Ontario Autism Program that were being implemented at the same time as the data collection. For example, in one refusal email related to a request for participant recruitment assistance, it was stated that "… *For Ontario, please be mindful of the significant changes in funding that the provincial government recently made that is impacting the families and the organizations*." As a large proportion of organizations targeted for recruitment were in Ontario, the stress for parents associated with these funding changes may have reduced the potential appeal of participating in a research study in their spare time.

The current study also utilized a cross-sectional design. Although the cross-sectional design of the current study aligns with many of the existing studies on ASD and media use (e.g., MacMullin et al., 2016; Mazurek & Wenstrup, 2013) the limited account of the developmental trajectories of these behaviours under study is a limitation. As classical RRBs have been found to

follow certain trajectories over time (e.g., Harrop et al., 2014; Richler et al., 2010), future studies should attempt to account for the development of media RRBs within children as they age. A longitudinal approach to investigating these behaviours would have allowed for further comparisons of the similarities between RRBs and media RRBs. In addition, a developmental perspective would necessitate the consideration of potential moderating and mediating mechanisms (e.g., parental beliefs regarding media use, media-related parenting practices) to understand factors that may influence the emergence and progression of media RRBs. It also would be useful to consider potential cascades related to media use. To illustrate, perhaps ASD and associated RRBs may be positioned as child vulnerabilities due to their association with unique sensitivity of cortical reward circuitry to non-social stimuli. In turn, risk factors such as media use exposure/engagement and prevalence of devices in the home may then catalyse the emergence of media RRBs. Finally, media RRBs may then shift to become a risk factor for the development of behavioural addiction with time. Although the current study suggests a more direct connection between media RRBs and the psychopathology of ASD, a cascading model of behavioural addiction cannot be ruled out.

Another direction of future research would be to implement or incorporate ecological or laboratory designs that enable observation of supposed media behaviour addictions and media RRBs to augment the existing literature, which is based on primarily self-report or parent-report methods. Similarly, studies could examine neuropsychological responses to media activities in children with ASD to determine what brain circuitry becomes activated. Identifying these systems and patterns of activation could then be compared to the robust literature associated with behavioural addiction (i.e., reward systems) to see if there are differential aspects of activity.

This would further help determine the nature of the behaviour children with ASD engage in when interacting with media.

Future studies should also investigate the degrees of similarity and difference between behaviours thought to represent media addiction and those considered to be media RRBs. In particular, both measures of media addiction and media RRBs should be used to determine the extent of overlap between the operationalized concepts of technology-based behavioural addiction, media RRBs, and cardinal ASD symptoms. Furthermore, these measures could be compared to gauge whether they can discriminate between ASD and typically developing populations, which would be in keeping with a developmental approach.

The survey design proved to be a limitation. Overall, there were patterns of systematic missingness among more involved components of the media survey (e.g., multi-part questions, questions with large numbers of response considerations). In addition, the combination of certain complex questions and large number of questions culminated into relatively long completion times. As parents have been shown to experience both high demands on their time (e.g., work, child care, family relationships), they may not have had the necessary free time to respond to this research survey (e.g., Vercruyssen, 2014). In addition, parents of children with ASD have been shown to experience greater amounts of stress than other parents (e.g., Hayes & Watson, 2013), which may further contribute to lacking time and/or energy to participate in research. Taken together, the survey was likely not as accessible as it could have been for parents and future research should ensure survey size and question complexity are more manageable for parents. Future studies should endeavour to achieve a balance between comprehensive assessment of media use and parent's time.

Similarly, the reliance on parent reports of child behaviours represented an inherent limitation. There are many factors that can impact parent reports potentially leading to discrepancies between what was reported and actual child behaviours such as common memory distortions (e.g., Robbins, 1963) or negative biases stemming from parent psychopathology (e.g., Kroes, Veerman, & De Bruyn, 2003). Indeed, it is recommended that multiple sources of information on a child should be considered to control for potential discrepancies arising from single-informant reports (Achenbach, 2006). However, parent-reports are often relied upon in research involving children and represent a primary data collection method on the media use of youth diagnosed with ASD (e.g., MacMullin et al., 2016; Mazurek & Wenstrup, 2013). In addition, there appears to be better consistency related to parent reports of overt behaviours, such as those related to externalizing problems (e.g., Duhig, Renk, Epstein, & Phares, 2000). In the current study, RRBs and media RRBs are outwardly observable and, therefore, may be reported with at least some accuracy. Future studies should consider incorporating researcher-based observational methods in order to enhance confidence in the research findings related to potential media RRBs.

Another potential drawback related to parent report is the extent of parental knowledge of technology. As the landscape of media content and the devices used to access this content are constantly changing, it may be difficult for parents who are not familiar with these changes to report on these aspects of their child's media use. Parents in the current study seemed to be more familiar with more intuitive categories of media such as audio-visual media, but had difficulty differentiating this from static visual media (e.g., pictures, articles on websites, written blogs). Indeed, there may be multiple types of media content represented on a given platform such as videos with extensive written descriptions hosted on the same web page, which may make it

difficult for parents to identify the media their child is accessing in a singular category. Research is needed to determine the extent that parent knowledge of technology may influence their reports on their child's media use.

Media use has also been traditionally difficult to operationalize, and research has often defined it using aggregate measures of time spent on media (Hasebrink & Popp, 2006). Difficulties measuring media use will only continue to become more difficult as technology advances and convergence occurs across devices and platforms. Unlike previous research that has focused on one particular device or content area, the current study was one of the first attempts to consider, the vast arrays of media devices, content, and behavioural combinations. Although full media profiles were not able to be constructed through the exploratory analyses due to methodological limitations in the current sample, future research should also attempt to use a broadband approach to consider the rich variety of media use behaviours.

Finally, continued study of children's media use should attempt to adopt a balanced view of media use behaviours to understand maladaptive and adaptive behavioural profiles. In recent years, there has been a proliferation of research on media-based psychopathology (e.g., De-Sola Gutierrez, Fonseca, & Rubio, 2016; Kuss & Griffiths, 2011), but there has been less focus on positive aspects of media use (e.g., Greitemeyer, 2011). Studies that consider both positive and negative dimensions of media use may be particularly important for determining how to consider media behaviours in the context of diagnosis.

Conclusion

Anecdotal evidence that media RRBs exist has been provided through the narratives of parents (e.g., Nally et al., 2000). However, to the author's knowledge, no empirical research had been undertaken to quantify the existence of these behaviours prior to the current study. As

expected, these media behaviours occurred in higher frequencies for children with ASD compared to children with no ASD diagnosis. Further exploration of media behaviours also showed that children with ASD demonstrated higher frequency, intensity, and duration of episodes of distress following interruption of and/or prevented access to media than children without ASD, which was consistent with previous findings of distress responses upon interruption of RRBs in ASD. Unexpectedly, age and adaptive functioning were not found to be associated with media RRBs for children with ASD. Another unexpected finding was that no statistically significant association was shown between age, adaptive function, and the numbers of personal devices children owned for children with ASD. Overall, these study findings suggest that proposed media RRBs are potentially a part of the mosaic of behavioural symptoms associated with ASD. As such, researchers and clinicians may want to consider that there is, at the very least, a potential alternative explanation to behavioural addiction in relation to media use in ASD populations. This has potential implications for the current diagnostic understanding of ASD in an increasingly technology-based society

In addition, children with ASD showed elements of developmentally appropriate skills and media preferences. That is, children with ASD demonstrated similar numbers of digital skills compared to their peers with no ASD diagnosis. Both groups of children also showed higher numbers of skills for types of newer media devices like smartphones and tablets compared to skills for older media devices like TVs and computers. Furthermore, both groups of children appeared to prefer cartoon/animated content as would be expected at their age. Given the continued advancement of technology and its near ubiquity across society, knowing how to use media is becoming an essential skill for effective participation in daily life.

Collectively, these findings demonstrated that there are both potentially psychopathological and adaptive aspects to the media use of children with ASD. Future research needs to consider both of these dimensions of media use to understand the value media use behaviours may hold for diagnostic decision-making and potential differential diagnosis in populations of children with ASD. Given the new incorporation of technology-based mental health diagnoses into formal diagnostic systems in psychology, the findings of the current study and the research it sparks will serve as important informational anchors moving forward.

REFERENCES

Aarseth, E., Bean, A. M., Boonen, H., Colder Carras, M., Coulson, M., Das, D., ... & Haagsma, M. C. (2017). Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal. *Journal of Behavioral Addictions, 6*(3), 267-270. https://doi.org/10.1556/2006.5.2016.088

Abdullah, M. B. (1990). On a robust correlation coefficient. *Journal of the Royal Statistical Society: Series D (The Statistician), 39*(4), 455-460. https://doi.org/10.2307/2349088

Achenbach, T. M. (2006). As others see us: Clinical and research implications of cross-informant correlations for psychopathology. *Current Directions in Psychological Science, 15*(2), 94-98. https://doi.org/10.1111/j.0963-7214.2006.00414.x

Achenbach, T. M. (2014). Developmental psychopathology. In P. H. Blaney, R. F. Krueger, & T. Millon (Eds.), *Oxford Textbook of Psychopathology* (pp. 488-512). New York, NY: Oxford University Press.

Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101*(2), 213-232. https://doi.org/10.1037//0033-2909.101.2.213

Aguinis, H., Gottfredson, R. K., & Joo, H. (2013). Best-practice recommendations for defining, identifying, and handling outliers. *Organizational Research Methods, 16*(2), 270-301. https://doi.org/10.1177/1094428112470848

American Academy of Pediatrics, Committee on Public Education (2001). *Children, adolescents, and television.* Retrieved from https://pediatrics.aappublications.org/content/107/2/423

American Academy of Pediatrics, Council on Communications and Media (2016). *Media use in school-aged children and adolescents.* Retrieved from https://pediatrics.aappublications.org/content/early/2016/10/19/peds.2016-2592

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Anderson, C. A., & Bushman, B. J. (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science*, *12*(5), 353-359. https://doi.org/10.1037/e315012004-001

Anderson, D. K., Oti, R. S., Lord, C., & Welch, K. (2009). Patterns of growth in adaptive social abilities among children with autism spectrum disorders. *Journal of Abnormal Child Psychology*, *37*(7), 1019-1034. https://doi.org/10.1007/s10802-009-9326-0

Astivia, O. L. O., & Zumbo, B. D. (2019). Heteroskedasticity in Multiple Regression Analysis: What it is, How to Detect it and How to Solve it with Applications in R and SPSS. *Practical Assessment, Research & Evaluation*, *24*(1). Retrieved from http://pareonline.net/getvn.asp?v=24&n=1

Azur, M. J., Stuart, E. A., Frangakis, C., & Leaf, P. J. (2011). Multiple imputation by chained equations: what is it and how does it work?. *International Journal of Methods in Psychiatric Research*, *20*(1), 40-49. https://doi.org/10.1002/mpr.329

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., ... & Durkin, M. S. (2018). Prevalence of autism spectrum disorder among children aged 8 years—Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2014. *Morbidity and Mortality Weekly Report: Surveillance Summaries*, *67*(6), 1-23.

