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Effects of Exposure to Screen Time on Developmental Milestones and Autism-Like Symptoms in India

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Abstract

The study aimed to compare the developmental milestones of children currently in foundational years with excessive screen time, with limited or no screen time, and their similarity with children diagnosed with autism. It examined three areas of concern, where a direct correlation is made between over-exposure to screen time causing developmental delays in foundational years, being similar to the developmental milestones of children with autism. The sample consisted of 124 parents of preschool children aged between two and six years old in India. The Child Developmental Inventory (CDI) was used to assess developmental milestones. Findings demonstrated that there was a significant difference in the developmental milestones of typically developing children with high and low screen time and that there was no significant difference when compared with children diagnosed with autism concluding that higher screen time leads to developmental delays which are similar to the developmental milestones of children diagnosed with autism. Results also revealed that screen time significantly affected some developmental milestones in autistic children, however, the impact of screen time on academic capability was not significant in both groups. Screen time has a significant impact on the developmental milestones of autistic children, and that typically developing children have similar developmental milestones, which indicates that further investigation is required to avoid the risk of incorrect diagnostic assessment for Autism in children.

Keywords: developmental milestones, screen time, autism, typically developing children

1. Introduction

1.1 Developmental Milestones and Associated Factors

The most critical years for the lifelong development of children are gobally recognized as the first 6-8 years of the child. These years hold importance due to the fact that the speed of development of children during these years is touted to be extremely rapid. (ECCE NCERT, 2006). Early childhood, which spans the period up to 8 years of age, is critical for cognitive, social, emotional, and physical development. During these years, a child's newly developing brain is highly plastic and responsive to change as billions of integrated neural circuits are established through the interaction of genetics, environment, and experience. Optimal brain development requires a stimulating environment, adequate nutrients, and social interaction with attentive caregivers. Unsafe conditions, negative interactions, and lack of educational opportunities during these early years can lead to irreversible outcomes, which can affect a child's potential for the remainder of his or her life (UNICEF, 2019, p. 2).

During foundational years, the child develops cognitive functioning and emotional, social, and physical development. It is considered to be the most crucial phase of learning as speech and motor skills are also developed significantly during this time. Contrary to popular notions that motor development begins and ends early, whereas cognitive development begins and ends later, both motor and cognitive development display equally protracted developmental timetables. When cognitive development is perturbed, as in a neurodevelopmental disorder, motor development is often adversely affected (Diamond, 2000). Studies of early cognitive development have led researchers to understand the developing mind as astonishingly competent, active, and insightful from a very early age. For example, infants engage in an intuitive analysis of the statistical

regularities in the speech sounds they hear en route to constructing language (Saffran, 2003). Communication is learned through modeling and observation of parents and the adults around them. Children learn through mimicking their parents and their families. Young children rely so much on what they learn from others that they become astute, by the preschool years, in distinguishing adult speakers who are likely to provide them with reliable information from those who are not (Harris, 2012; Jaswal, 2010). This connection of relationships and social interactions to cognitive development is consistent with how the brain develops and how the mind grows.

Childhood is the start of their education as well when they learn numeracy, literacy, and cognitive skills that become the basis for their academic growth later in life. Childhood is when we face challenges and obstacles and we learn to navigate through these difficulties and learn resilience, creativity, problem-solving, and decision-making skills. Children's brain makes connections faster in their formative years than at any other time in their lives. According to UNICEF (2005) young children are in their most important development stage of life, what they learn now and what happens to them now will influence them for the rest of their lives and the early years of the child are the more determinant of the child's psychosocial and cognitive development.

In 2021, the Centers for Disease Control and Prevention's Learn the Signs, Act early program, funded the American Academy of Pediatrics (AAP) to convene an expert working group to revise its developmental surveillance checklists. They concluded that early identification and intervention for 1 in 6 children with Developmental Delays have been shown to improve outcomes for children. However, in their study as well they found that that most children receive intervention by the age of 5 years and not before the crucial time of 3 years of age where a more prominent impact can be made.

