

The Impact of Screen Exposure on Attention Development in Preschool Children in Türkiye

Orhan Coşkun¹, Said Koçyiğit², Ömer Sönmez³, Uğur Topçu⁴, Esra Akyılmaz⁴, Bengü Togay⁵, Şeymanur Koçyiğit⁶

¹University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital, Department of Pediatric Neurology, İstanbul, Türkiye

²Acıbadem University Faculty of Medicine, Department of Neuroscience, İstanbul, Türkiye

³İstanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine, Department of Radiation Oncology, İstanbul, Türkiye

⁴University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital, Department of Pediatrics, İstanbul, Türkiye

⁵University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital, Department of Pediatric Emergency, İstanbul, Türkiye

⁶Acıbadem University Faculty of Medicine, Department of Pediatrics, İstanbul, Türkiye

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ABSTRACT

Objective: Excessive screen exposure that negatively affects a person's life is called problematic media use. Problematic media uses in healthy children is associated with a sedentary lifestyle and negative health outcomes. Problematic media use and its negative effects on attention are a subject of debate.

Methods: We screened children between the ages of 5 and 6 who visited the pediatric department. One hundred and eighty-six children were included in the study. Demographic data were collected from the patients and their families. Additionally, daily screen exposure times were evaluated. The long form of the Problematic Media Use Scale (screen addiction scale), which is valid for ages 4-11, and the Frankfurter Concentration Test for 5-6 Year Old Children (FTF-K) were applied to all participants.

Results: Children using multiple screens had significantly higher problematic media use scores and screen time compared to those using only television ($p=0.003$, $p=0.017$). No statistically significant relationship was found between children's age, screen addiction scale scores, screen exposure duration, and final FTF-K test scores ($p>0.05$). A significant positive correlation was found between the number of siblings and screen addiction scale scores, and screen exposure duration; ($r=0.19$, $p=0.010$), ($r=0.20$, $p=0.007$).

Conclusion: Problematic media use and exposure duration in preschool children were not found to have a direct relationship with attention.

Keywords: Screen exposure, attention development, FTF-K test, screen addiction, children, problematic media use

INTRODUCTION

The rapid development of digital technologies in recent years has significantly increased children's interaction with media, leading to the emergence of new concepts such as problematic media use (1). Problematic media use is defined as excessive dependency on media content, which negatively affects daily life activities and causes psychosocial issues (2).

The widespread use of media at an early age has made it even more critical to examine its effects on children's cognitive,

emotional, and social development (3). Excessive media use has been shown to lead to negative outcomes in children, such as externalizing behaviors, decreased academic performance, and sleep disorders (4).

The rapid development of digital technologies has further increased children's media interaction, making the relationship between attention development and screen exposure more significant (5). Research suggests that early and prolonged screen exposure is associated with issues such as attention

ORCID IDs of the authors: O.C. 0000-0001-9229-404X; S.K. 0009-0009-5107-1742; Ö.S. 0000-0002-7708-4092; U.T. 0009-0004-4219-7152; E.A. 0009-0000-3634-5279; B.T. 0000-0002-0294-7607; Ş.K. 0009-0001-9947-8084

Corresponding Author: Orhan Coşkun, MD,

E-mail: dr.orhancoskun@hotmail.com

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deficit and impairments in executive functions (6). Given that the study involves older children, the observed outcomes may reflect cumulative exposure effects. However, the specific age at which such problematic media use begins remains unidentified. However, there are also studies that do not show a relationship between attention deficit and screen exposure (7).

Attention development plays a crucial role in children's academic and social lives, with lower attention spans being linked to learning difficulties and behavioral problems later in life (8). Factors that determine children's screen time, such as parental control, the nature of media content, and the child's age, play a significant role in this development (9).

For children over the age of two, screen time should be limited to two hours. However, many studies have shown that this two-hour limit is often exceeded. It is also known that boys are exposed to more screen time than girls, and older children and adolescents spend more time on screens than younger children (10).

