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The Influence of Screen Time on School Performance of Children aged 7-10 Years – A Cross-Sectional Survey

Amber Latif, Hajra Javed, Sughra Wahid, Anam Zafar, Maliha Akhtar, Sarmed Yasir Mangi

Department of Paediatrics, KRL Hospital, Islamabad Pakistan

ABSTRACT

Objective: To study the impact of screen time on school performance in children of 7-10 years of age.
Study Design: Cross-sectional Comparative survey.
Place & Duration of Study: Two schools, one Government School and one private sector school, Islamabad Pakistan from Nov 2024 to Jan 2025.
Methodology: Total 308 school going children of 7-10 years of age meeting the inclusion criteria rom two schools were included in the study. Data was collected from their parents and teachers on the parents-day meeting as per designed proforma based on Child Occupational Self-Assessment (COSA). Fine motor and visuospatial skills were also assessed and compared with daily average screen time.
Results: A total of 310 children were included having median age of 8.00(2.00) years with 178(57.4%) boys and 131(42.3%) girls. The median daily screen time reported by parents was 4.00 (2.00) hours. The class grades in academics, attitude and class participation of children were found to vary with average daily screen time (p<0.0001). The sleep hours were also associated with the attitude in the class (p=-0.644, p<0.0001). Solving time for peg board pattern was 118.50(48.00) seconds and setting the calendar was 116(53.25) seconds had significant relationship with average daily screen time (p=0.961, 0.945, p<0.0001, <0.0001) respectively.
Conclusion: Excessive screen time found to be associated with lack of interest, delayed fine motor and visuospatial learning, as well as poorer academic performance.

Keywords: Child Occupational Self-Assessment (COSA), visuospatial skills, school performance, Screen time.

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INTRODUCTION

The last two decades have seen excessive exposure of all ages to the screen and there has been concomitant hollering of the perils it holds for us in the form of a dystopian reality. The screen captures the minds of children, more as compared to adults because of plasticity of their neural pathways.[1] The effects of digital age on the developing human brain have been declared not severe enough to warrant policy change in some large scale reviews but still, this is merely the beginning and only time will tell what is next.[2] Excessive screen time in school age children has been linked to increasing levels of stress, lack of sleep and behavioral problems.[3] It has also been associated with sedentary lifestyle, obesity and future cardiovascular risks.[4]

Screens improve learning and education but over exposure is certainly associated with a poor academic performance.[5] Children with over exposure to screens have been reported to have worse haptic and fine motor skills but a better visuospatial discrimination.[6] Another term that has not been recognized so far is virtual autism which is the presence of autism like features in school going children possible resulting from excessive screen time in the early years of development.[7]

On average, American school going children spend 4 to 6 hours a day watching screens. Such statistics are lacking in our population and this problem has been on the rise unchecked. American Academy of Child and Adolescent Psychology encourages to limit screen time to less than one hour on a week day and 3 hours on weekends and children above 6 years of age should be encouraged for healthy outdoor recreation and access to a personal screen should be deferred to an age when the child is ready.[8]

There have been limited local studies done on the impact of screen time on school going children. Like the rest of the world, Pakistan has also absorbed the digital evolution but we are yet to prepare for the potential issues it has created and is continuing to

Correspondence: Dr Amber Latif, Department of Paediatrics, KRL Hospital, Islamabad Pakistan
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conjure for our under-resourced country. Studies have only recently started to sprung up in Pakistan telling how detrimental is screen time proving for children.[9] Our study has not only focused on the performance of school going children of age group 7 to 10 years but also on sleep habits, behaviors and BMI differences with increasing screen time because this is where the first intervention strategy can be made and awareness campaigns launched.

METHODOLOGY

This study was conducted as a cross-sectional comparative survey study in two schools in Islamabad Pakistan. A permission was sought from the school administration prior to collection of data. An informed consent about measurements and publishing of data in local or international medical literature was also obtained from the parents of the children. Sample size was calculated using the Open Epi online sample size calculator with 95% confidence interval and a 90% power of study using the reported mean difference of sleep problem scores between children with daily screen time of more or less than 60 minutes by Suleman *et al.,* and it came out to be 310.[9] Sampling was done using convenience sampling technique and all children meeting the inclusion criteria at the SLS Montessori and School were included in the study.

