

Review Article

Evaluating the correlation between early digital device interaction and autism spectrum disorder

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ABSTRACT

The increasing use of digital devices among young children has raised concerns about their potential impact on early childhood development, particularly in relation to autism spectrum disorder (ASD). ASD, a neurodevelopmental disorder characterized by difficulties in social communication, behavior, and restricted interests, affects a growing number of children worldwide. This review explores the mechanisms through which early digital device interaction may influence the development of ASD. Research indicates that excessive screen time can interfere with brain development, particularly in areas related to attention, social processing, and emotional regulation. Overstimulation from fast-paced, visually stimulating content may impair the brain's ability to process social cues, which is a core challenge for children with ASD. Furthermore, digital devices may reduce opportunities for face-to-face interactions, which are critical for developing social communication skills. Although some studies suggest that digital devices, when used appropriately, can offer benefits, such as supporting language acquisition and social skills through educational apps, excessive use may exacerbate existing challenges in children with ASD. This review highlights the need for balanced digital engagement and further research to better understand how digital devices impact the developmental trajectory of children with ASD and to establish guidelines for safe and effective use.

Keywords: Autism spectrum disorder, Digital devices, Early childhood, Social development, Screen time

INTRODUCTION

In the modern digital age, children are exposed to technology at younger ages than ever before, with digital devices such as smartphones, tablets, and computers becoming central to daily life. As a result, the increasing interaction with digital devices by children—particularly

during the formative years of development—has prompted a growing interest in understanding their potential effects on early childhood development. One area of particular concern is the potential correlation between early digital device use and the development of autism spectrum disorder (ASD), a neurodevelopmental condition

characterized by challenges in social communication, behavior, and restricted interests.

ASD affects approximately 1 in 36 children in the United States, according to the Centers for Disease Control and Prevention (2023).¹ The condition is recognized for its broad spectrum of symptoms, which can range from mild social communication challenges to more significant difficulties in engaging with others, often accompanied by repetitive behaviors and rigid thinking patterns. The etiology of ASD remains complex and is thought to involve an interplay between genetic factors and environmental influences. While genetic studies have provided insight into the role of inherited risk factors, the impact of environmental variables—such as prenatal exposures and early childhood experiences—has gained increasing attention in recent years.

Among the various environmental factors under investigation, digital device use has emerged as a topic of particular concern. With the rise of interactive technologies, children today are often exposed to smartphones, tablets, and computers from a very young age. The American Academy of Pediatrics (2016) reports that children between the ages of 2 and 5 years spend, on average, about two hours a day on screens, often engaging with educational apps, video content, and interactive games.^{2,3} While some proponents of digital technology argue that educational apps and digital games can be beneficial for children's learning and development, others express concerns about the impact of excessive screen time on cognitive, emotional, and social development. For children with ASD, these concerns are amplified, as the condition often involves difficulties with social interaction, language development, and attention regulation—all areas that digital devices may affect.

Research examining the correlation between digital device use and ASD is still in its early stages, but the findings are varied. Some studies suggest that excessive screen time can exacerbate the symptoms of ASD, particularly by reducing opportunities for face-to-face social interactions, which are critical for children's social and communication development. These studies argue that the overstimulation and passive nature of screen time may hinder the development of important social and cognitive skills, contributing to the challenges faced by children with ASD.⁴ Conversely, other research suggests that certain types of digital engagement, such as interactive apps designed for children with ASD, may have therapeutic benefits, improving skills like language acquisition, social interaction, and behavior regulation.⁵

The growing prevalence of ASD and the rapid increase in digital device use among young children make this a timely and urgent area of research. Understanding the potential effects of early digital device exposure on children with ASD is crucial for parents, educators, and healthcare providers who are navigating the challenges of raising and supporting children with developmental disorders. This

review aims to explore the existing literature on the correlation between early digital device use and ASD, examining both the potential risks and benefits of digital engagement for children with ASD.

METHODS

This study is based on a comprehensive literature search conducted on 01 December 2024 in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed evaluation of the correlation between early digital device interaction and ASD. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

ASD is a complex neurodevelopmental disorder that affects communication, social interactions, and behavior. The symptoms of ASD typically appear in the early developmental stages of life, with many children showing signs of the condition before the age of three. These signs may include delayed speech development, difficulty with social interactions, a limited range of interests, and repetitive behaviors.