This study aims to investigate the effects of screen exposure on attention development in preschool children in Türkiye. Türkiye is a developing country. In developing countries, people generally face no significant economic barriers to accessing various video devices. This situation suggests that screen addiction may be prevalent. Therefore, examining their effects on children was deemed necessary. It is important to anticipate the negative effects that potential attention disorders may have on academic and social life. Our aim is to investigate whether screen exposure and problematic media use cause attention deficits in children with normal motor and social development. Therefore, the need for this research has been recognized.

METHODS

Design

Our study was designed as a single-center, cross-sectional study. We screened children between the ages of 5 and 6 who visited our pediatric department's outpatient clinics and emergency room. The study period was set from September 2024 to February 2025. A total of 327 children without chronic illness were identified, and 214 agreed to participate in the study. The Denver II test was administered to the participating children. Among the 214 participants, 28 children were excluded from the study due to delays in personal-social development, fine motor-adaptive development, and language development. Our study was completed with 186 children. Demographic data were collected from the patients and their families. Additionally, daily screen exposure times were evaluated. Since our study involved a young age group, parents were asked to record in writing the total duration of active and passive media use over one week. The daily average duration was then calculated. Due to the high amount of passive use (such as watching videos and television), a comparison between the two types of use could not be conducted. However, both active use (such as playing games) and passive use were commonly observed among most participants. Additionally,

the usage types include videos, television, and games that are watched or played solely for entertainment purposes. The long form of the Problematic Media Use Scale, which is valid for ages 4-11, and the Frankfurter Concentration Test for 5-6 Year Old Children (FTF-K) were applied to all participants. Families were selected from individuals living in the Gaziosmanpaşa district of Istanbul with similar income levels. Our study includes participants from the middle and lower income groups according to the standards of our country.

Ethics

The parents or guardians of the children provided informed consent, and the local Ethics Committee of the University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital approved the study (decision no: 81, date: 08.01.2025). The study adhered to the ethical principles outlined in the Declaration of Helsinki.

Participants

Children with chronic neuropsychiatric disorders or other chronic illnesses were excluded from the study. Children who had regular medication use were excluded.

Problematic Media Use Scale Long Form

The scale, originally developed by Domoff et al. (11) in 2019 to assess problematic media consumption (PMC) in children aged 4-11, consists of a 27-item long form and a 9-item short form. Its Turkish adaptation, including validity and reliability analyses, was conducted by Furuncu and Öztürk (12) in 2020. The long form (problematic media use scale - long form) follows a single-factor structure and is rated on a 5-point Likert scale (1= never, 5= always). The total score is calculated by averaging the responses across all items, with higher scores indicating greater levels of problematic media use. The Cronbach's alpha coefficient for the long form of the scale is reported as 0.97 (12).

The Frankfurter Concentration Test for 5-6 Year Old Children

FTF-K is a commonly utilized psychological assessment designed to evaluate the attention and concentration skills of children between the ages of 5 and 6. This test is especially valuable in educational and psychological contexts, as it helps assess a child's capacity to maintain focus on tasks that require sustained attention and cognitive regulation. FTF-K has been supported by various studies, confirming its strong reliability in assessing attention skills in young children. Its standardized structure allows for objective evaluation, making it a significant instrument in developmental psychology and educational assessments. The test is administered in a quiet setting with minimal distractions to ensure optimal concentration. The child is provided with a pencil and a standardized test sheet, while the examiner gives clear instructions before initiating the timed task. The child's performance is assessed based on response accuracy and speed, offering insights into his or her attentional capabilities (13-15).

Statistical Analysis

In this study, statistical analyses were conducted using the IBM SPSS software (version 23, Chicago, IL, USA, 2015). While evaluating the study data, descriptive statistical methods (mean, standard deviation, frequency) were used. Normality was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For normally distributed parameters, comparisons were made using the Independent Samples t-test and one-way analysis of variance (ANOVA). For non-normally distributed parameters, the Mann-Whitney U test and Kruskal-Wallis test were applied. Additionally, the Spearman rank correlation test was used to examine relationships between two parameters. A significance level of $p < 0.05$ was considered statistically significant.