1.2 The Present Study

Our study aimed to examine the relationship between screen time and developmental milestones of typically developing children and children diagnosed or given the prognosis of autism spectrum disorder of age 2-6 years. There is a lack of research examining the relationship between developmental milestones and screen time among preschool children in India and their association with autism-like symptoms. In 2021 in China, a research study concluded that screen time is related to autism-like symptoms and the Development Quotients of children with ASD. The longer the screen time, the more severe the symptoms of ASD (especially sensory symptoms), and the more obvious the developmental delay, especially in ASD children with a longer screen time and younger age, particularly in the language domain (Dong et al, 2021). In 2022 in Japan, a study concluded that among boys, longer screen time at 1 year of age was significantly associated with autism spectrum disorder at 3 years of age. It highlighted that boys are more at risk of developing autism-like features due to increasing screen time (Kushima et al, 2022). One research study in India was found where they insinuated in their conclusion that toddlers with high-screen media use developed autistic-like traits that may even progress to Autism (Dikkala et al, 2022). Therefore, this study aimed to examine the developmental milestones to observe similarities with symptoms of children with autism spectrum disorder of the same age as typically developing children in foundational years in India as it can lead to the possibility of incorrect diagnosis and highlights the need for either an additional diagnosis or some guidelines that differentiate the diagnostic criteria for early detection of autism in children.

1.3 Objectives of the Study

The main objective of the study is to examine the relationship between screen time and developmental milestones of typically developing children and children diagnosed with autism spectrum disorder in foundational years in India. The specific objectives are listed below.

1) To assess the difference in the developmental milestones of typically developing children with higher screen time and limited or no screen time.

2) To assess the difference in the developmental milestones of autistic children with higher screen time and limited or no screen time.

3) To assess the difference in the developmental milestones of autistic children with higher or limited screen time with typically developing children with higher screen time.

1.4 Related Literature

1.4.1 Developmental Milestones in foundational years in India

In 2017, the National Institute for the Empowerment of Persons with Intellectual Disability formerly known as the National Institute of Mentally Handicapped, published developmental milestones in children and their significance. The document divides developmental milestones into five categories, gross motor, fine motor, speech-language, cognitive, and social-emotional. It compares the developmental milestones that a child should have reached within an age criterion and when to be concerned regarding the child's development. It covers the ages from 0 to 5 years. In the years 2010-2014, NEIPID was also responsible for a joint venture, District Disability Rehabilitation Centre (DDRC) an initiative with the Central and State Governments to establish centers across the country for three years providing services of early detection and intervention for children, identification of persons with disabilities, therapeutic services like speech therapy, etc.

1.4.2 Impact of screen time in foundational years

In 2016, Jenny et al conducted a study on the impact of increased screen time on children in foundation years where they reported negative effects on sleep, physical health such as obesity and vision problems, and behavioral changes such as aggressive behavior with exposure to violent media content. However, the benefits of using the electronic devices were also prominent. It concluded to facilitate social communication among children specifically during the time of restricted outdoor activities. In addition, it has revolutionized learning as children have easy access to educational content. Though in recent years, children have had easier access to electronic devices and screen time has significantly increased. Smart devices with greater interaction capability have been developed and they have become a part of normal life with limited restrictions. Due to the COVID breakout during the years 2020-2023, the usage of devices increased significantly. In 2022, a study conducted by Mc Arthur et al observed an association between the duration of screen time being associated with poor child development outcomes, concluding that children with higher screen time had an increased likelihood of behavioral problems, delayed achievement of developmental milestones, and poorer vocabulary acquisition.

World Health Organization 2019 published guidelines on the amount of time in a 24-hour day that young children, under the age of 5 years, should spend being physically active or sleeping for their health and well-being, and the maximum recommended time these children should spend on screen-based sedentary activities or time restrained. For infants less than 1 year, no screening is recommended, for children aged 2-4 years no more than 60 minutes of screen time in a day was recommended. Apart from physical health and sleep, social skills are also affected adversely by screen time in preschool children (Hinkley, Brown, Carson, & Teychenne, 2018). A study in Japan concluded that greater screen time for children aged 1 year was associated with developmental delays in communication and problem-solving at ages 2 and 4 years (Takahashi et al, 2023).