Inclusion Criteria: All children of age 7 to 10 years of either gender were included in the study.

Exclusion Criteria: Children who were absent from the school or unavailable for weight and height measurements because of consent were excluded from the study.

Data were collected from parents and class teachers on the parents-day meeting. A specially designed proforma made with the help of Child Occupational Self-Assessment (COSA) that has been validated by Kramer *et a*l., was used for data collection.[10] Parents were asked about the academic performance of the children over the last one year in terms of their class grade and average screen time they have been exposed to in the last 3 years. Data was also collected with regards to dozing off in the class, sleep time, temper and attitude of the child in class and entered in the proforma. The child was also assessed with regards to fine motor and visuospatial skills for which help was taken from Pedretti's Occupational Therapy book in order to design relevant activities. Fine motor skills were judged by asking the child to copy a pattern from the paper and complete that using small pegs on a peg board by ChiodiniR. Visuospatial skills were assessed by giving child a command for setting the season, month, date, day, time of day and the clock on a JoKuYR Calendar Clock toy board (Figure-1). Both activities were timed and data was collected in seconds. Finally, measurements of body weight in kilograms and height in centimeters were taken, body mass index was calculated.

Figure-1: Children Toys used for Assessing Fine Motor and Visuospatial Skills

Data analysis was done using Statistical Package for Social Sciences version 25.0. Quantitative variables were not normally distributed and were expressed as median (interquartile range) and qualitative variables were expressed as frequencies and percentages. Spearman's Rank Correlation was used to express relationship between two quantitative variables while Kruskal Wallis H test was used to describe significance and a *p*-value of less than 0.05 was considered significant.

RESULTS

A total of 310 children were enrolled in this study having median age of 8.00 (2.00) years with a range corresponding to the age limits of inclusion criteria. There were 178(57.4%) boys and 131(42.3%) girl students. The median of average daily screen time of children reported by parents was 4.00 (2.00) hours. The median BMI of the children was 16.00 (3.00) kg/m^2.

From the study population, 31(10%) children had secured grade A in the last academic year, 147(47.4%) had secured grade B, 113(36.5%) received grade C and 19(6.1%) got grade D. The grades were distributed across the average screen time reported by parents and the relationship was found significant ($p<0.0001$). The replies of teachers towards the attitude of children towards tasks given in class also varied with only 7(2.3%) strongly positive. Most of the children were

reported to fall in the positive and fairly positive category and grades also varied significantly with the attitude (Table-II).

Table-I: Characteristics of Children Included in the Study (n=310)

Variable		Values [Median(IQR)] OR Frequency (%)
Age (in years)		8.00(2.00)
Gender	Male	178(57.4%)
	Female	131(42.3%)
Body Mass Index (kg/m^2)		16.00(3.00)
Daily Screen Time (in hours)		4.00(2.00)
Class Grade	A	31(10%)
	B	147(47.4%)
	C	113(36.5%)
	D	19(6.1%)
Daily Sleeping Time (in hours)		8.00(1.00)

Attitude of the children was also found to vary significantly with average daily screen time (p<0.0001). The responses of teachers with regards to participation of child in class activities and dozing off in the class have been summarized in the Table-III.

Table-II: Comparison of Class Grades and Attitude of Children (n=310)

Grades	Attitude	Strongly Positive	Positive	Fairly Positive	Negative	Strongly Negative
A		4(1.29%)	26(8.38%)	1(0.32%)	0	0
B		2(0.64%)	102(32.9%)	39(12.58%)	4(1.29%)	0
C		1(0.32%)	31(10%)	41(13.22%)	40(12.9%)	0
D		0	1(0.32%)	1(0.32%)	12(3.87%)	5(1.61%)

Comparing responses of class participation and dozing off frequency in the class across the screen time, the relationship was also found to be significant (p<0.0001). The children had varying sleep habits while at home as reported by parents. From the study population 69(22.3%) had sleep duration less than 8 hours. Rest of the children however, had sleep of ≥8 hours per day. The sleep hours were found significantly associated with the attitude in the class (Spearman p=-0.644, p<0.0001). BMI was also found to have a significant relationship with the screen time (Spearman p=0.383, p<0.0001). The time taken by the children to complete the peg board pattern and setting the activity calendar was measured in seconds. Median duration to complete the peg board pattern was 118.50(48.00) seconds and that for setting the calendar was 116(53.25) seconds. They were plotted against the average daily screen time and a relationship was found significant for both (Spearman p=0.961, 0.945, p<0.0001, <0.0001) respectively. (Figure-2)