Bakker, M., & Wicherts, J. M. (2014). Outlier removal, sum scores, and the inflation of the type I error rate in independent samples t tests: The power of alternatives and recommendations. *Psychological Methods, 19*(3), 409-427. https://doi.org/10.1037/met0000014

Barnes, K. A., Howard Jr, J. H., Howard, D. V., Gilotty, L., Kenworthy, L., Gaillard, W. D., & Vaidya, C. J. (2008). Intact implicit learning of spatial context and temporal sequences in childhood autism spectrum disorder. *Neuropsychology, 22*(5), 563-570. https://doi.org/10.1037/0894-4105.22.5.563

Barnes, S. A., Lindborg, S. R., & Seaman Jr, J. W. (2006). Multiple imputation techniques in small sample clinical trials. *Statistics in Medicine, 25*(2), 233-245. https://doi.org/10.1002/sim.2231

Bishop, S. L., Hus, V., Duncan, A., Huerta, M., Gotham, K., Pickles, A., ... & Lord, C. (2013). Subcategories of restricted and repetitive behaviors in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43*(6), 1287-1297. https://doi.org/10.1007/s10803-012-1671-0

Bleakley, A., Jordan, A. B., & Hennessy, M. (2013). The relationship between parents' and children's television viewing. *Pediatrics, 132*(2), e364-e371. https://doi.org/10.1542/peds.2012-3415

Bodfish, J. W., Symons, F. J., Parker, D. E., & Lewis, M. H. (2000). Varieties of repetitive behavior in autism: Comparisons to mental retardation. *Journal of Autism and Developmental Disorders, 30*(3), 237-243. https://doi.org/10.1023/a:1005596502855

Boneau, C. A. (1960). The effects of violations of assumptions underlying the t test. *Psychological Bulletin, 57*(1), 49-64. https://doi.org/10.1037/h0041412

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, *13*(1), 210-230. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Boyd, B. A., McDonough, S. G., & Bodfish, J. W. (2012). Evidence-based behavioral interventions for repetitive behaviors in autism. *Journal of Autism and Developmental Disorders*, *42*(6), 1236-1248. https://doi.org/10.1007/s10803-011-1284-z

Braun-Courville, D. K., & Rojas, M. (2009). Exposure to sexually explicit web sites and adolescent sexual attitudes and behaviors. *Journal of Adolescent Health*, *45*(2), 156-162. https://doi.org/10.1016/j.jadohealth.2008.12.004

Bushman, B. J., Gollwitzer, M., & Cruz, C. (2015). There is broad consensus: Media researchers agree that violent media increase aggression in children, and pediatricians and parents concur. *Psychology of Popular Media Culture*, *4*(3), 200-214. https://doi.org/10.1037/ppm0000046

Cain, N., & Gradisar, M. (2010). Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Medicine, 11*(8), 735-742. https://doi.org/10.1016/j.sleep.2010.02.006

Cantwell, D. P., Lewinsohn, P. M., Rohde, P., & Seeley, J. R. (1997). Correspondence between adolescent report and parent report of psychiatric diagnostic data. *Journal of the American Academy of Child & Adolescent Psychiatry, 36*(5), 610-619. https://doi.org/10.1097/00004583-199705000-00011

Center for Disease Control (2009). Prevalence of autism spectrum disorders—autism and developmental disabilities monitoring network, United States, 2006. *Morbidity and*

Mortality Weekly Report: Surveillance Summaries (Publication No. 58/SS10). Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/ss5810a1.htm

Center for Disease Control (2014). Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *Morbidity and Mortality Weekly Report: Surveillance Summaries* (Publication No. 63/SS02). Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/ss6302a1.htm

Chassiakos, Y. L. R., Radesky, J., Christakis, D., Moreno, M. A., & Cross, C. (2016). Children and adolescents and digital media. *Pediatrics, 138*(5), e20162593. https://doi.org/10.1542/peds.2016-2593

Chebli, S. S., Martin, V., & Lanovaz, M. J. (2016). Prevalence of stereotypy in individuals with developmental disabilities: A systematic review. *Review Journal of Autism and Developmental Disorders, 3*(2), 107-118. https://doi.org/10.1007/s40489-016-0069-x

Chen, G. M. (2011). Tweet this: A uses and gratifications perspective on how active Twitter use gratifies a need to connect with others. *Computers in Human Behavior, 27*(2), 755-762. https://doi.org/10.1016/j.chb.2010.10.023

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159. https://doi.org/10.1037//0033-2909.112.1.155

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). New York, NY: Taylor & Group, LLC

Collier, K. M., Coyne, S. M., Rasmussen, E. E., Hawkins, A. J., Padilla-Walker, L. M., Erickson, S. E., & Memmott-Elison, M. K. (2016). Does parental mediation of media influence child outcomes? A meta-analysis on media time, aggression, substance use, and sexual

behavior. *Developmental Psychology*, *52*(5), 798-812. https://doi.org/10.1037/dev0000108

Collins, L. M., Schafer, J. L., & Kam, C. M. (2001). A comparison of inclusive and restrictive strategies in modern missing data procedures. *Psychological methods*, *6*(4), 330-351. https://doi.org/10.1037//1082-989x.6.4.330

Colvert, E., Tick, B., McEwen, F., Stewart, C., Curran, S. R., Woodhouse, E., ... & Ronald, A. (2015). Heritability of autism spectrum disorder in a UK population-based twin sample. *JAMA psychiatry*, *72*(5), 415-423. https://doi.org/10.1001/jamapsychiatry.2014.3028

Corvey, K., Menear, K. S., Preskitt, J., Goldfarb, S., & Menachemi, N. (2015). Obesity, physical activity and sedentary behaviors in children with an autism spectrum disorder. *Maternal and Child Health Journal*, *20*(2), 466-476. https://doi.org/10.1007/s10995-015-1844-5

Cousineau, D., & Chartier, S. (2010). Outliers detection and treatment: a review. *International Journal of Psychological Research*, *3*(1), 58-67. https://doi.org/10.21500/20112084.844

Cribbie, R. A., Fiksenbaum, L., Keselman, H. J., & Wilcox, R. R. (2012). Effect of non-normality on test statistics for one-way independent groups designs. *British Journal of Mathematical and Statistical Psychology*, *65*(1), 56-73. https://doi.org/10.1111/j.2044-8317.2011.02014.x

Davis, N. O. & Carter, A. S (2014). Social development in autism. In F. Volkmar, R. Paul, S. Rogers, & K. Pelphrey (Eds.), *Handbook of autism and pervasive developmental disorders, 4th edition* (pp. 212-229). Hoboken, NJ: John Wiley & Sons Inc

DeCarlo, L. T. (1997). On the meaning and use of kurtosis. *Psychological methods*, *2*(3), 292-307. https://doi.org/10.1037//1082-989x.2.3.292

De-Sola Gutiérrez, J., Rodríguez de Fonseca, F., & Rubio, G. (2016). Cell-phone addiction: a review. *Frontiers in psychiatry*, *7*, 175. https://doi.org/10.3389/fpsyt.2016.00175

de Winter, J. C. (2013). Using the Student's t-test with extremely small sample sizes. *Practical Assessment, Research & Evaluation*, *18*(10). Retrieved from http://pareonline.net/getvn.asp?v=18&n=10.

de Winter, J. C., Gosling, S. D., & Potter, J. (2016). Comparing the Pearson and Spearman correlation coefficients across distributions and sample sizes: A tutorial using simulations and empirical data. *Psychological methods*, *21*(3), 273-290. https://doi.org/10.1037/met0000079

Dillman Carpentier, F. R., Brown, J. D., Bertocci, M., Silk, J. S., Forbes, E. E., & Dahl, R. E. (2008). Sad kids, sad media? Applying mood management theory to depressed adolescents' use of media. *Media Psychology*, *11*(1), 143-166. https://doi.org/10.1080/15213260701834484

Dixon, R. M., Verenikina, I., Costley, D., & Pryor, S. (2015). The use of iPads in the home setting for students with autism spectrum disorders. *Journal of Special Education Technology*, *30*(4), 193-206. https://doi.org/10.1177/0162643415623023

Duhig, A. M., Renk, K., Epstein, M. K., & Phares, V. (2000). Interparental agreement on internalizing, externalizing, and total behavioral problems: A meta-analysis. *Clinical Psychology: Science and Practice*, *7*(4), 435–453. https://doi.org/10.1093/clipsy.7.4.435

Enders, C. K. (2010). *Applied missing data analysis.* New, NY: The Guilford Press https://doi.org/10.1037/met0000079

Enders, C. K. (2013). Dealing with missing data in developmental research. *Child Development Perspectives*, *7*(1), 27-31. https://doi.org/10.1111/cdep.12008

Engelhardt, C. R., & Mazurek, M. O. (2014). Video game access, parental rules, and problem behavior: A study of boys with autism spectrum disorder. *Autism*, *18*(5), 529-537. https://doi.org/10.1177/1362361313482053

Engelhardt, C. R., Mazurek, M. O., & Sohl, K. (2013). Media use and sleep among boys with autism spectrum disorder, ADHD, or typical development. *Pediatrics*, *132*(6), 1081-1089. https://doi.org/10.1542/peds.2013-2066

Eversole, M., Collins, D. M., Karmarkar, A., Colton, L., Quinn, J. P., Karsbaek, R., ... & Hilton, C. L. (2016). Leisure activity enjoyment of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *46*(1), 10-20. https://doi.org/10.1007/s10803-015-2529-z

Evans, D. W., Leckman, J. F., Carter, A., Reznick, J. S., Henshaw, D., King, R. A., & Pauls, D. (1997). Ritual, habit, and perfectionism: The prevalence and development of compulsive-like behavior in normal young children. *Child Development*, *68*(1), 58-68. https://doi.org/10.1111/j.1467-8624.1997.tb01925.x

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149-1160. https://doi.org/10.3758/brm.41.4.1149

Fisher, W. W., Felber, J. M., Phillips, L. A., Craig, A. R., Paden, A. R., & Niemeier, J. J. (2019). Treatment of resistance to change in children with autism. *Journal of Applied Behavior Analysis*, *52*(4), 974-993. https://doi.org/10.1002/jaba.588

Frazier, J. A., Biederman, J., Bellordre, C. A., Garfield, S. B., Geller, D. A., Coffey, B. J., & Faraone, S. V. (2001). Should the diagnosis of attention-deficit/hyperactivity disorder be

considered in children with pervasive developmental disorder?. *Journal of Attention Disorders*, *4*(4), 203-211. https://doi.org/10.1177/108705470100400402

Frazier, T. W., Georgiades, S., Bishop, S. L., & Hardan, A. Y. (2014). Behavioral and cognitive characteristics of females and males with autism in the Simons Simplex Collection. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(3), 329-340. https://doi.org/10.1016/j.jaac.2013.12.004

Frazier, T. W., Youngstrom, E. A., Speer, L., Embacher, R., Law, P., Constantino, J., ... & Eng, C. (2012). Validation of proposed DSM-5 criteria for autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(1), 28-40. https://doi.org/10.1016/j.jaac.2011.09.021

Garg, S., Plasschaert, E., Descheemaeker, M. J., Huson, S., Borghgraef, M., Vogels, A., ... & Green, J. (2015). Autism spectrum disorder profile in neurofibromatosis type I. *Journal of Autism and Developmental Disorders*, *45*(6), 1649-1657. https://doi.org/10.1007/s10803-014-2321-5

Garrison, M. M., Liekweg, K., & Christakis, D. A. (2011). Media use and child sleep: the impact of content, timing, and environment. *Pediatrics*, *128*(1), 29-35. https://doi.org/10.1542/peds.2010-3304

Georgiades, S., Szatmari, P., Zwaigenbaum, L., Duku, E., Bryson, S., Roberts, W., Goldberg, J., & Mahoney, W. (2007). Structure of the autism symptom phenotype: A proposed multidimensional model. *Journal of the American Academy of Child and Adolescent Psychiatry*, *46*(2), 188–196. https://doi.org/10.1097/01.chi.0000242236.90763.7f

Gerbner, G. (1969). Toward" cultural indicators": The analysis of mass mediated public message systems. *AV Communication Review*, 137-148.