1.4.3 Autism and Screen Time

According to a 2021 study published in the Indian Journal of Pediatrics, the estimated prevalence of Autism in India is around 1 in 68 children (Singhi & Malhi, 2023). The prevalence of ASD was observed to be significantly higher among children 4–10 years with mild autism and also higher in the same age. The prevalence was higher in early years (1–7 years) for moderate autism. One possible reason could be that the case identification by the family was delayed till motor and speech development. Even though ASD can be diagnosed as early as age 2 years, most children are not diagnosed with ASD until after age 4 years (CDC, 2024).

Associations between symptoms severity of autism spectrum disorder and screen time among toddlers are being studied rigorously. A study in Iran concluded that in toddlers, a higher level of foreground and background screen time is associated with symptoms of ASD and repetitive behaviors. Furthermore, screen time was directly associated with a shorter time of social interaction which inferred that children prefer non-social coping strategies which will increase a child's ASD symptom severity(Sadeghi et al, 2023). In fact in India, a study was conducted to explore the vulnerabilities that prompted mothers to use screen media for their children, before a diagnosis of autism for their child which showed that mothers resorted to screening out of helplessness and not as an informed choice and feeling lost without proper advice on how to manage their children (Lal et al, 2023).

In 2018, Marius Teodor Zamfir surveyed the incidences of excessive consumption of virtual environments in children recently diagnosed with ASD. They concluded that sensory-motor and socio-affective deprivation caused by the consumption of more than 4 hours per day of virtual environment can activate behaviors and elements similar to those

found in children diagnosed with ASD. Following this survey, he defined this form of autism as virtual Autism. In the Journal of Education and Health Promotion, a letter was published acknowledging the existence of the concept of "Virtual Autism" among children which is being caused due to excess gadget exposure, and explored its causes and preventive measures emphasizing a balanced approach to child development in the digital age. (Garg et al, 2024). There is not enough data on the association between screen time exposure and ASD-like symptoms such as delay in language development, unusual social interactions, odd play patterns, and unusual communication patterns, however, internet gaming disorder is recognized by DSM-5-TR acknowledging the existence of behavioral addiction (DSM-5-TR, 2022). However, a significant association between screen time exposure and autism spectrum disorder-like symptoms in children was observed in children from four to six years of age.

2. Methods

2.1 Study Design and Subject Characteristics

In the current study, multivariate sample means were compared using the multivariate analysis of variance to determine whether the means of developmental milestones of typically developing children and children diagnosed with Autism Spectrum Disorder differ significantly across the usage of high and low screen time. The Child Development Inventory was used to examine the developmental milestones. The target population for this study is parents or primary caregivers of children in foundational years aged between two and six years in India. This is due to the increasing concern about developmental delays in children. On the other hand, children who are not staying together with their parents and children who are diagnosed with other neurodivergent disorders except Autism Spectrum Disorder were excluded.

2.2 Sampling Procedure and Sample Size

The sample in this study consists of 124 children aged 2-6 years. 31 children with diagnosed condition of ASD or proposed diagnosis of ASD were included whereas 93 typically developing children's data was included for the study. Parents' feedback was taken to determine the developmental milestones of the children.

The inclusion criteria were children between the ages of 2-6 years. The exclusion criteria were

a. children who had no access or availability of gadgets (rural areas),

b. children diagnosed with level 2 and 3 severities in autism spectrum disorder,

c. typically developing home-schooled children,

d. children with any birth defects (spina bifida, down syndrome, etc) leading to delayed developmental milestones and,

e. children diagnosed with other neurological disorders such as epilepsy, Alzheimers, dyslexia, dyspraxia, etc.)

2.3 Instrumentation

Some parents filled out the form through the Google Form link whereas most parents were assisted in filling the Child Development Inventory in person. Different special needs schools and NGOs were contacted to reach out to parents of children diagnosed with Autism. The children were diagnosed by RCI-certified clinical psychologists; however, the reports were kept confidential by either the parents or the organization. The authenticity of the diagnosis was based on the declaration by the parent and the organization. The Child Development Inventory was used for this study.

