

HOW DOES THE COVID-19 PANDEMIC AFFECT YOUNG CHILDREN'S SCREEN TIME? THE ROLE OF BIOECOLOGICAL FACTORS

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Abstract: During the COVID-19 pandemic, young children faced a shift to online education due to social isolation rules, resulting in increased time spent in front of digital screens. Even before the pandemic, the World Health Organization had recommended limiting screen time for young children as extended screen exposure was becoming more common with the increased prevalence of digital tools. This study aimed to examine the status of young children's screen time during the COVID-19 pandemic and explore the factors influencing it, encompassing child, parent, and environmental dynamics. Through a large-scale online survey, 1,346 parents with children aged 2 to 6 from all 81 provinces of Türkiye participated in the research. Hierarchical linear regression analysis revealed that age, digital device ownership, parental screen time, and mediation strategies were positively associated with children's screen time, while higher parental income, education, and engagement in dramatic play were negatively correlated. These findings underscore the importance of targeted interventions to achieve a healthier degree of screen usage among young children. Policymakers can play a role in raising awareness about limiting both parent and child screen time and promoting screen-free activities within the home environment, thereby contributing to improving the balance between screen usage and other activities among young children as society moves beyond the pandemic.

Keywords: screen time, parental mediation, young children, parent–child activities

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The introduction of touch screens and voice commands has made digital devices more user-friendly, and the availability of apps designed for young children has opened up numerous opportunities for play and learning (Hirsh-Pasek et al., 2015; Radesky et al., 2020). As a consequence, young children now spend a significant amount of time in front of screens. One recent study (Işıkoğlu Erdoğan et al., 2019) of screen usage in four nations — United States, Türkiye, China, and South Korea — and another (Rideout & Robb, 2020) from the United States showed that the young children surveyed use screens for over 2 hours per day on average. This extensive screen usage has given rise to the concept of “digital play” in academic literature, encompassing various recreational activities involving electronic toys, websites, gaming applications on mobile devices and tablets, and video and computer games (Marsh et al., 2020).

The outbreak of the COVID-19 pandemic in early 2020 prompted the closure of early childhood schools in many countries, including Türkiye, forcing parents to work from home. As a result, children in Türkiye were unable to attend classrooms throughout 2020, and had to rely on online education. The sudden shift to social isolation during the pandemic meant that families, including the children, were spending more time in front of screens (Koran et al., 2022; Lau & Lee, 2021; Witt et al., 2020). There were practical reasons for this: with parents juggling work responsibilities while facilitating their children’s distance education and mediating their screen usage, screen-based activities became a prevalent means of receiving news and entertainment, communicating with others, and engaging in distance learning during the COVID-19 period (Güzen, 2021). In light of these circumstances, this study was conducted to understand the status of young children’s screen time and the intervening factors that affected young children’s screen time, including child, parent, and environmental dynamics during the COVID-19 pandemic.

Issues With Screen Time

In recent years, the American Academy of Pediatrics (AAP; 2020), the World Health Organization (2019), and the Turkish Green Crescent Foundation (2020), which fight technology addiction, have begun offering recommendations to parents about limiting young children’s screen time. The AAP recommends no screen time for children until 18 to 24 months of age, except for video chatting, and recommends that parents limit screen time for children 2 to 5 years old to 1 hour or less per day. However, these guidelines have been critiqued as lacking strong empirical support (Ferguson & Beresin, 2017).

The impact of screen time on children’s health has been a subject of research for at least 40 years (e.g., Dietz & Gortmaker, 1985). However, today, technology companies have designed digital content in a way that is highly engaging and even addictive for young children, attracting their attention at an early age and increasing their screen use more than ever (Crepax & Mühlberg, 2022; Ding & Li, 2023). This has led to more research on children’s exposure to digital media and its effects, raising ethical concerns and sparking debates about the balance between potential benefits and risks. While some studies emphasize the negative effects of excessive digital

technology use on children's health and development, others point to its educational and creative benefits while acknowledging certain risks. In recent years, research has shifted from examining the effects of television on young children to exploring the impact on them of smartphones and tablets (Donohue, 2016; Fletcher et al., 2014; Heider & Jalongo, 2015; Marsh & Bishop, 2014). A current systematic review reported moderately strong evidence associating screen time with obesity and depressive symptoms (Stiglic & Viner, 2019). Other studies have found higher screen times to be significantly related to lower scores on developmental screening tests for infants (Madigan et al., 2019) and to reduced language and literacy skills for preschoolers and kindergarteners (Ribner et al., 2021). Young children's passive screen time involves only one-way communication; receiving information passively was found to be negatively correlated with executive function skills (Altun, 2022). On the other hand, educational media on screens can be beneficial for young children's learning (Mares & Pan, 2013; Radesky & Christakis, 2016; Zimmermann et al., 2017) through educational apps, websites, and videos. Interactive technology can also help children learn new skills, such as problem-solving and collaboration (Danby et al., 2018; Kucirkova et al., 2014). A Canadian study with 3- to 4-year-old children showed positive associations between screen exposure within the recommended level (not more than 1 hour per day) and language development and intellectual ability (Zhang et al., 2022). Appropriate use of digital tools can foster creativity, allowing children to engage in activities like digital art, composing music, and video production (Behnamnia et al., 2020). It is crucial to acknowledge that the benefits and risks of technology for children are intertwined.