Goffman, E. (1956). *The presentation of self in everyday life* [Monograph]. University of Edinburgh, Social Science Research Center

Gottschall, A. C., West, S. G., & Enders, C. K. (2012). A comparison of item-level and scale-level multiple imputation for questionnaire batteries. *Multivariate Behavioral Research*, *47*(1), 1-25. https://doi.org/10.1080/00273171.2012.640589

Government of Canada (2018). *Understanding the 2018 National Autism Spectrum Disorder Surveillance System report.* Retrieved from https://www.canada.ca/en/public-health/services/publications/diseases-conditions/understanding-national-autism-spectrum-disorder-surveillance-system-report-2018.html#a3

Graham, J. W., Olchowski, A. E., & Gilreath, T. D. (2007). How many imputations are really needed? Some practical clarifications of multiple imputation theory. *Prevention Science, 8*(3), 206-213. https://doi.org/10.1007/s11121-007-0070-9

Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioral addictions. *The American Journal of Drug and Alcohol Abuse*, *36*(5), 233-241. https://doi.org/10.3109/00952990.2010.491884

Greitemeyer, T. (2011). Effects of prosocial media on social behavior: When and why does media exposure affect helping and aggression? *Current Directions in Psychological Science, 20*(4), 251-255. https://doi.org/10.1177/0963721411415229

Griffiths, M. (1999). Internet addiction: Fact or fiction? *The Psychologist, 12*(5), 246-250.

Griffiths, M. (2000). Does Internet and computer" addiction" exist? Some case study evidence. *CyberPsychology and Behavior, 3*(2), 211-218. https://doi.org/10.1089/109493100316067

Griffiths, M. (2005). A ‘components’ model of addiction within a biopsychosocial framework. *Journal of Substance Use, 10*(4), 191-197. https://doi.org/10.1080/14659890500114359

Groenvold, M., Klee, M. C., Sprangers, M. A., & Aaronson, N. K. (1997). Validation of the EORTC QLQ-C30 quality of life questionnaire through combined qualitative and quantitative assessment of patient-observer agreement. *Journal of Clinical Epidemiology, 50*(4), 441-450. https://doi.org/10.1016/s0895-4356(96)00428-3

Grzadzinski, R., Dick, C., Lord, C., & Bishop, S. (2016). Parent-reported and clinician-observed autism spectrum disorder (ASD) symptoms in children with attention deficit/hyperactivity disorder (ADHD): implications for practice under DSM-5. *Molecular Autism, 7*(1), 7-19. https://doi.org/10.1186/s13229-016-0072-1

Gudelunas, D. (2012). There’s an app for that: The uses and gratifications of online social networks for gay men. *Sexuality & Culture, 16*(4), 347-365. https://doi.org/10.1007/s12119-012-9127-4

Harrop, C., McBee, M., & Boyd, B. A. (2016). How are child restricted and repetitive behaviors associated with caregiver stress over time? A parallel process multilevel growth model. *Journal of Autism and Developmental Disorders*, *46*(5), 1773-1783. https://doi.org/10.1007/s10803-016-2707-7

Harrop, C., McConachie, H., Emsley, R., Leadbitter, K., Green, J., & PACT Consortium. (2014). Restricted and repetitive behaviors in autism spectrum disorders and typical development: Cross-sectional and longitudinal comparisons. *Journal of Autism and Developmental Disorders, 44*(5), 1207-1219. https://doi.org/10.1007/s10803-013-1986-5

Hartley, S. L., & Sikora, D. M. (2009). Sex differences in autism spectrum disorder: an examination of developmental functioning, autistic symptoms, and coexisting behavior

problems in toddlers. *Journal of Autism and Developmental Disorders*, *39*(12), 1715-1722. https://doi.org/10.1007/s10803-009-0810-8

Hasebrink, U., & Domeyer, H. (2012). Media repertoires as patterns of behaviour and as meaningful practices: A multimethod approach to media use in converging media environments. *Participations, 9*(2), 757-779. https://doi.org/10.1515/commun.2006.023

Hasebrink, U., & Popp, J. (2006). Media repertoires as a result of selective media use. A conceptual approach to the analysis of patterns of exposure. *Communications,* 31(3), 369-387. https://doi.org/10.1515/commun.2006.023

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* New York, NY: The Guilford Press

Hayes, A. F., & Montoya, A. K. (2017). A tutorial on testing, visualizing, and probing an interaction involving a multicategorical variable in linear regression analysis. *Communication Methods and Measures*, *11*(1), 1-30. https://doi.org/10.1080/19312458.2016.1271116

Healey, B. (2007). Drop downs and scroll mice: The effect of response option format and input mechanism employed on data quality in web surveys. *Social Science Computer Review, 25*(1), 111-128. https://doi.org/10.1177/0894439306293888

Heerwegh, D., & Loosveldt, G. (2002). An evaluation of the effect of response formats on data quality in web surveys. *Social Science Computer Review*, *20*(4), 471-484. https://doi.org/10.1177/089443902237323

Hesterberg, T. C. (2015). What teachers should know about the bootstrap: Resampling in the undergraduate statistics curriculum. *The American Statistician*, *69*(4), 371-386. https://doi.org/10.1080/00031305.2015.1089789

Heymans, M. W., & Eekhout, I. (2019). *Applied missing data analysis with SPSS and (R)Studio.* Retrieved from https://bookdown.org/mwheymans/bookmi/

Holland, G., & Tiggemann, M. (2016). A systematic review of the impact of the use of social networking sites on body image and disordered eating outcomes. *Body Image, 17*, 100-110. https://doi.org/10.1016/j.bodyim.2016.02.008

Holmboe, K., Rijsdijk, F. V., Hallett, V., Happé, F., Plomin, R., & Ronald, A. (2014). Strong genetic influences on the stability of autistic traits in childhood. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(2), 221-230. https://doi.org/10.1016/j.jaac.2013.11.001

Holtmann, M., Bölte, S., & Poustka, F. (2007). Attention deficit hyperactivity disorder symptoms in pervasive developmental disorders: association with autistic behavior domains and coexisting psychopathology. *Psychopathology*, *40*(3), 172-177. https://doi.org/10.1159/000100007

Horton, N. J., & Lipsitz, S. R. (2001). Multiple imputation in practice: comparison of software packages for regression models with missing variables. *The American Statistician, 55*(3), 244-254. https://doi.org/10.1198/000313001317098266

Howlin, P. (2005). Outcomes in Autism Spectrum Disorders. In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders: Diagnosis, development, neurobiology, and behavior* (pp. 201-220). Hoboken, NJ, US: John Wiley & Sons Inc.

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry, 45*(2), 212-229. https://doi.org/10.1111/j.1469-7610.2004.00215.x

Hus, V., Pickles, A., Cook Jr, E. H., Risi, S., & Lord, C. (2007). Using the autism diagnostic interview—revised to increase phenotypic homogeneity in genetic studies of autism. *Biological Psychiatry, 61*(4), 438-448. https://doi.org/10.1016/j.biopsych.2006.08.044

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.

Kardefelt-Winther, D., Heeren, A., Schimmenti, A., van Rooij, A., Maurage, P., Carras, M., ... & Billieux, J. (2017). How can we conceptualize behavioural addiction without pathologizing common behaviours? *Addiction, 112*(10), 1709-1715. https://doi.org/10.1111/add.13763

Katz, E., Blumler, J. G., & Gurevitch, M. (1973). Uses and gratifications research. *Public Opinion Quarterly, 37*(4), 509-523. https://doi.org/10.1086/268109

Kazdin, A. E. (2017). *Research design in clinical psychology (5th ed.).* Boston, MA: Pearson.

King, D. L., Delfabbro, P. H., & Zajac, I. T. (2011). Preliminary validation of a new clinical tool for identifying problem video game playing. *International Journal of Mental Health and Addiction, 9*(1), 72-87. https://doi.org/10.1007/s11469-009-9254-9

Kohls, G., Antezana, L., Mosner, M. G., Schultz, R. T., & Yerys, B. E. (2018). Altered reward system reactivity for personalized circumscribed interests in autism. *Molecular Autism, 9*(1), 9-21. https://doi.org/10.1186/s13229-018-0195-7

Kohls, G., Yerys, B., & Schultz, R. T. (2014). Striatal development in autism: repetitive behaviors and the reward circuitry. *Biological Psychiatry, 76*(5), 358-359. https://doi.org/10.1016/j.biopsych.2014.07.010

Kraper, C. K., Kenworthy, L., Popal, H., Martin, A., & Wallace, G. L. (2017). The gap between adaptive behavior and intelligence in autism persists into young adulthood and is linked

to psychiatric co-morbidities. *Journal of Autism and Developmental Disorders, 47*(10), 3007-3017. https://doi.org/10.1007/s10803-017-3213-2

Kroes, G., Veerman, J. W., & De Bruyn, E. E. (2003). Bias in parental reports? Maternal psychopathology and the reporting of problem behavior in clinic-referred children. *European Journal of Psychological Assessment, 19*(3), 195-203. https://doi.org/10.1027//1015-5759.19.3.195

Kuo, M. H., Magill-Evans, J., & Zwaigenbaum, L. (2015). Parental mediation of television viewing and videogaming of adolescents with autism spectrum disorder and their siblings. *Autism, 19*(6), 724-735. https://doi.org/10.1177/1362361314552199

Kuo, M. H., Orsmond, G. I., Cohn, E. S., & Coster, W. J. (2011). Friendship characteristics and activity patterns of adolescents with an autism spectrum disorder. *Autism, 17*(4), 481-500. https://doi.org/10.1177/1362361311416380

Kuo, M. H., Orsmond, G. I., Coster, W. J., & Cohn, E. S. (2014). Media use among adolescents with autism spectrum disorder. *Autism, 18*(8), 914-923. https://doi.org/10.1177/1362361313497832

Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction—a review of the psychological literature. *International Journal of Environmental Research and Public Health, 8*(9), 3528-3552. https://doi.org/10.3390/ijerph8093528

Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet addiction: a systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design, 20*(25), 4026-4052. https://doi.org/10.2174/13816128113199990617

Lam, K. S., & Aman, M. G. (2007). The Repetitive Behavior Scale-Revised: independent validation in individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 37*(5), 855-866. https://doi.org/10.1007/s10803-006-0213-z