2.3.1 Developmental Milestones

The Child Development Inventory (CDI), completed by parents at home, assesses the development of social, self-help, motor, language, letter, and number skills, and the presence of symptoms and behavior problems in children between the ages of 15 months and 6 years 0 months precisely. The results provide the pediatrician with a profile of the child's development, problems, and strengths and aid comprehensive assessment. CDI norms and validity were determined for a community sample of 568 children. The CDI developmental scales correlate closely with age ($r = 0.84$). CDI results identified all the normative group children enrolled in early childhood/special education ($N = 26$) and correlated with academic achievement for children in kindergarten ($N = 132$). CDI scales correlated with reading achievement in kindergarten as follows: general development 0.69, letters 0.56, language comprehensive 0.42, expressive language 0.36, and self-help 0.35.

2.3.2 Screen Time

A section was included on the Google Form's first page with demographic details shared with the combined Child Development Inventory and Parenting Styles. The screen time was divided into four categories: No screen time/the child does not have access to any gadgets, Less than 2 hours, Between 2-4 hours, and More than 4 hours. High screen time (HST) was considered when parents selected between 2-4 hours and More than 4 hours, whereas Low screen time (LST) was considered when parents selected Less than 2 hours and No screen time/the child cannot access any gadgets.

2.4 Hypothesis Development

To ensure that the varied ibjectives of the study are fullfilled with understading the ddevelopment of children with respect to screen time while also caatering to the aspects of Autistic children, the study developed three critical hypothesis,

Hypothesis 1 - There will be a significant difference in the developmental milestones of typically developing children with higher screen time and typically developing children with limited or no screen time.

Hypothesis 2 - There will be a significant difference in the developmental milestones of autistic children with higher screen time and autistic children with limited or no screen time.

Hypothesis 3 - There will be no difference in the developmental milestones of typically developing children with higher screen time and autistic children with limited or no screen time.

2.5 Data Analysis

The data collected in this study is analyzed using the SPSS software. The general linear model was used for this study as it required multiple linear regression as there was more than one dependent variable. MANOVA- Multivariate analysis of variance was employed to analyze the data for the Child Development Inventory. It included descriptive statistics, estimates of effect size, and a homogeneity test at a 95% confidence level. A priori power analysis for ANCOVA (2 groups, 5 covariates, α=0.05, N=124) indicated >99% power to detect a large effect (Cohen's f=0.40) and ≥80% power for effects ≥ f≈0.27. Degrees of freedom: df_1=1 (group), df_2=117 (error).

3. Results and Discussion

3.1 Descriptive statistics

The findings in this study consist of 52% male and 48% female children in foundational years. 65% of children were of the age group between four and six years, whereas 35% of children were of the age group between two and three years. The study included 75% of typically developing children and 25% of children diagnosed with Autism Spectrum Disorder. 87% of mothers took the initiative to participate in the study whereas only 6% of fathers were interested. 7% of participants were Aunts and Uncles of the children. Regarding parent's education level, 58% of participants were graduates and 25% were post-graduates. 8% of the participants held a Doctorate as well.

Table 1 Descriptive Statistics

Frequencies for Child Gender

Child Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Boy	64	51.613	51.613	51.613
Girl	60	48.387	48.387	100.000
Missing	0	0.000		
Total	124	100.000		

Frequencies for Child Age

Child Age	Frequency	Percent	Valid Percent	Cumulative Percent
2 years	19	15.323	15.323	15.323
3 years	24	19.355	19.355	34.677
4 years	37	29.839	29.839	64.516
5 years	39	31.452	31.452	95.968
6 years	5	4.032	4.032	100.000
Missing	0	0.000		
Total	124	100.000		

Frequencies for Diagnosis

Diagnosis	Frequency	Percent	Valid Percent	Cumulative Percent
ASD	31	25.000	25.000	25.000
TDC	93	75.000	75.000	100.000
Missing	0	0.000		
Total	124	100.000		

Frequencies for Parent Education

Parent Education	Frequency	Percent	Valid Percent	Cumulative Percent
Doctorate	10	8.065	8.065	8.065
Graduate	72	58.065	58.065	66.129
HSSC	11	8.871	8.871	75.000
Post Graduate	31	25.000	25.000	100.000
Missing	0	0.000		
Total	124	100.000		