RESULTS

The reliability of the scales, commonly used to determine whether the information provided by the survey has stable characteristics, and whether the same results would be obtained from a second measurement conducted for the same purpose, was assessed using the Cronbach's alpha reliability coefficient for the screen addiction questionnaire applied to 186 children aged 5-6 years. The scale was found to have high reliability with a coefficient of 0.85 ($0.81 < \alpha < 1.00$) (16). The first validity and reliability studies of the FTF-K in the Turkish sample were carried out by Kaymak (17). The reliability of the test was evaluated by senior students enrolled in the Clinical Psychology Applications course at Ankara University Faculty of Educational Sciences, by applying it to 30

children aged 5-6 years by senior students enrolled in the Clinical Psychology Applications course at Ankara University Faculty of Educational Sciences. The test-retest method was used to determine the reliability. Based on the analysis, the correlation value between the test-retest applications was found to be over 0.70, indicating that the test is considered a reliable and valid data collection tool (17).

A post-hoc power analysis was conducted using the G*Power 3.1.9.7 software to assess the power of the accessible sample size (18). In the post-hoc analysis, assuming a medium effect size of $d = 0.5$ and a significance level of $\alpha = 0.05$, the statistical power was calculated for an independent samples t-test with 99 participants in group 1 and 87 participants in group 2, yielding a power ($1 - \beta$) of 0.959. For the Mann-Whitney U test under the same conditions, the power ($1 - \beta$) was found to be 0.952.

For a one-way ANOVA with a small to medium effect size ($d = 0.25$), a significance level of $\alpha = 0.05$, and a total sample size of 186 across four groups, the calculated power ($1 - \beta$) was 0.818.

In the correlation analysis, assuming an effect size of $p = 0.3$, a significance level of $\alpha = 0.05$, and a sample size of 186, the statistical power ($1 - \beta$) was determined to be 0.989.

Demographic findings are presented in Table 1.

The final FTF-K test scores were obtained by summing the raw and adjusted scores. These final scores allow for a comparison of the child with peers of the same age in months (see Table 2).

Among the 186 children aged 5-6 who took the FTF-K test, 88 (47.3%) had concentration levels above 75% of their peers. A total of 67 children (36%) had concentration levels above those of 51% of their peers, while 31 children (16.7%) had concentration levels below those of 74% of their peers.

When comparing age, screen exposure, screen addiction scale scores, and FTF-K test scores by gender, the results showed no statistically significant difference between boys and girls ($p > 0.05$) (see Table 3).

When children were categorized into four groups based on screen use (multiple devices, television only, tablet only, phone only), and their ages were compared across these groups, the results showed no significant difference ($p > 0.05$) (see Table 4).

Table 1. Demographic cohort

Total (n, %)	186 (100%)
Age (month) (mean \pm SD)	66.13\pm3.90
Sex (n, %)	186 (100%)
Female	99 (53.2%)
Male	87 (46.8%)
Number of siblings (mean \pm SD)	1.60\pm1.16
Screen exposure (hour) (mean \pm SD)	2.72\pm1.62
Screen addiction scale score (mean \pm SD)	57.36\pm21.11
FTF-K test (raw) score (mean \pm SD)	28.33\pm9
FTF-K test (final) score (mean \pm SD)	32.17\pm9
FTF-K test (final) score comparison (n, %)	186 (100%)
Below average (0-22 score)	31 (16.7%)
Average (23-32 score)	67 (36%)
Above average (33-48 score)	88 (47.3%)
Screen exposure (n, %)	186 (100%)
Multiple	108 (58.1%)
Only TV	30 (16.1%)
Only tablet	10 (5.4%)
Only smartphone	38 (20.4%)
n: Number of children, SD: Standard deviation, FTF-K: Frankfurter Concentration Test for 5-6 Year Old Children	