Previous studies have indicated that multiple factors (such as a child's age, parents' socioeconomic and educational status, and parents' beliefs and practices about media) impact young children's screen time (Carson & Janssen, 2012; Lauricella et al., 2015; Määttä et al., 2017). Research by Vandewater and Lee (2009) indicates that higher parental income is correlated with reduced screen time among children, possibly due to increased access to alternative activities and resources. Similarly, the findings of a study by Lauricella et al. (2015) support the notion that higher parental education levels are associated with lower levels of screen time in children; the researchers attributed this effect to heightened parental awareness of the detrimental effects of excessive screen exposure on child development. These relationships can also be attributed to various other social and economic factors, including access to educational materials, parental supervision, and family routines. In addition, parental beliefs and practices about media are among the essential factors in predicting children's screen time (Milosevic et al., 2022). While acknowledging the complexity of familial dynamics and individual differences, these studies underscore the parental role in shaping children's screen time behaviors.

Recent research has highlighted the significant impact of COVID-19 on increasing screen time among children (Eales et al., 2021; Garbe et al., 2020; Kharel et al., 2022; Robb, 2019). According to Robb's report, children in the United States now spend 4 additional hours per day on screens compared to pre-pandemic levels, an increase that was observed across all age groups, with the most significant rise seen among children aged 2 to 4. Kahrel et al. (2022) analyzed data from 71

studies in 35 countries and regions and reported that children and adolescents experienced reduced physical activity, increased screen time, and longer sleep hours during the pandemic.

In the context of children's increased screen time due to the impact of COVID-19, parents play a vital role in mediating and managing their children's digital activities, particularly for young children. Parental mediation refers to the behaviors and strategies that parents use to guide their children's screen use and foster responsible media consumption (American College of Pediatricians, 2020; Barkin et al., 2006; Livingstone & Helsper, 2008; Warren, 2005). Research on parental mediation has identified different types of approaches, such as active, restrictive, and technical mediation (Livingstone et al., 2017; Milosevic et al., 2022; Nikken & Schols, 2015; Papadakis et al., 2019). Active mediation involves parents engaging with their children in discussions about media content and experiences, sharing the child's media activities, and being physically present during screen time; restrictive mediation includes parents setting rules and limitations on screen time and guiding content choices; and technical mediation involves parents using tools like filters and monitoring software to control and supervise their children's digital activities (Livingstone et al., 2015; Nikken & Jansz, 2006). Although parents often use a combination of mediation strategies, active mediation in particular is linked with positive outcomes for young children, including greater social and cognitive skills and fewer problem behaviors (Benedetto & Ingrassia, 2021). However, it is essential to note that parental mediation practices can vary depending on factors such as children's age, children's gender, socioeconomic status, frequency of media usage, media literacy skills, and cultural characteristics (Buijzen & Valkenburg, 2005; Chan & McNeal, 2003; Eastin et al., 2006; Padilla-Walker & Thompson, 2005). These factors influence how parents approach and adapt their mediation strategies to meet the specific needs and circumstances of their children.

In Türkiye, as in many countries, parents are concerned that their young children's screen time is excessive, and they try various approaches to guide their screen usage (Budak, 2020; Işıkoğlu Erdoğan et al., 2019). Recent studies have revealed that Turkish children spend over 3 hours daily using screens and that they live in digitally rich home environments (Budak, 2020; Çelik et al., 2021; Güzen, 2021; Konca, 2021). A large-scale study in Türkiye found that 22.5% of children had problematic screen exposure, with excessive screen time leading to neglect of essential activities like eating, toileting, or sleeping (Yalçın et al., 2021). The COVID-19 pandemic led to a significant increase in screen time for Turkish children (Molu et al., 2022; Oflu et al., 2021).

Turkish parents face challenges in effectively guiding their children's screen interactions (Gözüm & Kandır, 2021; Şen et al., 2020). The transition from large to nuclear families has increased parental responsibilities, especially for mothers, who often lack support from extended family members (Kağıtçıbaşı, 1996). In addition, the lack of safe neighborhoods and accessible playgrounds may influence young children to turn to screen-based activities (Işıkoğlu & Ergenekon, 2021; Oflu et al., 2021). For this and other reasons, television remains the primary source of entertainment for Turkish families, with an average of 2.9 sets per household; family members often gather to watch TV, particularly during the evenings (TUIK, 2021). As a result of

these trends, it has become increasingly frequent for young children in Türkiye to have regular screen exposure.