DISCUSSION

The study evaluated the impact of screen time on the school performance and related behaviors of children and it was noted that academic performance was inversely related to screen exposure, with a significant trend of poorer grades among children with higher screen times (p<0.0001). Stiglic *et al.*, explained that harmful behaviors and negative lifestyles in children and teen agers were result of excessive screentime habits in early childhood which also leads to lack of sleep, psychological issues and poor health.[11] Similarly the findings of a study by Skalicka et al emphasized on the potential negative hazards of too much screen time and exposure especially where screens ere present in child`s personal space. Also, study emphasized face-to-face parental and social interactions are significant in child`s mental, social, emotional and psychological health.[12] The median BMI of the children was 16.00(3.00) kg/m^2 and was found to have a significant relationship with the screen time (Spearman p=0.383, p<0.0001). Vidhate *et al.*, explained that frequency of screen time and smartphone usage had positive correlation with BMI. He observed that children who were exposed to social media had higher mean BMI of 20.46±0.25 kg/m^2 and control group children had mean 18.21±0.18 kg/m^2 BMI.[13]

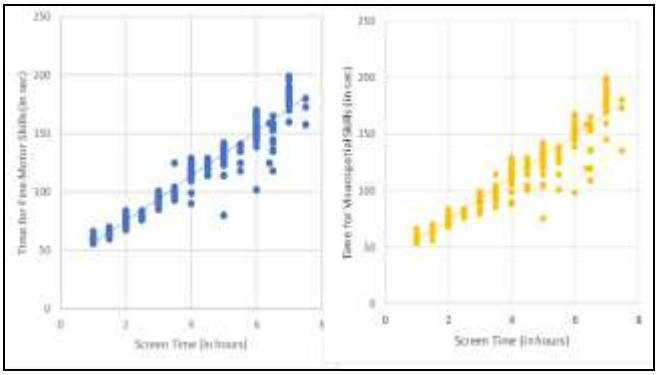

Figure-2: Simple Scatter Showing Relationship of Screen time with Time taken by Children to Complete the fine Motor and Visuospatial Activities (n=310)

The mean of average daily screen time of children reported by parents was 4.14±1.69 hours in this study.

Chen *et al.,* found that average screen time exposure of children of aged 0-2 years was 3.05 hours per day and 3-5 years aged children screen time was 3.14 hours with 86% and 74% of total time spent on television respectively.[14] The Common Sense Census also reported that average screen time has drastically increase with children of aged 0-8 years spending 2.5 hours on television and mobile screens.[15] The results of a cohorts study by Goode *et al*., shoed that children`s screen time and media usage has increased 32% in past two decades.[16] Lauricella et at explained results of linear regression analysis that parent`s excessive screen time was directly and strongly linked with child`s excessive screen time.[17]

Table-III: Screen Time Distribution Across Different Categories (n=310)

Variable	Grading	n(%)	Screen Time [Median (IQR)]	*p*-value
Class Grade	A	31(10%)	1.50(1.00)	<0.0001
	B	147(47.4%)	3.50(1.50)	
	C	113(36.5%)	5.00(1.50)	
	D	19(6.1%)	7.00(1.00)	
Class Participation	Rarely	65(21%)	2.00(0.50)	<0.0001
	Sometimes	107(34.5%)	4.00(1.50)	
	Often	92(29.7%)	5.00(2.00)	
	Almost Always	46(14.8%)	6.50(1.00)	
Dozing Off in Class	Rarely	68(21.9%)	2.00(0.50)	<0.0001
	Sometimes	96(31%)	4.00(1.50)	
	Often	100(32.3%)	5.00(1.90)	
	Almost Always	46(14.8%)	6.50(1.00)	
Attitude in Class	Strongly Positive	7(2.3%)	2.00(3.00)	<0.0001
	Positive	160(51.6%)	3.00(2.00)	
	Fairly Positive	82(26.5%)	5.00(1.00)	
	Negative	56(18.1%)	6.00(1.00)	
	Strongly Negative	5(1.6%)	7.00(1.00)	