The exact cause of ASD is still not fully understood, but it is believed to arise from a combination of genetic and environmental factors. Genetic studies have identified numerous risk genes associated with ASD, suggesting a hereditary component to the condition.⁶ However, environmental factors, including prenatal factors such as maternal infections or exposure to toxins, may also contribute to the development of ASD. In recent years, there has been growing interest in how environmental factors, such as the increasing use of digital devices in early childhood, may influence the development of neurodevelopmental disorders like ASD.⁷

Early detection of ASD is crucial for implementing effective interventions. Research has shown that the sooner a child is diagnosed and begins receiving therapeutic services, the better their outcomes are likely to be in areas such as language development, social skills, and behavioral regulation.⁸ This makes understanding the factors that influence early development, including digital device use, an important area of research.

The rise of digital devices in early childhood

The use of digital devices by young children has become ubiquitous in modern society. Tablets, smartphones, and other interactive screens are now common household items, and many children begin using these devices as early as 18 months of age. Digital devices have the

potential to serve both educational and entertainment purposes, offering a wide range of applications that claim to promote learning and development. Educational apps, interactive e-books, and digital games are designed to foster cognitive and motor skills, language development, and even social interaction in children.¹⁰ However, the rapid increase in screen time has raised concerns about the impact of digital media on children's physical, cognitive, and social development.

While some researchers argue that digital devices can offer valuable educational benefits, others express concern that excessive screen time may be detrimental to children's development.¹¹ Digital devices often replace activities that are crucial for early childhood development, such as physical play, reading, and face-to-face social interactions. The concern is that these devices may interfere with the development of key social and communication skills, which are critical for children with ASD.

Studies on digital device use and ASD

The relationship between early digital device use and the development or exacerbation of ASD has been a subject of debate in recent years. A number of studies have investigated the correlation between screen time and the likelihood of developing ASD. Some research suggests that increased screen time, particularly with passive media consumption like watching TV or videos, may be associated with an increased risk of social and language delays in young children. One study by Kushima et al found that excessive screen time in toddlers was linked to delays in speech development, which is a core symptom of ASD.¹² Similarly, another study by Christakis et al noted that prolonged exposure to digital screens during the critical developmental window could negatively affect social skills and attention, two areas often impaired in children with ASD.¹³

On the other hand, there is a body of research suggesting that certain types of digital engagement may have positive effects for children, particularly those diagnosed with ASD.¹⁴ For example, studies have shown that interactive apps and games designed specifically for children with ASD can help improve communication skills, social interactions, and even executive functioning (e.g., planning and problem-solving). Further, children with ASD who interacted with educational apps showed improvement in their ability to follow instructions and engage in social role-play scenarios.¹⁵ Such apps provide structured, predictable environments that may appeal to children with ASD, who often struggle with ambiguity and unstructured interactions.

Despite the potential benefits, many studies highlight the potential risks of excessive screen time for young children, particularly those with ASD. Digital devices can overstimulate children, leading to attention difficulties, irritability, and sleep disturbances, all of which can exacerbate the symptoms of ASD.¹⁶ For instance, a study

by Park et al showed that children with ASD who spent more than two hours per day on screens had poorer outcomes in areas like social communication, attention, and executive function. Furthermore, passive screen time, such as watching television or videos, does not promote interactive or reciprocal social engagement, which is critical for children with ASD to develop social and communication skills.¹³

It is important to note that many studies on digital device use and ASD face challenges in isolating the effects of screen time from other environmental factors. Variables such as parental involvement, socioeconomic status, and the presence of other developmental conditions may influence the outcomes of studies examining screen time and ASD. Therefore, more research is needed that controls for these confounding factors to determine the true impact of digital devices on children with ASD.

Mechanisms linking early digital device interaction and ASD

Several mechanisms may explain the potential impact of early digital device use on children with ASD, primarily related to the interaction between digital devices and the developing brain and behavior of children. One key area is the neurological effects of excessive screen time. Research has shown that extended exposure to digital screens can negatively affect brain development, particularly in regions related to attention, social processing, and emotional regulation. Early exposure to fast-paced and overstimulating digital content may alter the brain's ability to process social cues and regulate emotional responses, both of which are core difficulties for children with ASD.¹⁸ These children often face challenges in interpreting social signals, and excessive screen time may exacerbate these difficulties by impeding the neural development needed to navigate social environments effectively. Additionally, studies have suggested that passive screen time, such as watching TV or videos, could disrupt the development of neural networks involved in social interaction, leading to further difficulties in engaging with others.