Theoretical Framework

Drawing upon Bronfenbrenner's (1995) bioecological theory, the current study examines children's screen time in regard to multilevel systems ranging from the immediate to the environmental contexts. Bronfenbrenner's theory views child development as a system of interrelated relationships impacted by various environmental levels, ranging from the immediate family and school settings to broader cultural values and customs. Understanding interactions between individuals and their environment across these levels (microsystem, mesosystem, exosystem, and macrosystem) is vital. Additionally, the chronosystem, which encompasses environmental changes over time, including significant life transitions and historical events, is a crucial aspect of this multilevel approach (Tudge et al., 2021).

In recent years, studies have focused on technology's role in these ecological systems. Johnson and Puplampu (2008), highlighting how interactions with digital tools affect social interaction, cognitive development, and mental health, introduced the concept of the techno-subsystem, which they viewed as a dimension within the microsystem. Navarro & Tudge's (2022) neoecological theory, an updated version of Bronfenbrenner's bioecological theory, incorporates technosystems as a new level, emphasizing technology's influence on human development. According to this theory, two types of microsystems exist: physical and virtual. Physical microsystems include immediate physical environments like home, school, workplace, neighborhood, and social networks. Virtual microsystems comprise the digital or online environment, such as social media, online communities, and virtual games, where individuals interact. Navarro and Tudge (2022) proposed that virtual and physical microsystems are interconnected, with changes in one system impacting the other. For example, social media use can influence real-world social networks, while changes in the physical environment can affect online behavior.

Both the neoecological and bioecological theories are valuable for understanding the intricate issues surrounding children's screen time during the pandemic. Comprehending the relationship between technology and the subsystems that influence children's digital usage, along with contextual factors, is crucial. Previous studies have indicated that the COVID-19 pandemic posed a risk of increased screen time among children (Güzen, 2021; Molu et al., 2022; Oflu et al., 2021). Several research findings have also shown a range of factors that influence children's screen time, including age (Lauricella et al., 2015; Molu et al., 2021), access to digital devices (Kaur et al., 2019; Määttä et al., 2017), and parental mediation (Milosevic et al., 2022; Nikken & Schols, 2015). Consequently, the technosystem operates across all ecological levels, shaping individuals' development and interactions with the environment. This understanding allows for a comprehensive exploration of the complex interplay between the technology and ecological systems that influenced children's screen time behaviors during the COVID-19 pandemic in Türkiye.

In this regard, our research will contribute to the existing literature by comprehensively examining the dynamics of screen time between parents and children during the pandemic, a period marked by an unprecedented dependence on digital devices for both work and entertainment. What sets our study apart is its focus on multiple factors influencing children's screen time, ranging from demographic variables like age and socioeconomic status to more nuanced aspects such as parental mediation strategies and involvement in imaginative play. By evaluating the interwoven effects of these factors, our research aims to contribute to the understanding of young children's screen time behaviors during the pandemic. By investigating these diverse factors within a single study, we offer a holistic understanding of the complex interplay shaping screen time behaviors in families.

We analyzed a substantial sample of families and children in Türkiye to examine the prevalence of screen time within the country's cultural context. This investigation provides valuable insights for both theory and practice, helping to address the impact of the COVID-19 pandemic on young children's screen time and its implications for their development. This study aimed to investigate the associations between child, parent, and environmental factors and the amount of screen time. The research is guided by the following hypotheses:

1. Child's age and the number of digital devices they use will be positively related to higher screen time,
2. Higher parental income and education will be negatively related to screen time,
3. Higher parental mediation and longer duration of parent–child daily activities will be negatively associated with screen time.
4. Higher perceived challenges related to the pandemic will be associated with higher screen time.

Through investigating these hypotheses, the study aims to gain valuable insights into the factors influencing young children's screen time, especially during the pandemic.

Given the large-scale sample from 81 provinces in Türkiye, the study's insights extend beyond individual households, offering a comprehensive view of the broader societal patterns influencing screen time. At the same time, the significance of this research lies in its potential to provide both theoretical and practical contributions. On the one hand, the study advances our theoretical understanding of how multiple ecological factors intertwine to shape young children's digital media use during an unprecedented global crisis. On the other, its findings can inform practical developments: tailored policy recommendations, parenting interventions, and educational programs aimed at promoting healthier screen use among young children.

Method

Participants and Procedures

In this study, which explored the practices of parents regarding the screen use of their children aged 2 to 6 years during the COVID-19 pandemic, the general survey model was employed. This model involves examining either the entire population, or a representative sample from a large population, to draw general conclusions about the whole (Büyüköztürk et al., 2015; Karasar, 2013).