Frequencies for Guardian Relationship

Guardian Relationship	Frequency	Percent	Valid Percent	Cumulative Percent
Aunt	6	4.839	4.839	4.839

Frequencies for Guardian Relationship

Guardian Relationship	Frequency	Percent	Valid Percent	Cumulative Percent
Father	8	6.452	6.452	11.290
Mother	109	87.903	87.903	99.194
Uncle	1	0.806	0.806	100.000
Missing	0	0.000		
Total	124	100.000		

3.2 Developmental Milestones and Typically Developing Children Aged between 4 and 6 years old

Developmental milestones of typically developing children between the ages of four and six years were compared to determine the possible impact of screen time. The findings indicate that there was a significant difference in the developmental milestones of typically developing children with high and low screen time in all areas (social, p=0.000; self-help, p=0.000; gross-motor, p=0.003; fine-motor, p=0.010; expressive language, p=0.000; language comprehension, p=0.003; general development, p=0.000) except the areas of letters (p=0.294) and numbers (p=0.071) (Table 2). It indicates that children with higher screen time have delayed developmental milestones compared to children with lower screen time. However, the ability to learn letters and numbers was not as significantly different, indicating that exposure to high screen time does not significantly affect the ability to learn letters and numbers.

Table 2 Multivariate Analysis of Variance for Typically Developing Children Aged between 4 and 6 years old

Dependent Variable	Group	Mean	Standard Deviation	F	P	Partial Eta Squared
Social	High screen time	19.038	1.709	39.267	.000	.450
	Low screen time	34.500	1.779			
Self-help	High screen time	22.538	1.435	32.206	.000	.402
	Low screen time	34.292	1.493			
Fine motor	High screen time	22.038	.987	10.169	.003	.175
	Low screen time	26.583	1.028			
Gross motor	High screen time	20.962	1.252	7.149	.010	.130
	Low screen time	25.792	1.303			
Expressive language	High screen time	29.077	1.968	28.070	.000	.369

	Low screen time	44.125	2.048			
Language comprehension	High screen time	34.500	1.767	10.046	.003	.173
	Low screen time	42.583	1.839			
Letters	High screen time	11.038	.600	1.127	.294	.023
	Low screen time	11.958	.625			
Numbers	High screen time	10.000	.563	3.404	.071	.066
	Low screen time	11.500	.586			
General development	High screen time	44.808	2.303	22.514	.000	.319
	Low screen time	60.583	2.398			

3.3 Developmental Milestones and Autism Spectrum Disorder

Developmental milestones of children diagnosed with autism with high screen time were compared with children diagnosed with autism of ages between four and six years with low screen time to assess the effect of screen time using one-way MANOVA analysis. The findings indicate that there was a significant difference in certain areas of developmental milestones (social, p=0.005; gross-motor, p=0.018; fine motor, p=0.018; expressive language, p=0.006; language comprehension, p=0.000; general development, p=0.001) in autistic children with high screen time and low screen time. However, there was no significant difference in the ability to learn letters (p=0.100) and numbers (p=0.93) as well as the self-help skills (0.057) (Table 3). This indicates that screen time impacts the developmental milestones of children diagnosed with autism as well and that children with high screen time have delayed developmental milestones. The ability to learn numbers and letters was not impacted significantly as well as self-help skills.

Table 3 Multivariate Analysis of Variance for Autistic children Aged between 4 and 6 years old

Dependent Variable	Group	Mean	Standard Deviation	F	P	Partial Eta Squared
Social	High screen time	8.188	1.511	9.081	.005	.238
	Low screen time	14.733	1.561			
Self-help	High screen time	13.125	2.388	3.932	.057	.119
	Low screen time	19.933	2.467			