Lam, K. S., Bodfish, J. W., & Piven, J. (2008). Evidence for three subtypes of repetitive behavior in autism that differ in familiality and association with other symptoms. *Journal of Child Psychology and Psychiatry, 49*(11), 1193-1200. https://doi.org/10.1111/j.1469-7610.2008.01944.x

Lamborn, S. D., Mounts, N. S., Steinberg, L., & Dornbusch, S. M. (1991). Patterns of competence and adjustment among adolescents from authoritative, authoritarian, indulgent, and neglectful families. *Child Development, 62*(5), 1049-1065. https://doi.org/10.2307/1131151

Lanovaz, M. J. (2011). Towards a comprehensive model of stereotypy: Integrating operant and neurobiological interpretations. *Research in Developmental Disabilities, 32*(2), 447-455. https://doi.org/10.1016/j.ridd.2010.12.026

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

Lederman, N. G., & O'Malley, M. (1990). Students' perceptions of tentativeness in science: Development, use, and sources of change. *Science Education, 74*(2), 225-239. https://doi.org/10.1002/sce.3730740207

Lee, K. J., & Carlin, J. B. (2017). Multiple imputation in the presence of non-normal data. *Statistics in Medicine, 36*(4), 606-617. https://doi.org/10.1002/sim.7173

Leekam, S. R., Prior, M. R., & Uljarevic, M. (2011). Restricted and repetitive behaviors in autism spectrum disorders: a review of research in the last decade. *Psychological Bulletin, 137*(4), 562-593. https://doi.org/10.1037/a0023341

Leekam, S., Tandos, J., McConachie, H., Meins, E., Parkinson, K., Wright, C., ... & Couteur, A. L. (2007). Repetitive behaviours in typically developing 2-year-olds. *Journal of Child Psychology and Psychiatry, 48*(11), 1131-1138. https://doi.org/10.1111/j.1469-7610.2007.01778.x

Leppink, J. (2018). Analysis of Covariance (ANCOVA) vs. Moderated Regression (MODREG): Why the interaction matters. *Health Professions Education*, 4(3), 225-232. https://doi.org/10.1016/j.hpe.2018.04.001

Leys, C., Klein, O., Dominicy, Y., & Ley, C. (2013). Detecting multivariate outliers: Use a robust variant of the Mahalanobis distance. *Journal of Experimental Social Psychology, 74*, 150-156. doi: 10.1016/j.jesp.2017.09.011

Liao, T (2002). *Statistical group comparison.* United States: John Wiley & Sons, Inc

Lidstone, J., Uljarević, M., Sullivan, J., Rodgers, J., McConachie, H., Freeston, M., ... & Leekam, S. (2014). Relations among restricted and repetitive behaviors, anxiety and sensory features in children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *8*(2), 82-92. https://doi.org/10.1016/j.rasd.2013.10.001

Lin, L. Y., Sidani, J. E., Shensa, A., Radovic, A., Miller, E., Colditz, J. B., ... & Primack, B. A. (2016). Association between social media use and depression among US young adults. *Depression and Anxiety, 33*(4), 323-331. https://doi.org/10.1002/da.22466

Livingstone, S., & Helsper, E. J. (2008). Parental mediation of children's internet use. *Journal of Broadcasting & Electronic Media, 52*(4), 581-599. https://doi.org/10.1080/08838150802437396

Looney, S. W. (1995). How to use tests for univariate normality to assess multivariate normality. *The American Statistician, 49*(1), 64-70. doi: 10.1080/00031305.1995.10476117

Lovaas, I., Newsom, C., & Hickman, C. (1987). Self-stimulatory behavior and perceptual reinforcement. *Journal of Applied Behavior Analysis*, *20*(1), 45-68. https://doi.org/10.1901/jaba.1987.20-45

MacMullin, J. A., Lunsky, Y., & Weiss, J. A. (2016). Plugged in: Electronics use in youth and young adults with autism spectrum disorder. *Autism, 20*(1), 45-54. https://doi.org/10.1177/1362361314566047

Mandy, W. P., Charman, T., & Skuse, D. H. (2012). Testing the construct validity of proposed criteria for DSM-5 autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(1), 41-50. https://doi.org/10.1016/j.jaac.2011.10.013

Matson, J. L., & Goldin, R. L. (2013). Comorbidity and autism: Trends, topics and future directions. *Research in Autism Spectrum Disorders, 7*(10), 1228-1233. https://doi.org/10.1016/j.rasd.2013.07.003

Matson, J. L., & Kozlowski, A. M. (2011). The increasing prevalence of autism spectrum disorders. *Research in Autism Spectrum Disorders*, *5*(1), 418-425. https://doi.org/10.1016/j.rasd.2010.06.004

Mayes, S. D., & Calhoun, S. L. (2011). Impact of IQ, age, SES, gender, and race on autistic symptoms. *Research in Autism Spectrum Disorders, 5*(2), 749-757. https://doi.org/10.1016/j.rasd.2010.09.002

Mazurek, M. O., & Engelhardt, C. R. (2013a). Video game use in boys with autism spectrum disorder, ADHD, or typical development. *Pediatrics, 132*(2), 260-266. https://doi.org/10.1542/peds.2012-3956

Mazurek, M. O., & Engelhardt, C. R. (2013b). Video game use and problem behaviors in boys with autism spectrum disorders. *Research in Autism Spectrum Disorders, 7*(2), 316-324. https://doi.org/10.1016/j.rasd.2012.09.008

Mazurek, M. O., Engelhardt, C. R., Hilgard, J., & Sohl, K. (2016). Bedtime electronic media use and sleep in children with autism spectrum disorder. *Journal of Developmental & Behavioral Pediatrics, 37*(7), 525-531. https://doi.org/10.1097/dbp.0000000000000314

Mazurek, M. O., Shattuck, P. T., Wagner, M., & Cooper, B. P. (2012). Prevalence and correlates of screen-based media use among youths with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 42*(8), 1757-1767. https://doi.org/10.1007/s10803-011-1413-8

Mazurek, M. O., & Wenstrup, C. (2013). Television, video game and social media use among children with ASD and typically developing siblings. *Journal of Autism and Developmental Disorders, 43*(6), 1258-1271. https://doi.org/10.1007/s10803-012-1659-9

McCoy, S. M., Jakicic, J. M., & Gibbs, B. B. (2016). Comparison of obesity, physical activity, and sedentary behaviors between adolescents with autism spectrum disorders and without. *Journal of Autism and Developmental Disorders, 46*(7), 2317-2326. https://doi.org/10.1007/s10803-016-2762-0

McHugh, R. K., Sugarman, D. E., Kaufman, J. S., Park, S., Weiss, R. D., & Greenfield, S. F. (2014). Readability of self-report alcohol misuse measures. *Journal of Studies on Alcohol and Drugs, 75*(2), 328-334. https://doi.org/10.15288/jsad.2014.75.328

McManus, B. M., Mandic, C. G., Carle, A. C., & Robert, S. A. (2012). The effect of parent–child function on physical activity and television viewing among adolescents with and without special healthcare needs. *International Journal of Disability, Development and Education, 59*(3), 305-319. https://doi.org/10.1080/1034912x.2012.697749

McNeish, D. (2017). Missing data methods for arbitrary missingness with small samples. *Journal of Applied Statistics*, *44*(1), 24-39. https://doi.org/10.1080/02664763.2016.1158246

Media (n.d.). In *Merriam-Webster's online dictionary.* Retrieved from https://www.merriam-webster.com/dictionary/media

Media Technology Monitor (2016a). *Figure 5.5.8 Mobile device penetration* [Figure]. Retrieved from https://crtc.gc.ca/eng/publications/reports/policymonitoring/2017/cmr5.htm#f558

Media Technology Monitor (2016b). *Figure 4.2.16 Average number of hours Canadians watched traditional television (2011-2012 through 2015-2016 broadcast years) and Internet television (2010 to 2016)* [Figure]. Retrieved from https://crtc.gc.ca/eng/publications/reports/policymonitoring/2017/cmr4.htm#s42

Mendes, M., & Pala, A. (2003). Type I error rate and power of three normality tests. *Pakistan Journal of Information and Technology*, *2*(2), 135-139. https://doi.org/10.3923/itj.2003.135.139

Montes, G. (2016). Children with autism spectrum disorder and screen time: Results from a large, nationally representative US study. *Academic Pediatrics, 16*(2), 122-128. https://doi.org/10.1016/j.acap.2015.08.007

Moss, J., Howlin, P., Magiati, I., & Oliver, C. (2012). Characteristics of autism spectrum disorder in Cornelia de Lange syndrome. *Journal of Child Psychology and Psychiatry, 53*(8), 883-891. https://doi.org/10.1111/j.1469-7610.2012.02540.x

Mous, S. E., Overwater, I. E., Gato, R. V., Duvekot, J., Leontine, W., Lequin, M. H., ... & Dieleman, G. C. (2018). Cortical dysplasia and autistic trait severity in children with Tuberous Sclerosis Complex: a clinical epidemiological study. *European Child & Adolescent Psychiatry*, *27*(6), 753-765. https://doi.org/10.1007/s00787-017-1066-z

Must, A., Phillips, S. M., Curtin, C., Anderson, S. E., Maslin, M., Lividini, K., & Bandini, L. G. (2014). Comparison of sedentary behaviors between children with autism spectrum disorders and typically developing children. *Autism, 18*(4), 376-384. https://doi.org/10.1177/1362361313479039

Nally, B., Houlton, B., & Ralph, S. (2000). Researches in brief: The management of television and video by parents of children with autism. *Autism*, *4*(3), 331-337. https://doi.org/10.1177/1362361300004003008

Nathanson, A. I. (1999). Identifying and explaining the relationship between parental mediation and children's aggression. *Communication Research*, *26*(2), 124-143. https://doi.org/10.1177/009365099026002002

Nevski, E., & Siibak, A. (2016). The role of parents and parental mediation on 0–3-year olds' digital play with smart devices: Estonian parents' attitudes and practices. *Early Years*, *36*(3), 227-241. https://doi.org/10.1080/09575146.2016.1161601

Nguyen, C. D., Carlin, J. B., & Lee, K. J. (2017). Model checking in multiple imputation: an overview and case study. *Emerging Themes in Epidemiology, 14*(1), 8-. https://doi.org/10.1186/s12982-017-0062-6

Nikken, P., & Jansz, J. (2006). Parental mediation of children's videogame playing: A comparison of the reports by parents and children. *Learning, Media and Technology, 31*(2), 181-202. https://doi.org/10.1080/17439880600756803

Nikken, P., & Jansz, J. (2014). Developing scales to measure parental mediation of young children's internet use. *Learning, Media and Technology*, *39*(2), 250-266. https://doi.org/10.1080/17439884.2013.782038

Notten, N., Kraaykamp, G., & Konig, R. P. (2012). Family media matters: unraveling the intergenerational transmission of reading and television tastes. *Sociological Perspectives*, *55*(4), 683-706. https://doi.org/10.1525/sop.2012.55.4.683

Odom, S. L., Thompson, J. L., Hedges, S., Boyd, B. A., Dykstra, J. R., Duda, M. A., ... & Bord, A. (2015). Technology-aided interventions and instruction for adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*(12), 3805-3819. https://doi.org/10.1007/s10803-014-2320-6

Ok, M. W. (2018). Use of iPads as assistive technology for students with disabilities. *TechTrends, 62*(1), 95-102. https://doi.org/10.1007/s11528-017-0199-8

Orsmond, G. I., & Kuo, H. Y. (2011). The daily lives of adolescents with an autism spectrum disorder: Discretionary time use and activity partners. *Autism, 15*(5), 579-599. https://doi.org/10.1177/1362361310386503

Ontario Ministry of Education (2006). *The Ontario curriculum grades 1-8: Language (revised).* Retrieved from http://www.edu.gov.on.ca/eng/curriculum/elementary/language18currb.pdf

Osborne, J. W. (2013). *Best practices in data cleaning: A complete guide to everything you need to do before and after collecting your data.* Thousand Oaks, CA: Sage Publications Inc.