The data for this study were obtained from a larger project involving parents recruited from 81 provinces in Türkiye through a comprehensive online survey (Şimşek et al., 2023). The larger study employed a stratified random sampling method to ensure diverse and representative participation. To recruit participants, three early childhood public schools (preschools and kindergartens) were randomly selected from each province. The administrators or teachers of these schools were contacted and provided with an explanation of the research purposes and procedures. Subsequently, they distributed the survey links to the parents. Data collection using online forms took place from February 2021 to March 2021. During this period, preschools and kindergartens were operating with a hybrid model, offering face-to-face education two days a week and online education for the remaining three days. Face-to-face sessions followed strict social isolation rules, with children wearing masks and adhering to hygiene protocols.

A total of 1,346 parents with children aged 2 to 6 years participated in the online surveys. Considering that the Turkish census bureau estimates that there were approximately 4 million children aged 2 to 6 living in Türkiye in 2021 (TUIK, 2021), the sample size provides a valuable representation of the target population for the study. To determine the appropriate sample size, we utilized the table developed by Krejcie and Morgan (1970), which indicated that a sample size of 385 was required. Notably, all 81 provinces were represented in the research, with participant numbers ranging from three to 100 parents per province. Prior to conducting the online survey, ethical approval was obtained from the Ethical Review Board of Pamukkale University. After obtaining the ethics committee's approval, online written consent was obtained from the participating parents. Demographic information from the parents and their children is presented in Table 1.

Table 1 shows that 1,161 (86.3%) of the parents participating in the research were mothers, 566 (42.1%) of the parents held a university degree, and 656 (48.7%) of them came from middle-income homes. The majority (704, 52.3%) of the participants' children were boys. Only 8.5% were reported to not use any digital tools at home, and 47% had their own digital tools. Additionally, the mean parental age was 33.9, and the mean of the children's ages was 60.8 months.

Table 1. *Description of Participants (N = 1,346)*

Characteristic	<i>F</i>	%
Parental gender		
Woman	1161	86.3
Man	185	13.7
Parental education		
Elementary	228	16.9
High school	294	21.8
Vocational school	91	6.8
University	566	42.1
Graduate	167	12.4
Parental income		
Low income	305	22.7
Medium income	656	48.7
High income	385	28.6
Child's gender		
Girl	642	47.7
Boy	704	52.3
Number of digital tools child uses		
0	115	8.5
1	659	49.0
2	397	29.5
3	147	10.9
4 or more	28	2.1
Number of digital tools child owns		
0	848	63.0
1	431	32.0
2	56	4.2
3 or more	11	0.8
Total	1346	100.0

Measures

A survey was developed to assess variables related to children's screen time, parent–child family activities, and demographic information. To ensure the survey's validity, the researchers sought expert opinions from three early childhood specialists. Based on their feedback, three items were discarded, and some questions were reworded for better clarity. Later, the survey questions were piloted with 20 local parents (Gall et al., 2006). The entire survey took approximately 10 minutes for parents to complete. Some items were then reworded based on additional feedback from the subject specialists.

Dependent Variable

Screen time: Participant parents estimated their child's daily engagement with digital device-based activities by responding to the item: "On an average day, about how much time does your

child usually spend with computers or tablets?” Response options were *none, 1 to 30 min, 31 to 60 min, 1 to 2 hrs, 2 to 3 hrs, 3 or more hrs*. Using the same scale, parents were asked to report the child’s daily use of smartphones and of televisions, and time spent on distance education. Total screen time was calculated by adding the time children spent on computers/tablets, smartphones, television, and distance education.

Independent Variables

Demographic information: Parents provided demographic information via a survey, including parent and child gender, date of birth, income, educational level, parental daily screen time, and digital devices their child owns or access.

Parent–child daily activities: Initially, 20 non-participating parents who had a child aged 2 to 6 were randomly called and asked what kinds of activities they would do with their child on a typical day during the COVID-19 pandemic. Based on their answers, 10 activities — watching TV, shared reading, storytelling, playing outside, digital games, dramatic play, music and dancing, art, board games, and household chores — were selected as daily activities. Later, participant parents indicated how much time they spent doing these activities with their child on a typical day. Activities were rated on a 6-point scale: 1 (*no time*), 2 (*1–30 min*), 3 (*31–60 min*), 4 (*1–2 hr*), 5 (*2–3 hr*), and 6 (*3 or more hr*). The Cronbach’s alpha coefficient for the survey was .82, which demonstrates good internal reliability.

Challenges during the pandemic: Parents were asked to choose the challenges that they and their children experienced during the COVID-19 pandemic. The options for parents were: (1) following health, hygiene, and social isolation rules; (2) working from home and taking care of the child; and (3) planning screen-free activities for the child. The reported challenges for children were: (1) following health, hygiene, and social isolation rules; (2) missing out on playing outside and with friends; and (3) attending distance education classes. In these items, the parents were able to choose any number of options they wished.