Another area of concern is how early digital device exposure may interfere with the development of critical behavioral and cognitive skills. Children with ASD often struggle with social communication and emotional regulation, and digital devices may exacerbate these challenges. For example, children with ASD frequently find it difficult to interpret non-verbal cues, such as facial expressions and body language, which are essential for successful social interactions. Interaction with digital devices, particularly those that provide little or no social feedback, may limit opportunities for children with ASD to practice interpreting these cues, potentially hindering their social development. Moreover, the isolated nature of screen-based activities may reduce the amount of time children spend engaging in the types of interactive play and communication with others that foster social skills.¹⁹

In addition to these developmental concerns, digital devices have the potential to overstimulate young children, especially when exposed to fast-moving, colorful content commonly found in apps and games. This overstimulation can disrupt attention and increase impulsivity, which are behaviors already challenging for children with ASD. Furthermore, excessive screen time may come at the expense of face-to-face interactions, which are essential for children's language development and social skills. For children with ASD, the opportunity to engage in face-to-face interactions is particularly crucial, as these interactions provide real-world contexts in which children can practice communication skills and receive feedback in real time.²⁰ When children spend excessive time on digital devices, the time available for these important social experiences is diminished, potentially impeding their development in these critical areas.

Thus, the mechanisms linking early digital device use to ASD are multifaceted, involving both neurological changes and the disruption of key behavioral and cognitive development processes. The overstimulation and reduced face-to-face interactions associated with screen time may further complicate the development of essential social and communication skills in children with ASD.

Critical appraisal of the literature

While the literature on the correlation between early digital device use and ASD provides valuable insights, there are several methodological limitations to consider. Many studies rely on small sample sizes, which limits the generalizability of their findings. Additionally, most studies are correlational in nature, making it difficult to establish causality between digital device use and the development of ASD symptoms. Longitudinal studies that track children over time and account for various confounding factors are needed to better understand the long-term effects of early digital device exposure.

Furthermore, there is a lack of consistency in how digital device use is measured across studies. Some studies define excessive screen time as more than one hour per day, while others use a threshold of two hours or more. Similarly, the types of content and interactions with digital devices vary widely, with some studies focusing on passive media consumption and others examining educational apps. This lack of standardization makes it challenging to draw firm conclusions from the existing literature.

Table 1: Brain development areas affected by digital devices in children with ASD.⁹

Brain area	Effect of excessive screen time	Potential outcome for ASD
Attention	Impaired attention span, increased distractibility	Increased impulsivity and reduced ability to focus
Social processing	Difficulty interpreting social cues (e.g., facial expressions)	Heightened social isolation, difficulty with peer interactions
Emotional regulation	Difficulty regulating emotional responses and behavior	Emotional outbursts, heightened anxiety
Language processing	Delayed language development, struggle with non-verbal cues	Struggles with communication and social engagement

Table 2: Recommended screen time guidelines for children with ASD.¹⁷

Age group (years)	Recommended screen time	Content type	Parental involvement	Potential benefits
0-2	No screen time recommended	Educational or interactive content only	No screen time without parental interaction	Minimal exposure, avoid overstimulation
2-5	1 hour or less per day	Educational content and interactive apps	Supervised use with interactive content	Promotes learning if used appropriately
6 and older	1-2 hours per day	Educational content, age-appropriate games, and social activities	Supervised use, encourage discussions and social interaction around content	Supports skill development, but requires moderation

CONCLUSION

The relationship between early digital device interaction and ASD is complex and multifaceted. While there is evidence to suggest that excessive screen time can negatively impact social communication, attention, and cognitive development in children with ASD, there is also research indicating that certain types of digital engagement, such as educational apps, can have positive

effects. The key to understanding the impact of digital devices on children with ASD lies in finding a balance—ensuring that screen time is appropriately limited and that children are exposed to content that supports their developmental needs. Further research is required to better understand the underlying mechanisms at play and to develop guidelines for how digital devices can be used most effectively in supporting the development of children with ASD.