Ouellette-Kuntz, H., Coo, H., Lam, M., Breitenbach, M. M., Hennessey, P. E., Jackman, P. D., ... & Chung, A. M. (2014). The changing prevalence of autism in three regions of Canada. *Journal of Autism and Developmental Disorders, 44*(1), 120-136.

Ozonoff, S., Iosif, A. M., Young, G. S., Hepburn, S., Thompson, M., Colombi, C., ... & Rogers, S. J. (2011). Onset patterns in autism: correspondence between home video and parent report. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(8), 796-806. https://doi.org/10.1016/j.jaac.2011.03.012

Perry, A., Taheri, A., Ting, V., & Weiss, J. A. (2015). The GO4KIDDS Brief Adaptive Scale. *Journal of Applied Research in Intellectual Disabilities, 28*(6), 594-597. doi: 10.1111/jar.12143.

Peters, S. U., Horowitz, L., Barbieri-Welge, R., Taylor, J. L., & Hundley, R. J. (2012). Longitudinal follow-up of autism spectrum features and sensory behaviors in Angelman syndrome by deletion class. *Journal of Child Psychology and Psychiatry, 53*(2), 152-159. https://doi.org/10.1111/j.1469-7610.2011.02455.x

Petrina, N., Carter, M., & Stephenson, J. (2014). The nature of friendship in children with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 8*(2), 111-126. https://doi.org/10.1016/j.rasd.2013.10.016

Pituch, K. A., & Stevens, J. P. (2016). *Applied multivariate statistics for the social sciences* (6th ed.). New York, NY: Routledge.

Raacke, J., & Bonds-Raacke, J. (2008). MySpace and Facebook: Applying the uses and gratifications theory to exploring friend-networking sites. *Cyberpsychology & Behavior*, *11*(2), 169-174. https://doi.org/10.1089/cpb.2007.0056

Raghunathan, T. (2016). *Missing data analysis in practice.* Boca Raton, FL: CRC Press Taylor & Francis Group

Rapp, J. T., & Vollmer, T. R. (2005). Stereotypy I: A review of behavioral assessment and treatment. *Research in Developmental Disabilities*, *26*(6), 527-547. https://doi.org/10.1016/j.ridd.2004.11.005

Rao, P. A., & Landa, R. J. (2014). Association between severity of behavioral phenotype and comorbid attention deficit hyperactivity disorder symptoms in children with autism spectrum disorders. *Autism*, *18*(3), 272-280. https://doi.org/10.1177/1362361312470494

Realmoto, G. M. (2015). Autism Spectrum Disorder: Diagnostic considerations. In S. H. Fatemi (Eds.) *Contemporary clinical neuroscience: The molecular basis of autism* (pp. 15-21). New York, NY: Springer

Reese, R. M., Richman, D. M., Belmont, J. M., & Morse, P. (2005). Functional characteristics of disruptive behavior in developmentally disabled children with and without autism. *Journal of Autism and Developmental Disorders*, *35*(4), 419-428. https://doi.org/10.1007/s10803-005-5032-0

Richler, J., Bishop, S. L., Kleinke, J. R., & Lord, C. (2007). Restricted and repetitive behaviors in young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *37*(1), 73-85. https://doi.org/10.1007/s10803-006-0332-6

Richler, J., Huerta, M., Bishop, S. L., & Lord, C. (2010). Developmental trajectories of restricted and repetitive behaviors and interests in children with autism spectrum disorders. *Development and Psychopathology*, *22*(1), 55-69. https://doi.org/10.1017/s0954579409990265

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). *Generation M 2: Media in the lives of 8-to 18-year-olds.* Retrieved from Henry J. Kaiser Family Foundation website: https://kaiserfamilyfoundation.files.wordpress.com/2013/04/8010.pdf

Robbins, L. C. (1963). The accuracy of parental recall of aspects of child development and of child rearing practices. *The Journal of Abnormal and Social Psychology*, *66*(3), 261-270. https://doi.org/10.1037/h0049084

Roberts, D. F., Foehr, U. G., & Rideout, V. (2005). *Generation M: Media in the lives of 8-to 18-year-olds*. Retrieved from Henry J. Kaiser Family Foundation website: https://kaiserfamilyfoundation.files.wordpress.com/2013/01/generation-m-media-in-the-lives-of-8-18-year-olds-report.pdf

Rodriguez, B. F., Bruce, S. E., Pagano, M. E., & Keller, M. B. (2005). Relationships among psychosocial functioning, diagnostic comorbidity, and the recurrence of generalized anxiety disorder, panic disorder, and major depression. *Journal of Anxiety Disorders*, *19*(7), 752-766. https://doi.org/10.1016/j.janxdis.2004.10.002

Rodriguez, N. M., Thompson, R. H., Schlichenmeyer, K., & Stocco, C. S. (2012). Functional analysis and treatment of arranging and ordering by individuals with an autism spectrum disorder. *Journal of Applied Behavior Analysis*, *45*(1), 1-22. https://doi.org/10.1901/jaba.2012.45-1

Rodriguez, N. M., Thompson, R. H., Stocco, C. S., & Schlichenmeyer, K. (2013). Arranging and ordering in autism spectrum disorder: Characteristics, severity, and environmental correlates. *Journal of Intellectual & Developmental Disability, 38*(3), 242-255. https://doi.org/10.3109/13668250.2013.812192

Romeu, J. L., & Ozturk, A. (1993). A comparative study of goodness-of-fit tests for multivariate normality. *Journal of Multivariate Analysis, 46*(2), 309-334. https://doi.org/10.1006/jmva.1993.1063

Rothbaum, F., & Weisz, J. R. (1994). Parental caregiving and child externalizing behavior in nonclinical samples: A meta-analysis. *Psychological Bulletin, 116*(1), 55-74. https://doi.org/10.1037//0033-2909.116.1.55

Ruxton, G. D., Wilkinson, D. M., & Neuhäuser, M. (2015). Advice on testing the null hypothesis that a sample is drawn from a normal distribution. *Animal Behaviour, 107*, 249-252. https://doi.org/10.1016/j.anbehav.2015.07.006

Salbach-Andrae, H., Klinkowski, N., Lenz, K., & Lehmkuhl, U. (2009). Agreement between youth-reported and parent-reported psychopathology in a referred sample. *European Child & Adolescent Psychiatry, 18*(3), 136-143. https://doi.org/10.1007/s00787-008-0710-z

Samuels, P. (2015). *Advice on reliability analysis for small samples.* Retrieved from https://www.researchgate.net/publication/280936182_Advice_on_Reliability_Analysis_with_Small_Samples/link/56cf2acd08aeb52500c9854e/download

Schafer, J. L. (1999). Multiple imputation: a primer. *Statistical Methods in Medical Research, 8*(1), 3-15. https://doi.org/10.1177/096228029900800102

Scott, F. J., Baron-Cohen, S., Bolton, P., & Brayne, C. (2002). The CAST (Childhood Asperger Syndrome Test) Preliminary development of a UK screen for mainstream primary-school-age children. *Autism, 6*(1), 9-31. https://doi.org/10.1177/1362361302006001003

Sevin, J. A., Rieske, R. D., & Matson, J. L. (2015). A review of behavioral strategies and support considerations for assisting persons with difficulties transitioning from activity to activity. *Review Journal of Autism and Developmental Disorders, 2*(4), 329-342. https://doi.org/10.1007/s40489-015-0056-7

Shane, H. C., & Albert, P. D. (2008). Electronic screen media for persons with autism spectrum disorders: Results of a survey. *Journal of Autism and Developmental Disorders, 38*(8), 1499-1508. https://doi.org/10.1007/s10803-007-0527-5

Shankar, P. R., Davenport, M. S., Woolen, S. A., Carlos, R. C., & Maturen, K. E. (2018). Survey research: a primer for the academic radiologist. *Academic Radiology, 25*(6), 751-756. https://doi.org/10.1016/j.acra.2018.02.003

Sheldon, P., & Bryant, K. (2016). Instagram: Motives for its use and relationship to narcissism and contextual age. *Computers in Human Behavior, 58*, 89-97. https://doi.org/10.1016/j.chb.2015.12.059

Shingala, M. C., & Rajyaguru, A. (2015). Comparison of post hoc tests for unequal variance. *International Journal of New Technologies in Science and Engineering*, *2*(5), 22-33. Retrieved from http://www.ijntse.com/upload/1447070311130.pdf

Sidhu, S. S., Gwynette, M. F., & Veenstra-VanderWeele, J. M. (2016). 46.0 Will you friend me? Understanding the complex interplay between social media, online gaming, and technology in autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *55*(10), S70. https://doi.org/10.1016/j.jaac.2016.07.712

Skinner, B. F. (1963). Operant behavior. *American Psychologist, 18*(8), 503-515. https://doi.org/10.1037/h0045185

Slater, M. D. (2003). Alienation, aggression, and sensation seeking as predictors of adolescent use of violent film, computer, and website content. *Journal of Communication, 53*(1), 105-121. https://doi.org/10.1093/joc/53.1.105

Slater, M. D., Henry, K. L., Swaim, R. C., & Anderson, L. L. (2003). Violent media content and aggressiveness in adolescents: A downward spiral model. *Communication Research, 30*(6), 713-736. https://doi.org/10.1177/0093650203258281

Spiker, M. A., Lin, C. E., Van Dyke, M., & Wood, J. J. (2012). Restricted interests and anxiety in children with autism. *Autism, 16*(3), 306-320. https://doi.org/10.1177/1362361311401763

So, R., Makino, K., Fujiwara, M., Hirota, T., Ohcho, K., Ikeda, S., ... & Inagaki, M. (2017). The prevalence of Internet addiction among a Japanese adolescent psychiatric clinic sample with autism spectrum disorder and/or attention-deficit hyperactivity disorder: a cross-sectional study. *Journal of Autism and Developmental Disorders, 47*(7), 2217-2224. https://doi.org/10.1007/s10803-017-3148-7

Sofronoff, K., Attwood, T., & Hinton, S. (2005). A randomised controlled trial of a CBT intervention for anxiety in children with Asperger syndrome. *Journal of Child Psychology and Psychiatry, 46*(11), 1152-1160. https://doi.org/10.1111/j.1469-7610.2005.00411.x