Parental digital play mediation strategies: Parents completed the Parental Digital Play Mediation scale developed by Budak & Işıkoğlu (2022), a valid and credible scale developed in Türkiye to measure how parents mediate their children’s digital play. The scale consists of 23 items on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). There are four subscales: (1) Active Mediation: being present when the child is playing digital games, discussing game contents, and giving explanations and instructions; (2) Technical Restrictions: setting time and content limitations; (3) Encouraging: suggesting digital play to calm the child down and using digital play to keep the child busy; and (4) Permissive: letting the child play digital games alone, permitting the child to freely play, and letting the child choose which digital games to play. The scale and subscales demonstrated good internal reliability, with Cronbach’s alphas from .74 to .92. Confirmatory factor analysis was used to verify the factorial validity of the Parental Digital Play Mediation scale. The incremental fit indices ($\chi^2 = 2.409$; RMSEA = .058 [.05–.08]; SRMR = .059; CFI = .90) provided evidence for the factorial validity of the scale.

Data Analysis

A descriptive analysis was conducted to determine the means and standard deviations for all the measures, as well as the correlations among them. Hierarchical regression was the main statistical method implemented to help answer the research questions. Independent variables were included in the analysis sequentially. In the first stage, variables related to the child — age, number of digital devices used, and number of digital devices owned — were included in the model. In the second stage, variables related to the parents — age, education, income, and screen time — were included in the model. In the third stage, parental mediation strategies and durations of parent–child daily activities (watching TV, reading, storytelling, etc.) were entered into the model. Finally, the variables related to the challenges parents and children faced during the COVID-19 pandemic were entered into the model.

Prior to conducting the hierarchical regression analysis, plots of standardized residuals to evaluate assumptions of normality, autocorrelation, multicollinearity, independence of errors, and absence of outliers were checked. According to Kline (2023), a distribution is considered approximately normal if skewness is between -3 and $+3$ and kurtosis (excess) is between -10 and $+10$; that is, the absolute values of skewness and kurtosis should not exceed 3 and 10 respectively. Kurtosis and skewness values ranged from -1.996 to 2.400 in the current study, indicating approximate normality. Autocorrelation between the variables was examined using the Durbin-Watson coefficient, and the obtained value of 1.824 was considered acceptable (Kalaycı, 2016). For multicollinearity, the VIF values were calculated and ranged from 1.006 to 1.112 for the independent variables, indicating that multicollinearity was not a concern (Hair et al., 2009).

Results

To determine predictive factors of children’s screen time, descriptive statistics (means and standard deviations of variables) and correlations with the dependent variable (screen time) are presented in Table 2.

The results of the study indicate that, during the pandemic, the children were exposed to screens for almost 4 hours ($M = 235.90$ min) daily. Pearson correlations were computed to estimate the association between the predictors and the outcome variable. Again, correlations were examined to control for multiple linearity, which is one of the assumptions of multiple linear regression analysis (Tabachnick & Fidell, 2013). As shown in Table 2, correlation coefficients among variables ranged from $-.06$ to $.33$. Initial analysis showed that the child’s screen time was moderately positively correlated with the number of digital tools the child owned and TV watching time. Child screen time was positively correlated with parental age, parental screen time, both the encouraging and the permissive parental mediation strategies, and several child characteristics: age, number of digital tools the child uses, digital play, planning screen-free activities for the child, and attending distance education classes. Additionally, children’s screen time was negatively

correlated with parental education level, parental income level, missing out on playing outside and with friends, and time spent in dramatic play.

Table 2. *Descriptive Statistics and Correlations for Variables (N = 1,346)*

Variable	<i>M</i>	<i>SD</i>	<i>r</i>
Child's screen time (minutes)	235.90	150.52	1.00
Child			
Child's age	60.76	11.71	.20**
Number of digital tools the child uses	1.49	0.88	.27**
Number of digital tools the child owns	0.43	0.62	.31**
Parent			
Parental age	33.92	5.12	.14**
Parental education (1 = elementary, 5 = graduate)	3.11	1.34	-.15**
Parental income (1 = low, 3 = high)	2.06	0.71	-.13**
Parental screen time (minutes)	129.67	75.04	.22**
Parental mediation strategies			
Active mediation	3.83	8.24	.01
Technical restrictions	3.15	3.70	.005
Encouraging	2.08	4.59	.29**
Permissive	1.89	3.10	.28**
Parent-child daily activities (minutes)			
Watching TV	74.67	54.80	.33**
Playing outdoor/physical activities	71.95	58.84	-.00
Household chores, cooking, eating, etc.	70.45	53.51	.02
Dramatic play (housekeeping, dressing up, etc.)	66.82	57.38	-.06*
Music and dancing	59.80	52.93	.02
Storytelling	56.26	50.06	-.02
Art activities (coloring, drawing, etc.)	55.74	51.15	-.00
Board games	47.96	52.60	.03
Shared reading	42.55	36.38	-.03
Digital play	21.13	32.23	.21**
Challenges during the pandemic			
Challenges for parents			
Following health, hygiene, and social isolation rules	.68	.47	-.04
Working from home and taking care of the child	.58	.49	-.01
Planning screen-free activities for the children	.79	.41	.14**
Challenges for children			
Following health, hygiene, and social isolation rules	.33	.47	-.04
Missing out on playing outside and with friends	.98	.14	-.09*
Attending distance education classes	.23	.42	.14**

Note. With regard to “Challenges during the pandemic”, each parent selected from 16 statements, 8 applying to themselves and 8 to their child. Participants were allowed to select more than one statement. These were grouped into categories, three for parents and three for children. To calculate the mean, the total number of selections in each category was divided by the number of participants.