Fine motor	High screen time	16.938	1.775	6.281	.018	.178
	Low screen time	23.333	1.833			
Gross motor	High screen time	16.063	1.888	6.282	.018	.178
	Low screen time	22.867	1.950			
Expressive language	High screen time	12.125	2.830	8.714	.006	.231
	Low screen time	24.133	2.923			
Language comprehension	High screen time	15.875	2.773	27.899	.000	.490
	Low screen time	36.933	2.864			
Letters	High screen time	7.625	1.217	2.891	.100	.091
	Low screen time	10.600	1.257			
Numbers	High screen time	6.813	1.168	3.024	.093	.094
	Low screen time	9.733	1.207			
General development	High screen time	26.313	3.167	14.420	.001	.332
	Low screen time	43.600	3.271			

3.4 Developmental Milestones of Typically Developing Children and Autism Spectrum Disorder diagnosed children

Developmental milestones of typically developing children with high screen time were compared with developmental milestones of children diagnosed with autism spectrum disorder with low screen time. The children were of ages between four and six years. The findings of between tests showed that there is no significant difference in the development milestones (social, p=0.191; self-help, p=0.438; gross motor, p=0.553; fine motor, p=0.444; expressive language, p=0.270; language comprehension, p=0.502; letters, p=0.720; numbers, p=0.835; general development, p=0.802) of children diagnosed with Autism with low screen time and typically developing children with high screen time (Table 4). This indicated that the developmental milestones of children diagnosed with autism with low screen time and typically developing children with high screen time are similar and that there is not much difference when they are compared.

Table 4 Multivariate Analysis of Variance for Developmental Milestones of Typically Developing Children and Autistic Children

Dependent Variable	Group	Mean	Standard Deviation	F	P	Partial Eta Squared
Social	TDC High screen time	14.733	2.573	1.775	.191	.044
	ASD Low screen time	19.038	1.955			
Self-help	TDC High screen time	19.933	2.649	.613	.438	.015
	ASD Low screen time	22.538	2.012			
Fine motor	TDC High screen time	23.333	1.725	.357	.553	.009
	ASD Low screen time	22.038	1.310			
Gross motor	TDC High screen time	22.867	1.961	.599	.444	.015
	ASD Low screen time	20.962	1.489			
Expressive language	TDC High screen time	24.133	3.519	1.252	.270	.031
	ASD Low screen time	29.077	2.673			
Language comprehension	TDC High screen time	36.933	2.857	.460	.502	.012
	ASD Low screen time	34.500	2.170			
Letters	TDC High screen time	10.600	.967	.130	.720	.003
	ASD Low screen time	11.038	.734			
Numbers	TDC High screen time	9.733	1.010	.044	.835	.001
	ASD Low screen time	10.000	.767			
General development	TDC High screen time	43.600	3.803	.064	.802	.002
	ASD Low screen time	44.808	2.888			

3.5 Discussion

The data for typically developing children with high and low screen time indicated a notable difference across most developmental milestones, except for letters and numerical abilities, suggesting that elevated screen time may hinder children's developmental progress. However, the absence of a significant impact on letters and numerical skills implies that cognitive abilities related to academics may remain unaffected by screen exposure. This provides a strong case for the acceptance of Hypothesis 1, as discussed.

The data for children diagnosed with autism revealed significant differences in four developmental areas, while self-help, letters, and numbers showed no variation. The consistency in letters and numbers aligns with findings in data for typically developing children, suggesting that screen time does not impact academic abilities. The lack of difference in self-help skills may be attributed to the challenges autistic children face in daily living activities, where screen time appears to have no additional effect. However, it is essential to note that autism, a social disorder, showed a negative correlation with screen time in areas like social skills and expressive language. This suggests that screen time could exacerbate difficulties in social interaction and emotional expression in autistic children, who are already vulnerable in these areas. The foundational years are crucial for autistic children to make significant progress, and as they age, learning new skills becomes increasingly challenging. From these results it could be seen that Hypothesis 2 also stands significant for 4 areas but lacks in the rest 3.

The comparison between typically developing children with high screen time and autistic children with limited or no screen time was aimed at exploring whether their developmental milestones align. The hypothesis posited that high screen time might delay developmental milestones in typically developing children, making them comparable to those of autistic children. The findings supported this, with no significant differences observed in any developmental areas, suggesting similar developmental outcomes between the two groups. The decision not to compare autistic children with high screen time was based on the expectation of pronounced developmental delays, which could reduce the likelihood of misdiagnosis. Instead, comparing children with limited screen time provided a clearer picture. This raises the possibility that typical children may be at risk of misdiagnosis due to screen time-induced developmental delays, implying that with reduced screen time and early intervention, these children might avoid such delays and achieve typical developmental milestones. All these results point to the fact that Hypothesis 3 is also significant, and thus, there is no difference in all the areas under observation.