Soke, G. N., Philofsky, A., Diguiseppi, C., Lezotte, D., Rogers, S., & Hepburn, S. (2011). Longitudinal changes in scores on the Autism Diagnostic Interview—Revised (ADI-R) in

pre-school children with autism: Implications for diagnostic classification and symptom stability. *Autism, 15*(5), 545-562. https://doi.org/10.1177/1362361309358332

Starcevic, V., Billieux, J., & Schimmenti, A. (2018). Selfitis and behavioural addiction: A plea for terminological and conceptual rigour. *Australian & New Zealand Journal of Psychiatry, 52*(10), 919-920. https://doi.org/10.1177/0004867418797442

Storch, E. A., Arnold, E. B., Jones, A. M., Ale, C. M., Wood, J. J., Ehrenreich-May, J., ... & Murphy, T. K. (2012). The role of co-occurring disruptive behavior in the clinical presentation of children and adolescents with anxiety in the context of autism spectrum disorders. *Child Psychiatry & Human Development, 43*(5), 734-746. https://doi.org/10.1007/s10578-012-0294-1

Stratis, E. A., & Lecavalier, L. (2013). Restricted and repetitive behaviors and psychiatric symptoms in youth with autism spectrum disorders. *Research in Autism Spectrum Disorders, 7*(6), 757-766. https://doi.org/10.1016/j.rasd.2013.02.017

Szatmari, P., Georgiades, S., Bryson, S., Zwaigenbaum, L., Roberts, W., Mahoney, W., ... & Tuff, L. (2006). Investigating the structure of the restricted, repetitive behaviours and interests domain of autism. *Journal of Child Psychology and Psychiatry, 47*(6), 582-590. https://doi.org/10.1111/j.1469-7610.2005.01537.x

Szatmari, P., Georgiades, S., Duku, E., Bennett, T. A., Bryson, S., Fombonne, E., ... & Volden, J. (2015). Developmental trajectories of symptom severity and adaptive functioning in an inception cohort of preschool children with autism spectrum disorder. *JAMA Psychiatry, 72*(3), 276-283. https://doi.org/10.1001/jamapsychiatry.2014.2463

Szatmari, P., Liu, X. Q., Goldberg, J., Zwaigenbaum, L., Paterson, A. D., Woodbury-Smith, M., ... & Thompson, A. (2012). Sex differences in repetitive stereotyped behaviors in autism:

implications for genetic liability. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 159*(1), 5-12. https://doi.org/10.1002/ajmg.b.31238

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Pearson Education Inc.

Taylor, J. L., & Seltzer, M. M. (2011). Employment and post-secondary educational activities for young adults with autism spectrum disorders during the transition to adulthood. *Journal of Autism and Developmental Disorders,* 41(5), 566-574. https://doi.org/10.1007/s10803-010-1070-3

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. https://doi.org/10.1111/jlme.12200

Thelen, E. (1981). Rhythmical behavior in infancy: An ethological perspective. *Developmental Psychology, 17*(3), 237. https://doi.org/10.1037//0012-1649.17.3.237

Tomczak, M., Tomczak, E., Kleka, P., & Lew, R. (2014). Using power analysis to estimate appropriate sample size. *Trends in Sport Sciences*, *21*(4) 195-206.

Turner, M. (1999). Annotation: Repetitive behaviour in autism: A review of psychological research. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 40*(6), 839-849. https://doi.org/10.1017/s0021963099004278

Valkenburg, P. M., Krcmar, M., Peeters, A. L., & Marseille, N. M. (1999). Developing a scale to assess three styles of television mediation:"Instructive mediation,""restrictive mediation," and "social coviewing". *Journal of Broadcasting & Electronic Media, 43*(1), 52-66. https://doi.org/10.1080/08838159909364474

Valkenburg, P. M., & Vroone, M. (2004). Developmental changes in infants' and toddlers' attention to television entertainment. *Communication Research, 31*(3), 288-311. https://doi.org/10.1177/0093650204263435

Van Rooij, A., & Prause, N. (2014). A critical review of "Internet addiction" criteria with suggestions for the future. *Journal of Behavioral Addictions, 3*(4), 203-213. https://doi.org/10.1556/jba.3.2014.4.1

van Steensel, F. J., Bögels, S. M., & Perrin, S. (2011). Anxiety disorders in children and adolescents with autistic spectrum disorders: a meta-analysis. *Clinical Child and Family Psychology Review, 14*(3), 302-317. https://doi.org/10.1007/s10567-011-0097-0

Venter, A., Lord, C., & Schopler, E. (1992). A follow-up study of high-functioning autistic children. *Journal of Child Psychology and Psychiatry, 33*(3), 489-597. https://doi.org/10.1111/j.1469-7610.1992.tb00887.x

Vercruyssen, A. (2014). Costs and benefits of reaching parents for survey participation through school communication systems: testing the potential of a straightforward convenience sample. *Survey Methods: Insights from the Field*. Retrieved from https://www.ssoar.info/ssoar/bitstream/handle/document/40740/ssoar-insights-2014-vercruyssen-costs_and_benefits_of_reaching.pdf?sequence=1&isAllowed=y&lnkname=ssoar-insights-2014-vercruyssen-Costs_and_benefits_of_reaching.pdf

Volkmar, F. R., & McPartland, J. C. (2014). From Kanner to DSM-5: Autism as an evolving diagnostic concept. *Annual Review of Clinical Psychology, 10*(1), 193-212.

Volkmar, F. R., Reichow, B., & McPartland, J. (2012). Classification of autism and related conditions: progress, challenges, and opportunities. *Dialogues in Clinical Neuroscience, 14*(3), 229-237.

von Hippel, P. T. (2013). Should a normal imputation model be modified to impute skewed variables? *Sociological Methods & Research*, *42*(1), 105-138. https://doi.org/10.1177/0049124112464866

Watson, K. K., Miller, S., Hannah, E., Kovac, M., Damiano, C. R., Sabatino-DiCrisco, A., ... & Dichter, G. S. (2015). Increased reward value of non-social stimuli in children and adolescents with autism. *Frontiers in Psychology*, *6*, 1026. https://doi.org/10.3389/fpsyg.2015.01026

Weissgerber, T. L., Milic, N. M., Winham, S. J., & Garovic, V. D. (2015). Beyond bar and line graphs: time for a new data presentation paradigm. *PLoS biology*, *13*(4), e1002128. https://doi.org/10.1371/journal.pbio.1002128

White, S. W., Scahill, L., Klin, A., Koenig, K., & Volkmar, F. R. (2006). Educational placements and service use patterns of individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 37*(8), 1403-1412. https://doi.org/10.1007/s10803-006-0281-0

Wilcox, R. R. (2017). *Introduction to robust estimation and hypothesis testing* (4th ed.). San Diego, CA: Academic Press

Williams, J., Scott, F., Stott, C., Allison, C., Bolton, P., Baron-Cohen, S., & Brayne, C. (2005). The CAST (childhood asperger syndrome test) test accuracy. *Autism, 9*(1), 45-68. https://doi.org/10.1177/1362361305049029

Williams, J., Allison, C., Scott, F., Stott, C., Bolton, P., Baron-Cohen, S., & Brayne, C. (2006). The Childhood Asperger Syndrome Test (CAST) Test–retest reliability. *Autism, 10*(4), 415-427. https://doi.org/10.1177/1362361306066612

Widyanto, L., & Griffiths, M. (2006). 'Internet addiction': a critical review. *International Journal of Mental Health and Addiction, 4*(1), 31-51. https://doi.org/10.1007/s11469-006-9009-9

World Health Organization (2018). *International classification of diseases and related health problems* (11th rev., ICD-11). Geneva, Switzerland: Author.

Wolff, S. (2004). The history of autism. *European Child & Adolescent Psychiatry, 13*(4), 201-208. https://doi.org/10.1007/s00787-004-0363-5

Wolff, J. J., Hupp, S. C., & Symons, F. J. (2013). Brief report: Avoidance extinction as treatment for compulsive and ritual behavior in autism. *Journal of Autism and Developmental Disorders, 43*(7), 1741-1746. https://doi.org/10.1007/s10803-012-1721-7

Wong, C., Odom, S. L., Hume, K. A., Cox, A. W., Fettig, A., Kucharczyk, S., ... & Schultz, T. R. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders, 45*(7), 1951-1966. https://doi.org/10.1007/s10803-014-2351-z

Young, K. S. (1998). Internet addiction: The emergence of a new clinical disorder. *Cyberpsychology & Behavior, 1*(3), 237-244. https://doi.org/10.1089/cpb.1998.1.237

Young, K. S. (2004). Internet addiction: A new clinical phenomenon and its consequences. *American Behavioral Scientist, 48*(4), 402-415. https://doi.org/10.1177/0002764204270278

APPENDICES

Appendix A

Demographics Questionnaire

In this survey you will be asked questions about your child. If you have more than one child, please report on the child that is (a) between the ages of **4 - 11** and (b) considered to use more electronic media than their siblings on an average day. If more than one of your children meet the above criteria, **select only one child** and keep only that child in mind when completing the questionnaires.

1. Your primary country of residence:_____ [If not Canada→redirect to end of survey]
2. What age is the child you will be reporting on? _____ [If not between 4 to 11→ redirect to end of survey]
3. Has your child used an electronic media device within the last 30 days? [If NO→ redirect to end of survey]

☐ YES ☐ NO

4. Has your child undergone a therapeutic intervention conducted by a mental health professional (e.g., Clinical Psychologist, Psychiatrist, Applied Behaviour Therapist, Social Worker) meant to decrease the amount of time they spend on media devices? [If YES→redirect to end of survey]

☐ YES ☐ NO

Please fill out the following survey as completely and honestly as possible. Your time and information is much appreciated.