* $p < .05$; ** $p < .01$; *** $p < .001$.

In other words, the study's findings indicated that certain child variables, such as age and the number of digital tools the child owns, showed a positive but relatively weak relationship with children's screen time. Parental age and screen time were positively correlated, while parental education and income exhibited a negative correlation with children's screen time. Not surprisingly, the results reveal that some types of parental mediation — the encouraging and the permissive strategies — displayed a positive correlation with screen time. This suggests that when parents adopt these mediation approaches, children's screen time tends to increase. Regarding the duration of parent–child daily activities, the findings show both significant and nonsignificant relationships. Notably, children's screen time demonstrated positive correlations with the duration of watching TV and engaging in digital play activities. In other words, as children's screen time increased, there was a parallel increase in both television viewing and digital play duration. Conversely, the duration of dramatic play was negatively correlated with screen time: as children engaged in more dramatic play activities, their screen time tended to decrease. However, other daily activities did not show significant correlations with screen time. Lastly, the study revealed a positive correlation between the number of challenges parents and children faced during the pandemic and screen time. This suggests that the difficulties experienced by families during the pandemic may have contributed to increased screen time for children.

To examine the factors predicting children's screen time, a four-step hierarchical linear regression was conducted. Children's variables (age, number of digital tools used, number of digital tools owned) were entered as covariates in Model 1; parental variables (age, education level, income level, screen time) were entered in Model 2; parental mediation strategies and child–parent activity were entered in Model 3. Finally, challenges during the pandemic for parents and children were entered in Model 4. The regression model for child screen time was statistically significant ($F[27, 1207] = 23.37, p = .001$). The results are displayed in Table 3.

In Model 1, the level of the children's variables predicted 15% ($R^2 = .15$) of the variance in screen time ($F[3, 1238] = 69.38, p < .001$). The addition of the parental variables (age, education, income) in Model 2 accounted for a statistically significant contribution to the variance in children's screen time ($R^2 = .24$), a 9% increase from Model 1. With the addition of parent–child activities and parental mediation strategies, the variables in Model 3 predicted 33% of the child's screen time ($F[21, 1223] = 28.53, p < .001$). In Model 4, the predictors of the child's screen time were the child's age, number of digital devices used, number of digital devices owned, parental education, parental income, parental screen time, parental mediation strategies (encouraging), parent child activities (TV, dramatic play, digital play), and parental challenges (planning screen-free activities for the children). These predictors explained 34% of the total variance in children's screen time.

Table 3. Predictors of Child’s Screen Time: Hierarchical Regression Results (N = 1,346)

Predictors	Model 1		Model 2		Model 3		Model 4	
	B	β	B	β	B	β	B	β
Intercept	42.20		31.70		-89.68		-74.69	
Child variable								
Age	1.97	.16***	1.42	.11***	1.48	.12***	1.38	.11***
Number of DT used	32.56	.20***	28.51	.17***	18.30	.11***	16.21	.10***
Number of DT owned	50.82	.21***	48.91	.20***	39.48	.16***	39.56	.16***
Parent variable								
Age			2.89	.10***	3.14	-.11***	3.14	.11***
Education level			-15.57	-.14***	-9.23	-.09**	-8.87	-.08**
Income level			-30.04	-.15***	-21.33	-.11**	-20.80	-.10**
Screen time			.49	.25***	.36	.19***	.36	.18***
Child–parent interaction and activities								
Parental mediation strategy								
Active mediation					-.45	-.03	-.76	-.04
Technical					.61	.02	.95	.02
Encouraging					4.08	.13**	3.90	.12***
Permissive					1.84	.04	1.93	.04
Parent–child daily activity								
Watching TV					.59	.22***	.58	.22***
Playing outdoors					-.02	-.01	.42	-.01
Household chores					.02	.01	.01	.00
Dramatic play					-.22	-.09**	-.20	-.08*
Music & dancing					.12	.04	.14	.05
Storytelling					.05	.02	.06	.02
Art activities					.03	.01	.05	.02
Board games					-.08	-.03	-.12	-.04
Shared reading					.09	.02	-.03	.02
Digital play					.44	.09***	.42	.09***
Challenges during pandemic								
Parent								
Following health, hygiene, and social isolation							-4.05	-.03
Working from home and taking care of the child							-2.42	-.01
Planning screen-free activities for the children							15.68	.01***
Child								
Following health, hygiene, and social isolation rules							-5.18	-.03
Missing out on playing outside and with friends							-6.16	-.04
Attending distance education classes							13.09	.04
F	69.38***		54.34***		28.53***		23.37***	
R ²	.15		.24		.33		.34	
Adjusted R ²	.143		.232		.319		.329	

*p < .05; **p < .01; ***p < .001.