Table 2. FTF-K test (final) score distribution

(n, %)	Final score	Percentage	Assessment
31 (16.7%)	0-22	26%	Below average
67 (36%)	23-32	49%	Average
88 (47.3%)	33-48	25%	Above average
n: Number of children, FTF-K: Frankfurter Concentration Test for 5-6 Year Old Children			

However, when comparing screen addiction scale scores among these four groups, the results indicated a statistically significant difference: χ^2 (3, n=186) =12.690, $p=0.005$. Post-hoc comparisons using the Bonferroni-corrected Dunn method revealed that children using multiple screens had significantly higher screen addiction scale scores compared to those using only television ($p=0.003$). However, no significant differences were found among the other groups ($p>0.05$) (see Table 4).

Similarly, when screen exposure levels were compared among these four groups, a significant difference was observed; χ^2 (3, n=186) =8.939, $p=0.030$. Post-hoc comparisons using the Bonferroni-corrected Dunn method showed that children using multiple screens had significantly higher screen exposure than those using only television ($p=0.017$). However, no significant differences were found among the other groups ($p>0.05$) (see Table 4).

Lastly, when comparing the mean final FTF-K test scores among these four screen-use groups, the results indicated no statistically significant difference; F (3,182) =0.777, $p=0.508$ (see Table 4).

When children were categorized into three groups based on their final FTF-K test scores (below average, average, and above

average) and compared in terms of age, number of siblings, screen addiction scale scores, and screen exposure, the results showed no statistically significant differences among the groups ($p>0.05$) (see Table 5).

Spearman's rho correlation coefficients were calculated to assess the relationships between children's age, number of siblings, screen addiction scale scores, screen exposure duration, and final FTF-K test scores. The results showed no statistically significant relationship between children's age, screen addiction scale scores, and screen exposure duration, and final FTF-K test scores ($p>0.05$).

However, a significant positive correlation was found between the number of siblings and screen addiction scale scores ($r=0.19$, $p=0.010$). Additionally, a significant positive correlation was observed between the number of siblings and screen exposure duration ($r=0.20$, $p=0.007$). Furthermore, a strong positive correlation was identified between screen addiction scale scores and screen exposure duration ($r=0.97$, $p<0.001$) (see Table 6).

Table 3. Age, screen exposure, screen addiction scale score, and FTF-K test score comparison between females and males

	Female	Male	p-value
Age (month) (mean \pm SD); (median)	66.11 \pm 3.86; (65)	66.15 \pm 3.96; (66)	0.980 ^a
Screen exposure (ho) (mean \pm SD); (median)	2.62 \pm 1.54; (2)	2.84 \pm 1.7; (2)	0.454 ^a
Screen addiction scale score (mean \pm SD); (median)	55.82 \pm 19.15; (54)	59.11 \pm 23.13; (54)	0.493 ^a
FTF-K test (final) score (mean \pm SD)	32.54 \pm 8.72; (33)	31.75 \pm 9.36; (31)	0.887 ^b

^a: Mann-Whitney U test, ^b: Independent Samples t test, FTF-K: Frankfurter Concentration Test for 5-6 Year Old Children

Table 4. Age, number of siblings, screen exposure, screen addiction scale score, and FTF-K test (final) score comparison in terms of screen utilization

	Multiple	Only Tv	Only tablet	Only smartphone	p-value
Age (month) (mean \pm SD); (median)	66.22 \pm 4.03; (66)	65.37 \pm 3.51; (65)	65.9 \pm 4.51; (67)	66.53 \pm 3.72; (68)	0.579 ^a
Number of siblings (mean \pm SD); (median)	1.60 \pm 1.01; (2)	1.50 \pm 1.25; (1.5)	1.70 \pm 1.83; (1.5)	1.66 \pm 1.30; (1.5)	0.923 ^a
Screen addiction scale score (mean \pm SD); (median)	61.19 \pm 22.0; (56.5)	45.7 \pm 14.0; (44)	56.8 \pm 15.55; (62)	55.82 \pm 20.47; (49.5)	0.005 ^a
Screen exposure (h) (mean \pm SD); (median)	2.96 \pm 1.69; (3)	1.93 \pm 1.11; (2)	2.7 \pm 1.42; (3)	2.66 \pm 1.63; (2)	0.030 ^a
FTF-K test (final) score (mean \pm SD)	32.92 \pm 8.58	30.3 \pm 9.56	30.7 \pm 8.1	31.89 \pm 9.98	0.508 ^b