1. Your age: _____

2. Your gender: _____

3. What is your relation to the child?
☐ Birth parent
☐ Step parent

☐ Adoptive parent
☐ Foster parent
☐ Custodial relative (e.g., grandparent, uncle, aunt)
☐ Other *please specify* _____
☐ prefer not to answer

4. Do you have more than one child? ☐ YES ☐ NO

5. How many children do you have in addition to the child you are reporting on? _____

6. For each child, provide his or her age and whether or not they have been diagnosed with Autism Spectrum Disorder:

☐ First child age _____ Autism Spectrum Disorder Diagnosis: ☐ No ☐Yes
☐ Second child age _____ Autism Spectrum Disorder Diagnosis: ☐ No ☐Yes
☐ Third child age _____ Autism Spectrum Disorder Diagnosis: ☐ No ☐Yes
☐ Fourth child age _____ Autism Spectrum Disorder Diagnosis: ☐ No ☐Yes
☐ More than four children: If checked, please indicated the birth order of these children, their age, and if they have a diagnosis of Autism Spectrum Disorder using the format above (e.g., Fifth child/15/Yes):
_____
_____
_____
_____

7. Which ethnic background best describes you?
☐ Aboriginal/Indigenous/First Nations (e.g., Inuit, Metis, North American Indian)
☐ Arab/Middle Eastern (e.g., Egyptian, Iranian, Lebanese)
☐ Black (e.g., African, Haitian, Jamaican, Somali)
☐ East Asian (e.g., Chinese, Japanese, Korean)
☐ Hispanic/Latino (e.g., Mexican, Cuban, Brazilian)
☐ South Asian (e.g., Pakistani, Indian, Bangladeshi)
☐ White (European or European Descent)
☐ Other *please specify* _____
☐ prefer not to answer
8. What languages are spoken in the home? _____
9. Have you ever been diagnosed by a psychologist or psychiatrist with the following (check all that apply):
   ☐ Specific Learning Disorder: Reading (Dyslexia)
   ☐ Intellectual Disability

☐ A Neurocognitive Disorder (e.g., Alzheimer's Disease, Dementia); If checked please indicate what kind:_____

☐ A Genetic Syndrome (e.g., Angelman Syndrome, Rett's Disease, Neurofibiromatosis Type 1); If checked please indicate what kind:_____

☐ A Medical Disorder (e.g., Fetal Alcohol Spectrum Disorder, Traumatic Brain Injury); If checked please indicate what kind:_____

☐ Autism Spectrum Disorder

☐ A Schizophrenia Spectrum Disorder

☐ A Dissociative Disorder (e.g., Dissociative Amnesia)

☐ An Obsessive Compulsive Spectrum Disorder (e.g., OCD, Skin-picking Disorder, Hair-pulling Disorder)

☐ Major Depression or Depression

☐ Bipolar Disorder

☐ A Substance Use Disorder

☐ Acute Stress Disorder

☐ Other (please specify)_____

☐ I have never been diagnosed with a developmental or psychiatric disorder

☐ prefer not to answer

10. What is your current relationship status?

☐ Single (never married)

☐ Married

☐ Divorced/separated

☐ Common-law

☐ Widowed

☐ In a relationship, but not living together

☐ Other (please specify):_____

☐ prefer not to answer

11. What is your highest education attained:

☐ Less than high school

☐ High school diploma

☐ Some college

☐ College diploma

☐ Some university

☐ University undergraduate degree

☐ Master's degree

☐ Doctoral degree

☐ Not sure
☐ Other
☐ prefer not to answer

12. Please indicate the approximate annual income of your household:

☐ $10, 000 or less
☐ $10, 001 to $20, 000
☐ $20, 001 to $30, 000
☐ $30, 001 to $40, 000
☐ $40, 001 to $50, 000
☐ $50, 001 to $60, 000
☐ $60, 001 to $70, 000
☐ $70, 001 to $80, 000
☐ $80, 001 to $90, 000
☐ $90, 001 and up
☐ prefer not to answer

Reminder: When completing the rest of the survey questions, please keep the following in mind: If you have more than one child, please report on the child that is (a) between the ages of 4 - 11 and (b) considered to use more electronic media than their sibling(s) on an average day. If more than one of your children meet the above criteria, **select only one child** and keep only that child in mind when completing the questionnaires.

About The Child You Are Reporting On

13. Child's age: _____

14. Child's gender: _____

15. Which ethnic background best describes your child?

☐ Aboriginal/Indigenous/First Nations (e.g., Inuit, Metis, North American Indian)
☐ Arab/Middle Eastern (e.g., Egyptian, Iranian, Lebanese)
☐ Black (e.g., African, Haitian, Jamaican, Somali)
☐ East Asian (e.g., Chinese, Japanese, Korean)
☐ Hispanic/Latino (e.g., Mexican, Cuban, Brazilian)
☐ South Asian (e.g., Pakistani, Indian, Bangladeshi)
☐ White (European or European Descent)
☐ Other *please specify* _____
☐ prefer not to answer

16. Do you live with the child you are reporting on?

☐ YES ☐ NO

17. How many days of the week you live with the child you are reporting on?

☐ 1 day ☐ 2 days ☐ 3 days ☐ 4 days ☐ 5 days ☐ 6 days ☐ 7 days

18. Has your child received psychological, psychoeducational, neuropsychological or cognitive testing by a psychologist (e.g., have you ever been interviewed about your child and/or filled out a number of questionnaires/checklists AND has your child completed a number of tasks which helped to identify how he/she thinks and his/her strengths and weakness)?

☐ YES ☐ NO

19. Does your child have any of the following developmental, physical, or psychiatric disorders? Please check all that apply.

☐ Autism Spectrum Disorder

☐ Anxiety Disorder; If checked please indicate what kind:_____

☐ Intellectual Disability or Global Developmental Delay

☐ Attention-Deficit/Hyperactivity Disorder (ADHD or ADD)

☐ Specific Learning Disorder; If checked please indicate what kind:_____

☐ A Genetic Syndrome (e.g., Fragile X syndrome, Prader-Willi syndrome); If checked pleased indicate what kind:_____

☐ A Communication Disorder (e.g., Language Disorder, Social Communication Disorder) If checked please indicate what kind:_____

☐ A Medical Disorder or Condition (e.g., Fetal Alcohol Spectrum Disorder; Pediatric Acute-Onset Neuropsychiatric Syndrome, Traumatic Brain Injury); If checked please indicate what kind:_____

☐ An Obsessive Compulsive Spectrum Disorder (e.g., OCD, Skin-picking Disorder, Hair-pulling Disorder); If checked please indicate what kind:_____

☐ A Disruptive, Impulse-Control, or Conduct Disorder (e.g., Oppositional Defiant Disorder, Intermittent Explosive Disorder); If checked please indicate what kind:_____

☐ Depressive Disorder (e.g., Disruptive Mood Dysregulation Disorder, Major Depression); If checked please indicate what kind:_____

☐ Other *please specify* _____

☐ My child has never been diagnosed with a developmental or psychiatric disorder

20. How does your child best communicate with others?

☐ Spoken language

☐ Sign language

☐ Alternative communication tools (e.g., communication picture books, speech-generating devices)

☐ My child is mostly nonverbal

☐ Other *please specify* _____

If Autism Spectrum Disorder is selected:

21. At what age was your child diagnosed with Autism Spectrum Disorder? _____

22. What professional diagnosed your child with an autism spectrum disorder?

☐ Psychologist

☐ Pediatrician/Family Doctor

☐ Psychiatrist

☐ Other *please specify* _____

23. To the best of your knowledge, are you the only child's parent/guardian to have completed this survey?

 Yes

 No

Appendix B

Media Use Patterns Survey

For each of the following questions, please mark your answers based on what was happening during the **past 30 days.**

1. How many electronic media devices (e.g., smartphones, computers, TVs, iPods) did you have in your household? [Textbox]
2. How many of the household electronic media devices were considered your child's personal media devices? [Textbox]
3. How often did your child use your personal media devices? [Scale = 1 = Never; 2= Less than once a month; 3 = Between once a month and once a week; 4 = Between once a week to several times a week; 5 = Between once a day and several times a day; 6 = Once an hour; 7 = Several times an hour]
4. How often did your child use devices they own or were given for their personal use? (Never to Several times an hour)?
5. How much time **per day on average** did your child spend using both household and personal media devices? (9 pt Likert- *None; 0.5 hour or less; 0.5 to 1.5 hours; 1.5 to 2.5 hours; 2.5 to 3.5 hours; 3.5 to 4.5 hours; 4.5 to 5.5. hours; 5.5. to 6 hours; Greater than 6 hours* [Please specify-Textbox])
   How much time **per day on average** did your child spend using assistive technologies (AT) that need electronic media devices to work? For example: Using a speech app on an iPad to help your child talk to others. (9pt Likert- *None to Greater than 6 hours* [Please specify-Textbox])
6. In the past 30 days, please show how often your child became upset when the device gets moved from its usual position within the house? (Never to Several times an hour)?
   I. If Any Option Other than Not at all: About how long are they upset after noticing the device has been moved? (9 pt Likert- *None; 0.5 hour or less; 0.5 to 1 hours; 1 to 1.5 hours; 1.5 to 2 hours; 2 to 2.5 hours; 2.5 to 3 hours; 3 to 3.5 hours; Greater than 3.5 hours* [Please specify-Textbox])
   II. If Any Option Other than Not at all: Please show how upset they became. [7 pt-Likert-Not at all, Mildly Upset, Mildly to Moderately Upset, Moderately Upset, Moderately to Severely Upset; Severely Upset; Overwhelmingly Upset]

For each of the following questions, please show how often in the **past 30 days** your child did the following behaviours or actions. [Scale = 1 = Never; 2= Less than once a month; 3 = Between once a month and once a week; 4 = Between once a week to several times a week; 5 = Between once a day and several times a day; 6 = Once an hour; 7 = Several times an hour]

7. Ignore or tune out the world around them when the media is on
8. Talk about the media **content** (e.g., characters, an event/scene, an action) to themselves or others in the room

9. Ask repeated questions about the media **content**
10. Ask repeated questions about the media **device**
11. Does your child have one or two media devices that they are highly interested in?
    Examples of some media devices include: TV, computer, and smartphone (YES/NO)
12. Does your child have one or two media content that they are highly interested in?
    Examples of some media devices include: TV episode, and radio show (YES/NO)
13. Refuses to use other media devices and/or get other media content when they do not have access to the one or two media devices and/or content they want.
14. Engage in a routine that involves using, watching, listening, or playing some type of media content
15. Engage in a routine that involves the use of one or more media devices
16. What device is most often involved in the routine?
    a. Smartphones
    b. Computers
    c. Digital Cameras/Video Cameras/Drones
    d. TVs
    e. Tablets
    f. Video game consoles
    g. Virtual reality headsets
    h. Smart home devices (e.g., Amazon Echo, Google Home)
    i. Music devices (stereo/radio/music players)
    j. Smart watches (including wearable fitness trackers)
    k. Streaming devices (e.g., Apple TV/Google Chromecast/etc)
    l. Other; Please Specify:

17. Repeatedly uses the same websites, apps, computer programs
18. Repeatedly watches the same show, movie, or video
19. Repeatedly watches the **same part** of a show, movie, or video
20. Repeatedly plays the same online game, video game, or app
21. Chooses to repeatedly play the **same level** of an online game, video game, or app

22. Repeatedly listens to the same audio media recording (Audio Media Examples: Song, audiobook, podcast, radio show)
23. Repeatedly listens to the **same part** of the audio media recording (Audio Media Examples: Song, audiobook, podcast, radio show)
24. Insists that a media device be on in the background during activities when they are not viewing or using the device
25. Insists on using the **same device** to get media content

Remember to only report on behaviours or actions that you saw your child do within the **past 30 days.**

26. Rocks back and forth, or side to side during the use of a media device
27. Flaps hands or wiggles fingers during the use of a media device (not for the purposes of using the device)
28. Fidgets with the media device (not for the purposes of using the device)
29. Arranges various media devices in rows or patterns while using them
30. Holds the media device up to their face closely and checks it from different angles or from out of the corner of their eye
31. Closely looks at parts of the media device (e.g., buttons, edges, lights, ports)
32. Smells or sniffs the media device
33. Touches, taps, or rubs the surface of the device [not related to using a touch screen]
34. Becomes upset if interrupted when accessing media content or using a media device
    I. About how long are they upset after being interrupted? [9pt Likert- *None to Greater than 3.5 hours*]
    II. About how upset do they become when they are interrupted? [7pt Likert-Not at all to Overwhelmingly Upset]
35. Becomes upset if interrupted when speaking about the media content or a media device.
    I. About how long are they upset after being interrupted? (9 pt Likert- *None* to *Greater than 3.5 hours* [Please specify Textbox])
    II. About how upset do they become when they are interrupted? [7pt Likert-Not at all to Overwhelmingly Upset]

For each of the following questions, please show how often in the **past 30 days** your child did each of the following behaviours or actions. [1 = Never; 2= Less than once a month; 3 = Between once a month and once a week; 4 = Between once a week to several times a week; 5 = Between once a day and several times a day; 6 = Once an hour; 7 = Several times an hour]

36. Repeatedly insists on getting or using their media and/or media devices when they do not have access to it.
37. Refuses to finish a daily routine (For example, breakfast, getting ready for school or bed) without a media device being present
38. Becomes upset when they do not have access to the media content and/or media devices they want.