Child's screen time was positively predicted by the child's age ($\beta = .11, p < .001$), the number of digital tools the child used ($\beta = .10, p < .001$), the number of digital tools the child owned ($\beta = .16, p < .001$), parent's age ($\beta = .11, p < .001$), parental screen time ($\beta = .18, p < .001$), the parental mediation strategy of encouraging ($\beta = .12, p < .001$), parent-child daily activities of watching TV ($\beta = .22, p < .001$) and digital play ($\beta = .09, p < .001$), and parental challenges of planning screen-free activities ($\beta = .01, p < .001$). As the parental education level ($\beta = -.08, p < .01$), parental income level ($\beta = -.10, p < .01$), and the parent-child daily activity of dramatic play ($\beta = -.08, p < .05$) increased, the child's screen time was more likely to decrease.

Discussion and Conclusion

This study investigated the factors influencing the screen time of 2- to 6-year-old children during the COVID-19 pandemic. The findings strongly align with Bronfenbrenner's (1979) bioecological framework, which predicts the impact of child, parental, and pandemic-related factors on the microsystem, mesosystem, and chronosystem that shape a child's development and, consequently, predict their screen time. Furthermore, in line with neocological theory, our study acknowledges the growing prominence of technological systems in the contemporary world. These systems are increasingly influencing children's screen time behaviors and experiences, adding a new dimension to their ecological contexts.

First, our findings indicate that there are correlations among children's age, their possession of digital devices, and the amount of time they spend on screens each day. This aligns with previous studies (Connell et al., 2015; Radesky et al., 2020; Rideout & Robb, 2019) suggesting that, as children get older, they have access to a wider range of digital tools and content. It has also been noted that the number of young children who own smartphones or tablets is increasing (Ofcom, 2020; Rideout & Robb, 2020). This rise in digital device access has led to more screen time; this is in line with neocological theory, which emphasizes the effect of device ownership on interactions in a child's microsystem. The COVID-19 pandemic has further amplified this trend, with distance education driving parents to provide digital devices for their children.

Second, in predicting children's screen time, parental factors were found to be the most influential. Interestingly, parents' screen time and age were positively associated with an increase in children's screen time, whereas parents' education and income were negatively associated with it. Notably, the fact that children had higher screen time when their parents also did is in line with previous studies that have established a strong link between parental media consumption and children's screen time (Lauricella et al., 2015; Lee et al., 2022; Linder et al., 2021; Poulain et al., 2019; Uzundağ et al., 2022). It seems likely that parents watching TV and using computers and smartphones motivates children to use these devices as well. Surprisingly, we observed a positive correlation between parents' age and their children's screen time, with children of older parents having increased screen time, even though previous studies have produced mixed results on this point (Connell et al., 2015; Detnakintra et al., 2020). It is possible that the relatively high average age of the parents in our study helps to explain this discrepancy: older parents may have a

preference for quieter activities, including screen-based ones, for their children. Our findings also indicate that children's screen time is impacted by their parents' educational and income levels, which is in line with expectations. Similar studies have shown that parents with higher education tend to have a more structured approach to managing their children's screen time compared to parents with lower education (Çelik et al., 2021; Loprinzi et al., 2013; Määttä et al., 2017; Nikken & Schols, 2015).

Third, in regard to parental mediation strategies, the “encouraging” subscale is the sole predictor of children's screen time. Surprisingly, contrary to our expectations and previous research, there were no associations found between children's screen time and the “active” and “technical” mediation strategies (Barkin et al., 2006; Connell et al., 2015; Lauricella et al., 2015; Nevski & Siibak, 2016). Circumstances arising from the COVID-19 pandemic may have played a crucial role in the study's outcome. The increased social isolation may have made it challenging for parents to offer alternative activities, despite their attempts to use active and technical mediation strategies, with their children's screen time increasing as a result. Indeed, our findings show that parents for whom it was difficult to plan screen-free activities had children with higher screen time.

Lastly, this study revealed a significant association between children's screen time and the duration of two parent–child daily activities: watching TV and dramatic play. During the pandemic, TV usage in households increased significantly as families sought to receive current news about pandemic restrictions and other information. Additionally, parents and children turned to TV as an easily accessible, versatile, and cost-effective family activity for entertainment while staying at home (Määttä et al., 2017; Ofcom, 2020). As anticipated, the duration of parent–child TV viewing habits positively predicted children's screen time.