^a: Kruskal-Wallis test, ^b: One-Way ANOVA test, SD: Standard deviation, FTF-K: Frankfurter Concentration Test for 5-6 Year Old Children

Table 5. Comparison of evaluation groups formed according to the final FTF-K test score in terms of age, number of siblings, screen addiction scale score, and screen exposure

	Below average (0-22 score range)	Average (23-32 score range)	Above average (33-48 score range)	p-value
Age (month) (mean \pm SD); (median)	66.90 \pm 3.74; (68)	66.07 \pm 3.82; (66)	65.90 \pm 3.82; (65)	0.458 ^a
Number of siblings (mean \pm SD); (median)	1.97 \pm 1.22; (2)	1.48 \pm 1.33; (1)	1.57 \pm 0.97; (2)	0.054 ^a
Screen addiction scale score (mean \pm SD); (median)	54.52 \pm 22.80; (51)	57.46 \pm 20.55; (51)	58.28 \pm 21.08; (57)	0.518 ^a
Screen exposure (h) (mean \pm SD); (median)	2.55 \pm 1.73; (2)	2.70 \pm 1.61; (2)	2.80 \pm 1.59; (3)	0.661 ^a

^a: Kruskal-Wallis test, FTF-K: Frankfurter Concentration Test for 5-6 Year Old Children, SD: Standard deviation

Table 6. Correlation coefficients of children's ages, number of siblings, screen addiction scale scores, screen exposure durations, and FTF-K test (final) scores

	M	SD	Age (month)	Number of siblings	Screen addiction scale score	Screen exposure (h)	FTF-K test (final) score
Age (month)	66.13	3.9	-				
Number of siblings	1.60	1.16	0.01	-			
Screen addiction scale score	57.36	21.11	0.10	0.19*	-		
Screen exposure (h)	2.72	1.62	0.09	0.20*	0.97**	-	
FTF-K test (final) score	32.17	9	-0.13	-0.07	0.01	-0.01	-

*p<0.05, **p<0.001; M: Mean, SD: Standard deviation, n:186, FTF-K: Frankfurter Concentration Test for 5-6 Year Old Children Spearman's rho correlation coefficient

DISCUSSION

Problematic media use has emerged as a significant issue in the rapidly advancing technological age. It can lead to social relationship problems, promote sedentary lifestyles, and negatively affect cognitive functions. However, there are many factors that mitigate the negative effects of time spent in front of screens. It is stated that the impact of time spent actively or passively on cognition differs (19). There are studies showing that extended screen time has adverse effects on attention. Studies argue that screen time does not necessarily lead to attention deficits. The complexity of this issue seems to arise from the influence of many different factors (6,7). The aim of our study is to investigate this issue in preschool children. However, when designing our study, we included children who had normal development in language, personal-social skills, and fine motor skills by applying a developmental test. The goal here is to examine the isolated effect of screen exposure on attention. It is likely that children with deficits in personal-social development, language delay, or motor skills would exhibit lower attention performance. To explore the direct impact of problematic media use on attention, our study was structured to focus on this relationship.

Our examination of the study results revealed that the participants' final FTF-K test scores were above average. This rate, which was 47.3%, indicates that the participants had higher levels of attention. One possible reason for this could be the selection of participants based on a developmental test. When comparing age, screen exposure, screen addiction scale scores, and FTF-K test scores by gender, no significant differences were found in our study. The literature suggests that executive functions (such as self-control and inhibition) are higher in adolescent girls than in boys (20). However, while no behavioral differences have been observed in the preschool period, stronger prefrontal activity has been identified in girls (21). In our study, no significant differences were found in screen addiction and attention scores.