Teachers reported that children with greater screen time were more likely to doze off in class and showed minimal positive attitudes and participation in classroom tasks, with significant associations noted for these behaviors (p<0.0001). Additionally, children's sleep duration was associated with their classroom attitudes, with shorter sleep hours correlating to poorer attitudes (Spearman's p=-0.644, p<0.0001). Similar findings were noted in a study which showed that excessive bedtime screen time had poor sleep quality with longer sleep onset latency leading to shortened sleep duration in children. This lack of sleep leads to excessive day time laziness and chances of doing off in class. Hence, negatively effecting learning ability resulting in poor school performance.[18]

In this study, only 7(2.3%) children had strongly positive attitude towards tasks given in class while others had fairly positive and negative attitude towards class room learning due to poor sleep. Paulich et al found that higher screen time led to sleep deprivation which moderately negatively affect mental health causing developmental and behavioral issues, lack off interest in learning and poorer academic performance.[19] A cross sectional survey in Islamabad by Suleman *et al.,* reported that children with screen time of >1 hour likely to suffer from withdrawal syndrome (11.94±3.91, p=0.014), sleep issues (10.97±3.20, p=0.010) and Autism spectrum issues (17.66±5.89, p=0.047) in comparison to those having screen time of less than 1 hour per day.[9]

Excessive screen time in recent past years have drastically increased in children as well negatively affecting cognitive functioning and impacting school performance and learning skills. From the study population in this study, 31(10%) children had secured grade A in the last academic year, whereas 147(47.4%) had secured grade B, 113(36.5%) received grade C and 19(6.1%) got grade D which were found significant when distributed across the average screen time reported by parents (p<0.0001). In a meta-analysis by Zhao *et al*., it was found that excessive screen exposure directly linked with poor school performance and lower cognitive developmental scores.[20] Similar findings were noted by McHarg *et al*., that higher the screen time per day, lower the academic performance and learning.[21] Similarly, Adelantado reported that higher television watching time inversely affect school performance in children (ES=-0.19; 95% CI: -0.29 to –0.09).[22]

Fine motor and visuospatial skills were assessed using pegboard patterns and calendar-setting tasks, respectively. The median times for task completion were 118.50 seconds for the pegboard and 116 seconds for the calendar-setting activity. Both times showed a strong positive correlation with screen time, indicating that children with higher screen exposure took longer to complete these tasks (Spearman's p=0.961 and 0.945, p<0.0001 for both). Karani *et al*., concluded that excessive screen exposure either television, mobile or I-pad in early age has negative and devastating effect on child`s development including language, cognitive,

fine motor and spatial skills. However, he also explained that introducing screen time with supervised better content has beneficial role in speech, language, motor, cognitive, social and mental development.[23] The results of logistic regression analyses by Kerai *et al*., explained that children with screen time of more than 1 hours per day were more likely to be vulnerable in developmental health areas including physical health and wellbeing (OR=1.41; 95%, CI: 0.99 - 2.0; *p*=0.058), social competence (OR=1.60; 95% CI, 1.16 - 2.2; *p*=0.004), emotional maturity (OR=1.29; 95% CI, 0.96-1.73; *p*=0.097), language and cognitive development (OR=1.81; 95% CI, 1.19 - 2.74; *p*=0.006) and communication skills (OR=1.60; 95% CI, 1.1 – 2.34; *p*=0.015) in comparison to those having less than one hour screen exposure per day.[24]

The findings underscore significant relationships between higher screen exposure and multiple adverse outcomes, including poor academic performance, diminished classroom engagement, disrupted sleep patterns, and delays in fine motor and visuospatial task completion. Supervised social media exposure and limited screen time with better content and parental control may provide a viable answer in regards to children`s screen time and their school performance.

LIMITATIONS OF STUDY

The foremost limitation of this study is two center study design. so the results cannot necessarily be generalized to all factions of society.

CONCLUSION

Active and passive screen exposure and prolong screen time negatively impact quality of life and developmental aspects. Excessive screen time effects mental, psychological and social development and also found to be associated with lack of interest, delayed language, fine motor and visuospatial learning, as well as poorer academic performance.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AL & HJ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

SW & AZ: Data acquisition, data analysis, approval of the final version to be published.

MA & SYM: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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