4. Implications and Limitations

4.1 Implications

The findings underscore the evident delay in developmental milestones attributed to screen time, highlighting the necessity for stringent screen time regulation to mitigate its impact on both typically developing children and those diagnosed with autism. The similarities in developmental delays between these groups suggest a pressing need for more precise diagnostic tools to prevent potential misdiagnosis of autism, as overlapping features may obscure accurate assessments. This emphasizes the importance of early intervention strategies tailored to address delayed milestones, enabling affected children to align more closely with their peers. While the data suggests that screen time does not adversely affect academic abilities, and may even offer some cognitive benefits, the broader negative effects on other developmental areas render unregulated screen time impractical. Therefore, strict oversight is recommended. Furthermore, the study's detailed assessment of developmental milestones offers a robust foundation for crafting personalized intervention plans, which have been shared with individual parents to address specific concerns and enhance their child's developmental trajectory. Parents were also provided with a comprehensive review of the child development inventory, which served as an incentive for their participation. This review offered a nuanced understanding of each child's progress and included personalized intervention strategies based on parental concerns and the areas where their child exhibited lower scores. This approach not only supports the child's development but also engages parents in a collaborative process aimed at optimizing their child's growth and potential.

4.2 Limitations

The study, while comprehensive in its exploration of screen time's effects on developmental milestones, acknowledges the scope was limited to typically developing children and those diagnosed with autism. It did not extend to other special needs or diagnoses such as learning disabilities or ADHD, where the impact of screen time might vary. This presents an

opportunity for future research to broaden the understanding of how screen time influences a wider spectrum of developmental conditions. Although the study did not directly include an early intervention plan, the findings offer a valuable foundation for developing such plans. The study also acknowledges the limited data and justifies its use with power analysis. The data collected could be instrumental in shaping intervention strategies tailored to the specific needs of children with delayed milestones, guiding future efforts in this area. The study also highlighted the challenges faced by parents in completing the extensive 300-question survey. While the process was demanding and required significant motivation, the resulting detailed reports on their children's developmental milestones provided parents with meaningful insights and a deeper understanding of their child's progress. This outcome underscores the importance of parental involvement in research and the potential benefits that such comprehensive data collection can offer. Moving forward, there is an opportunity to streamline data collection methods while maintaining the richness of the information gathered, thereby enhancing both parental engagement and the overall efficacy of research in this crucial area of child development.

5. Conclusion

The study's findings illuminate the possible significant impact of screen time on children's developmental milestones during their formative years, particularly in light of the observed parallels between typically developing children with high screen time and those diagnosed with autism spectrum disorder (ASD). The results suggest a strong association between excessive screen time and developmental delays, drawing comparisons with the developmental patterns characteristic of children with ASD. This connection implies that extended screen exposure may contribute to or intensify developmental delays, raising important considerations regarding early childhood interactions with digital devices. Additionally, the study brings attention to the potential for misdiagnosis or delayed diagnosis of autism, given the overlapping symptoms that excessive screen time can induce. These symptoms, which may resemble those of autism, such as social, self-help, and language skills, underscore the necessity of distinguishing between screen time-induced developmental delays and those intrinsic to ASD. Accurate differentiation is essential to ensure that children receive the appropriate interventions and support tailored to their specific needs. The study also examines the influence of parenting practices, emphasizing the critical role of parental guidance in moderating screen time to mitigate its adverse effects on child development. While screen time can offer educational value when carefully managed, the study advocates for controlled usage, particularly during early childhood when the brain is most malleable and susceptible to environmental factors. In conclusion, the study underscores the importance of raising awareness among parents, educators, and healthcare professionals about the potential risks associated with excessive screen time. It calls for the development of comprehensive guidelines and early intervention strategies to address these concerns, contributing to the ongoing discourse on child development in the digital era.

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