In contrast, the duration of dramatic play had a negative predictive effect on screen time. Dramatic play, also known as pretend or imaginative play, is a crucial aspect of early childhood development characterized by children's spontaneous enactment of imaginary roles and scenarios. Research suggests that when children participate in imaginative and pretend play activities with their parents, they are likely to spend less time in front of screens, which can be attributed to several factors (Demirbaş & Koçak, 2020). First, dramatic play provides a stimulating and interactive alternative to screen-based entertainment, capturing children's interest and attention in ways that passive screen viewing does not (Hofferth & Sandberg, 2001). Second, the quality of time spent with parents during dramatic play strengthens parent–child relationships, making solitary activity less appealing (McHale et al., 2001). Parents who actively engage in dramatic play with their children may establish household routines and expectations that prioritize offline activities over screen use (Christakis, 2009). Overall, the immersive nature of dramatic play and the positive influence of parental involvement promote healthier and more balanced media habits.

Such interactive parent–child activities have been suggested as an effective approach to reducing screen time in early childhood (Detnakintra et al., 2020; Poulain et al., 2019; Przybylski

& Weinstein, 2019). Our study supports this notion, as we found that engaging in dramatic play, which naturally fosters parent–child interaction, can effectively reduce children’s screen time. Thus, we recommend that parents be encouraged to actively participate in play activities with their children. Barriers such as time constraints, work responsibilities, and limited access to safe play spaces as a result of the COVID-19 pandemic can hinder parent–child play. Developing effective strategies and interventions to address these challenges is crucial for encouraging quality playtime and reducing excessive screen time.

Implications for Practice and Policy

This study delved into the nuanced dynamics of screen time among young children during the COVID-19 pandemic, exploring its implications across various interconnected factors exacerbated by the global health crisis. Our investigation addressed a notable gap in the existing literature by showing the significant protection that parental socioeconomic status, educational background, and involvement in non-screen activities like imaginative play provided against overuse of digital screens by children during the pandemic. Our analysis revealed a clear association: children of parents with lower socioeconomic status and educational attainment and higher personal screen usage tend to spend more time engaged with digital screens. Furthermore, our findings highlight a link between parental endorsement of digital device usage and increased screen time among their children, which has become more pronounced in the context of heightened screen use for educational and recreational purposes, especially during the pandemic. These results are consistent with other research that underscores the importance of educating parents about effectively managing their children’s screen time (Ribner & McHarg, 2021; Rideout & Robb, 2020; Işıkoğlu Erdoğan et al., 2019; Uzundağ et al., 2021).

We emphasize the importance of promoting alternative activities that aid child development in an environment of increasing digital addiction (Ding & Li, 2022). Proposing a multifaceted approach, we advocate for disseminating parental education through workshops, educational materials, targeted social media campaigns, and collaborative efforts with educational institutions and community support networks. These key implications of our study align with recommendations by American Academy of Pediatrics (2020), which has underscored the need for collaborative partnerships between health care professionals, educators, and parents in order to develop positive media habits in children.

Our research unveils a complex interplay of factors that shaped children’s screen time during the COVID-19 pandemic and calls for concerted action to create environments that support holistic child development amidst the unprecedented challenges posed by increased screen use. Informed guidance and collaborative endeavors will be needed to ensure that the well-being of future generations is not impaired by the pervasive influence of screens, even when that influence is exacerbated by a global health crisis.

As an integral part of children's microsystems, parents play a crucial role as mediators in their children's screen usage (Öztürk & Irmak, 2021). They both provide digital tools and model their use. To fulfil their role as mediators effectively, parents should be equipped with strategies to navigate the advantages and disadvantages of digital technology for their children and to foster healthy media habits. Such strategies could include establishing and enforcing appropriate screen time limits, actively monitoring their children's online content, and imparting the critical thinking skills needed for safe online navigation. Additionally, encouraging more parent–child engagement in dramatic play can be a valuable approach to reducing children's screen time, underscoring the significance of parental involvement in screen-free activities. By fostering opportunities for screen-free activities within the home environment, families can enhance positive interactions and develop healthier screen habits for children. Providing parents with knowledge and practical tools can help cultivate a balanced and informed approach to screen usage in the digital age. Policymakers can contribute by initiating parental education programs to promote awareness about the significance of limiting both parent and child screen time. This collaborative effort could lead to a more mindful and beneficial use of digital media, ultimately benefiting children's overall well-being and development.

The study's findings should be treated with caution due to some limitations. First, the majority of the participants were mothers, a commonly encountered imbalance in research studies. Second, relying on parental reports of their child's screen time may introduce biases, as parents might have difficulty recalling and reporting the exact amount of time their children spend on screens. In addition, parents may feel societal pressure to be seen as responsible caregivers, which could result in underreporting of their child's screen time. Third, the data collection was conducted through an online survey, which may have introduced some selection biases. Parents who are illiterate or have limited internet access may have been excluded from participating in the study. Despite these limitations, the study still provides useful insights into the environmental factors associated with excessive screen time in young children. By examining the reported associations between parental education, income, and encouragement of screen use with children's screen time, the study emphasizes the critical role of parents in mediating screen usage for their children. However, future research may benefit from using more objective measures of screen time and employing diverse data collection methods to improve the robustness and representativeness of the findings.

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