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REFERENCES

- Shukla S. Autism Spectrum Disorder: Clinical and Genetic Aspects. *Curr Drug Therapy*. 2024;20:e15748855313794.
- Livingstone S. New 'screen time' rules from the American Academy of Pediatrics. Parenting for a Digital Future. 2016. Available at: <https://blogs.lse.ac.uk/medialse/2016/10/24/new-screen-time-rules-from-the-american-academy-of-pediatrics/>. Accessed on 12 October 2024.
- Friel CP, Duran AT, Shechter A, Diaz KM. US children meeting sleep, screen time, and physical activity guidelines. *Am J Prev Med*. 2020;59(4):513.
- Lane R, Radesky J. Digital media and autism spectrum disorders: Review of evidence, theoretical concerns, and opportunities for intervention. *J Dev Behav Pediatr*. 2019;40(5):364-8.
- Aresti-Bartolome N, Garcia-Zapirain B. Technologies as support tools for persons with autistic spectrum disorder: a systematic review. *Int J Env Res Public Health*. 2014;11(8):7767-802.
- Lichtenstein P, Carlström E, Råstam M, Gillberg C, Anckarsäter H. The genetics of autism spectrum disorders and related neuropsychiatric disorders in childhood. *Am J Psychiatr*. 2010;167(11):1357-63.
- Sealey L, Hughes B, Sriskanda A, Guest J, Gibson A, Johnson-Williams L, et al. Environmental factors in the development of autism spectrum disorders. *Env Int*. 2016;88:288-98.
- Dawson G, Bernier R. A quarter century of progress on the early detection and treatment of autism spectrum disorder. *Dev Psychopathol*. 2013;25(4):1455-72.
- Dong H-Y, Wang B, Li H-H, Yue X-J, Jia F-Y. Correlation between screen time and autistic symptoms as well as development quotients in children with autism spectrum disorder. *Front Psychiatry*. 2021;12:619994.
- Noorhidawati A, Ghalebani SG, Hajar RS. How do young children engage with mobile apps? Cognitive, psychomotor, and affective perspective. *Computers Education*. 2015;87:385-95.
- Clemente-Suárez VJ, Beltrán-Velasco AI, Herrero-Roldán S, Rodríguez-Besteiro S, Martínez-Guardado I, Martín-Rodríguez A, et al. Digital Device Usage and Childhood Cognitive Development: Exploring Effects on Cognitive Abilities. *Children*. 2024;11(11):1299.
- Kushima M, Kojima R, Shinohara R, Horiuchi S, Otawa S, Ooka T, et al. Association between screen time exposure in children at 1 year of age and autism spectrum disorder at 3 years of age: the Japan environment and children's study. *JAMA Pediatrics*. 2022;176(4):384-91.
- Christakis DA, Ramirez JSB, Ferguson SM, Ravinder S, Ramirez J-M. How early media exposure may affect cognitive function: A review of results from observations in humans and experiments in mice. *Proceed Nat Acad Sci*. 2018;115(40):9851-8.
- Bauminger-Zviely N, Eden S, Zancanaro M, Weiss PL, Gal E. Increasing social engagement in children with high-functioning autism spectrum disorder using collaborative technologies in the school environment. *Autism*. 2013;17(3):317-39.
- Curran F. Adapting E-Books and a Teleoperated Agent Designed in Preschool Contexts for Play-Based Group Therapy for Children Developing Social Play, Executive Function, and Adaptive Behavior Skills: The University of Iowa. 2024.
- Dunkley VL. Autism and screen time: special brains, special risks. 2016. *Psychology Today*. Available at: <https://www.psychologytoday.com/intl/blog/mental-wealth/201612/autism-and-screen-time-special-brains>. Accessed on 12 October 2024.
- Montes G. Children with autism spectrum disorder and screen time: results from a large, nationally representative US study. *Acad Pediatr*. 2016;16(2):122-8.
- Swider-Cios E, Vermeij A, Sitskoorn MM. Young children and screen-based media: The impact on cognitive and socioemotional development and the importance of parental mediation. *Cognitive Development*. 2023;66:101319.
- Heffler KF, Sienko DM, Subedi K, McCann KA, Bennett DS. Association of early-life social and digital media experiences with development of autism spectrum disorder-like symptoms. *JAMA Pediatrics*. 2020;174(7):690-6.
- Mihăilă-Popa V. Early Childhood Development: The Influence of Digital Technology on Psychological Processes and Mechanisms. *J Digital Pedagog*. 2023;2(1):25-37.

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