Our findings indicate that children exposed to multiple digital devices had higher problematic media use scale scores and greater screen exposure compared to children who only watched television. This suggests that phones and tablets may have a higher addictive potential. Our study concluded that exposure to multiple digital devices increases the risk of

addiction (Table 4). However, when examining attention test scores, no differences were found between children using multiple screens and those using a single digital device. Since television is considered a more passive form of screen exposure, our study indirectly suggests that active and passive participation do not create a significant difference. While in preschool children, not only television but also tablets and phones may serve as passive engagement tools (such as watching videos), some studies indicate that active or passive participation affects cognition in adolescents (19). This may explain the absence of differences in attention test scores.

No significant differences were found when children were categorized into three groups based on their final FTF-K test scores (below average, average, and above average) and examined in terms of age, number of siblings, screen addiction scale scores, and screen exposure. This suggests that even children with below-average attention levels do not necessarily have a connection with screen addiction. However, in our study, as the number of siblings increased, the "problematic media use scale" scores and screen exposure duration also increased. This may be due to reduced parental attention in families with multiple children. This situation may also result from neglect of the children when there are many siblings. Perhaps we did not encounter this situation because siblings may encourage each other to use videos, television, and games. The risk of screen addiction appears to be higher in preschool children from large families, making this an important finding in our study (Table 6). Additionally, a strong correlation was observed between the problematic media use scale and screen exposure time, which supports the reliability of the responses provided by families.

In summary, our study did not find a direct relationship between screen addiction and attention in preschool children. Studies suggesting such a relationship likely indicate that screen exposure, affecting personal social development, fine motor skills, and language development, leads to secondary attention-related problems. This suggests that screen exposure alone may not cause an attention disorder. The contradictory findings may be due to the differing effects of the content that children were exposed to. Additionally, we were unable to assess the positive or negative effects of active media use in this age group, as passive

use was predominantly observed. Moreover, negative impacts on attention may increase cumulatively with age, which could explain why we did not detect significant effects in our study. However, the literature on this topic remains controversial (6,7) as multiple factors play a role in this relationship. The effects of screen addiction may vary depending on cultural factors. As Türkiye is a Middle Eastern country with strong family and kinship ties, the negative effects of screen exposure may have been less apparent in our study. Since our study specifically focused on the impact of screen exposure on attention, it contributes valuable insights to the literature. Conducting future studies with children who have developmental delays may provide more guidance. It is likely to observe the negative effects of problematic media use in children with developmental delays (such as language delay and social delay).

Study Limitations

Future studies with larger sample groups could further examine developmental delays and their association with attention, providing additional contributions to this field. The cross-sectional nature of our study presents a limitation. Longitudinal studies with extended follow-up periods could provide more comprehensive insights. Since data were recorded by parents, some subjectivity may have been introduced. However, considering the large number of recordings and the fact that they were collected in the home environment, this method was the most feasible. Additionally, since passive media use was more commonly observed in this age group, we were unable to clearly differentiate between active and passive use among our participants.

CONCLUSION

Problematic media use and exposure duration in preschool children were not found to have a direct relationship with attention. However, they may have negative effects on attention when accompanied by developmental delays. Problematic media use and screen exposure are more prevalent among children in large families. However, no significant impact on attention has been identified.

Ethics

Ethics Committee Approval: Ethics Committee of the University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital approved the study (decision no: 81, date: 08.01.2025).

Informed Consent: The parents or guardians of the children provided informed consent.

Footnotes

Author Contributions: Concept - O.C.; Design - O.C.; Data Collection and/or Processing - O.C., S.K., Ö.S., U.T., E.A., B.T., Ş.K.; Analysis and/or Interpretation - O.C.; Literature Search - O.C.; Writing - O.C., S.K.

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