I. About how long are they upset when they do not have access to the media content and/or media devices they want? (9 pt Likert- None to Greater than 3.5 hours [Please specify Textbox])
II. About how upset do they become when they do not have access to the media content and/or media devices they want? [7pt Likert-Not at all to Overwhelmingly Upset]

For each of the following questions, please show how often in the past 30 days your child did each of the following behaviours. [1 = Never; 2= Less than once a month; 3 = Between once a month and once a week; 4 = Between once a week to several times a week; 5 = Between once a day and several times a day; 6 = Once an hour; 7 = Several times an hour]

39. Will use the media **devices** on their own
    a. How able is your child to use the media devices on their own? [Not at all, Needs a lot of support, Needs some support, Needs a little support, Needs no support]
40. Will access media **content** on their own
    a. How able is your child to access the media content on their own? [Not at all to Needs no support]
41. How long does your child typically require assistance when they are engaged in a media activity (None, Minimal Time, Some of the Time, Most of the Time, Entire Time)
42. For each type of device, please show which behaviours you have seen your child do.

	Smartphone	Computers	TV	Tablets	Videogame Consoles	Handheld videogame devices	Virtual reality headsets	Music Players	Smart Watches	Streaming Devices	Smart home devices
Turn on/off device											
Change device settings (For Example: Sound, picture quality, and/or Wifi connection											
Internet/online searching											
Downloading (For Example: games, music, apps, and/or documents)											
Signing in to a device or electronic account (For Example: Logging on to Gmail or Facebook)											
Starting, pausing, and/or stopping media content											
Finding media content either online or offline											
Uses search features requiring typing/writing											
Uses search features requiring audio recording (e.g., Siri)											
Sending a written message											
Sending a voice message											
Setting up a device for use											
Connecting additional parts or devices to a device (For Example: Plugging in headphones to a computer or music player)											

43. Which media devices is your child most able to use on their own? Please rank the options below starting from 1 (Most skilled). Only rank the devices your child uses.
    a. Smartphone
    b. Computers

c. Digital Cameras/Video Cameras/Drones
d. TVs
e. Tablets
f. Video game consoles
g. Virtual reality headsets
h. Smart home devices (e.g., Amazon Echo, Google Home)
i. Music devices (stereo/radio/music players)
j. Smart watches (including wearable fitness trackers)
k. Streaming devices (e.g., Apple TV/Google Chromecast/etc)

44. Please rank the **top 3** media devices your child used most to access **each type** of **audio** media content using the options below.

For example, if a smartphone is the device you have seen your child use most often to access "Radio Shows", then you would select "smartphone" from the drop down box in the "Most Used" column for this media type. If they use "music players" as a second choice behind smartphones to access "Radio Shows" then select this from the drop down in the "2nd Most Used" column and so on. If your child **did not** access a type of audio media, then **do not rank** a device for that option.

	Most Used	2nd Most Used	3rd Most Used
Radio Shows			
Radio News			
Music			
Podcasts			
Audiobooks			
Other (Please specify):			
Drop Down Options: Smartphone; Computers; TV; Tablets; Videogame Consoles; Handheld videogame devices; Virtual reality headsets; Music Players; Smart Watches; Streaming Devices			

45. Please rank the **top 3** media devices your child used most to access **each type** of **audio-visual** media content using the options below.

For example, if a smartphone is the device you have seen your child use most often to access "Online TV", then you would select "smartphone" from the drop down box in the "Most Used" column for this media type. If they use "Computers" as a second choice behind smartphones to access "Online TV" then select this from the drop down in the "2nd Most Used" column and so on. If your child **did not** access a type of audio-visual media, then **do not** rank a device for that option.

	Most Used	2nd Most Used	3rd Most Used
Traditional TV			
Online TV			
Traditional movies			
Online movies			
Videos			
Traditional for-purchase games			
Game Apps			
Online/Internet Games			
Other (Please specify):			
Drop Down Options: Smartphone; Computers; TV; Digital and Video Cameras/Drones; Tablets; Videogame Consoles; Handheld videogame devices; Virtual reality headsets; Music Players; Smart Watches; Streaming Devices			

46. Please rank the **top 3** media devices your child used most to access **each type** of **visual** media content using the options below.

For example, if a smartphone is the device you have seen your child use most often to access "Images", then you would select "smartphone" from the drop down box in the "Most Used" column for this media type. If they use "Computers" as a second choice behind smartphones to access "Images" then select this from the drop down in the "2nd Most Used" column and so on. If your child **did not** access a type of audio-visual media, then **do not** rank a device for that option.

	Most Used	2nd Most Used	3rd Most Used
Photographs/Images			
Maps			
Writing (For example: Articles)			
Other (Please specify):			
Drop Down Options: Smartphone; Computers; TV; Digital and Video Cameras/Drones; Tablets; Videogame Consoles; Handheld videogame devices; Virtual reality headsets; Music Players; Smart Watches; Streaming Devices			

47. In the past 30 days, about how many minutes ***per day on average*** did your child spend doing these activities? 9 pt Likert-*None to Greater than 6 hours*
    a. Playing alone outside without media devices
    b. Playing alone indoors without media devices
    c. Playing with others outside without media devices
    d. Playing with others indoors without media devices
    e. Reading print media such as books, newspapers, magazines without the use of a media device
    f. Doing school work without the use of a media device
    g. Doing school work with a media device
    h. Chores
    i. Sleep
    j. Accessing electronic audio media such as music, podcasts, radio shows
    k. Accessing electronic audio-visual media such as TV, movies, videos
    l. Accessing electronic visual media such as images or articles
    m. Other:_____
48. Please rank the **top 3** types of **audio** content your child accessed using the first drop -down option. Then use the drop-down options to the right to show **how often** your child accessed the **audio** content.

	Audio Content	How often accessed	If you indicated "other" for content Please Specify:
Most Accessed	Drop Down = a to n	Drop Down = 1 to 7	
2nd Most Accessed			
3rd Most Accessed			
Drop Down Options: Children's stories; Fantasy; History; News; Comedy; Art; Music; Celebrities; Food and drink; Sports; Science; How things work; Technology; Other: please specify			

49. Please rank the **top 3** types of **visual** content your child accessed using the first drop -down option. Then use the drop-down options to the right to show **how often** your child accessed the **visual** content.

	Visual Content	How often accessed	If you indicated "other" for content Please Specify:
Most Accessed	Drop Down = a to n	Drop Down = 1 to 7	
2nd Most Accessed			
3rd Most Accessed			
Drop Down Options: Animals;Celebrities;Landscapes (can be cities or nature);Cartoons, Anime, Manga; Art (For example: sketches, paintings, sculptures, wood carvings); Music (For example: instruments, sheet music, concerts);Plans/Technical Drawings (For example: circuit layout, building plans, device plans);Memes;GIFs (Graphics Interchange Format; Pictures that move briefly without sound);Machines (For example: clocks, computers);Transportation (For example: cars, trucks, trains, airplanes);Food and drink;Science;Other: please specify			

50. Please rank the **top 3** types of **TV and movie** content your child accessed using the first drop -down option. Then use the drop-down options to the right to show **how often** your child accessed the **TV and movie** content.

	TV and Movie Content	How often accessed	If you indicated "other" for content Please Specify:
Most Accessed	Drop Down = a to n	Drop Down = 1 to 7	
2nd Most Accessed			
3rd Most Accessed			
Drop Down Options: Animation/Cartoon; Comedy; Romance; Thriller; News; Mystery; Crime; Action/Adventure; Horror; Sci-Fi/Fantasy; Drama; Documentary; Reality TV; Game Show; Sports; Other			

51. Please rank the **top 3** types of **video** content your child accessed using the first drop -down option. Then use the drop-down options to the right to show **how often** your child accessed the **video** content.

	Video Content	How often accessed	If you indicated "other" for content Please Specify:
Most Accessed	Drop Down = a to n	Drop Down = 1 to 7	
2nd Most Accessed			
3rd Most Accessed			
Drop Down Options: Animation/Cartoon;Science;Instructional/Do it yourself;Movie/TV clips, trailers;Videogame information, trailers, game play;Reviews;Home videos;Vlogs;Music videos;Comedy;Animals;Sports;News;Video compilations;Food and drink;Other			

52. Please rank the **top 3** types of **video game** content your child accessed using the first drop -down option. Then use the drop-down options to the right to show **how often** your child accessed the **video game** content.

	Video Game Content	How often accessed	If you indicated "other" for content Please Specify:

Most Accessed	Drop Down = a to n	Drop Down = 1 to 7	
2nd Most Accessed			
3rd Most Accessed			
Drop Down Options: Action; Adventure; Education/Learning; Fighting; Fitness/Exergames; Music; Dance; Platform; Puzzle; Racing; Role-playing; Shooter; Simulation; Sports; Strategy; Idle; Other			

53. Please rank the **top 3** types of **website-based or free Internet games** content your child accessed using the first drop -down option. Then use the drop-down options to the right to show **how often** your child accessed the **website-based or free Internet games** content.

	Website-based or free Internet games content	How often accessed	If you indicated "other" for content Please Specify:
Most Accessed	Drop Down = a to n	Drop Down = 1 to 7	
2nd Most Accessed			
3rd Most Accessed			
Drop Down Options: Action; Adventure; Education/Learning; Fighting; Fitness/Exergames; Music; Dance; Platform; Puzzle; Racing; Role-playing; Shooter; Simulation; Sports; Strategy; Idle; Other			

54. Please show how often your child used electronic media devices to get information about a topic of **their interest**. Only report on topics that were **not researched for school work.**

	Topics	How often accessed	If you indicated "other" for content Please Specify:
Topic of interest 1	Drop Down = a to n	Drop Down = 1 to 7	

Topic of interest 2			
Topic of interest 3			
Drop Down Options: Machines (For example: computers, coffee maker, motors) Gaming (For example: new games, cheats/hacks, game news); Movies/TV (For example: new releases, actors, fan fiction); Celebrities; Historical Figures; Fictional Characters; Music; Science; Animals; Sports; Transportation (For example: trains, cars); News; Health and Fitness; Other: please specify			

VITA AUCTORIS

NAME: Eric Gilliland

PLACE OF BIRTH: Harare, Zimbabwe

YEAR OF BIRTH: 1992

EDUCATION: Molokai High School, Molokai, HI, 2010

University of Saskatchewan, B.A (Hons)., Saskatoon, SK, 2016

University of Windsor, M.A., Windsor, ON, 2019