



Association Between Screen Time, Sleep Duration, and Academic Performance Among School-Aged Children: A Cross-Sectional Observational Study.

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Abstract

Background: Recreational screen exposure and inadequate sleep are increasingly common among school-aged children and can influence learning-related behaviors. Their combined relationship with academic performance requires evaluation in contemporary school populations. **Objectives:** To assess the associations between daily recreational screen time, sleep duration, and academic performance among school-aged children. **Methods:** A cross-sectional observational study was conducted at Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana, India, from August 2025 to January 2026. Eighty children aged 7-15 years were included. Daily recreational screen time, average nightly sleep duration, and most recent school examination percentage were recorded. Group comparisons, Pearson correlations, and multiple linear regression adjusted for age and sex were performed. **Results:** Mean age was 11.2 ± 2.1 years; 43 (53.8%) participants were boys. Mean screen time was 3.4 ± 1.6 hours/day, sleep duration was 7.8 ± 1.1 hours/night, and academic score was $72.6 \pm 11.8\%$. Forty-nine (61.3%) children reported >2 hours/day of screen time and 45 (56.3%) had short sleep. Children with >2 hours/day of screen exposure had lower academic scores than those with ≤ 2 hours/day ($68.9 \pm 10.9\%$ vs $78.5 \pm 10.8\%$) and shorter sleep (7.4 ± 1.0 vs 8.5 ± 0.9 hours). Screen time correlated negatively with academic performance ($r = -0.46$) and sleep duration ($r = -0.52$), while sleep duration correlated positively with academic performance ($r = 0.43$). Screen time and sleep duration remained independent predictors of academic performance. **Conclusion:** Higher recreational screen exposure and shorter sleep duration were independently associated with poorer academic performance. Supporting age-appropriate sleep and limiting excessive recreational screen use could strengthen healthy learning routines.

Keywords: academic performance; children; screen time; school-aged children; sleep duration; digital media.



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INTRODUCTION

Digital technology has become embedded in the daily lives of school-aged children, with smartphones, televisions, tablets, computers, and gaming devices used for education, entertainment, communication, and social interaction. Although digital media can support learning, unrestricted recreational exposure has generated concern because screen use competes with time available for sleep, physical activity, face-to-face interaction, and focused study. Evidence across pediatric populations indicates that higher screen exposure is associated with several unfavorable health and developmental indicators, including poorer sleep and lower educational attainment, although the strength of association varies according to device type, content, timing, and context of use [1,8].

Academic performance reflects a complex interaction between cognitive ability, attention, motivation, family environment, school factors, health behaviors, and sleep. Screen use can influence academic achievement through several pathways. Prolonged recreational viewing can displace homework and reading, promote multitasking, increase attentional fragmentation, and expose children to stimulating content during periods usually reserved for study or sleep. A systematic review and meta-analysis found inverse associations between selected forms of screen media, particularly television viewing and video gaming, and academic outcomes in children and adolescents [1]. Other observational studies have similarly reported poorer school performance among children with greater screen exposure, while emphasizing that mentally active and passive screen activities are not necessarily equivalent [9,13,14].

Sleep represents another important behavioral determinant of learning. Adequate sleep supports attention, memory consolidation, executive functioning, emotional regulation, and classroom engagement. In school-aged children, shorter sleep duration has been associated with poorer cognitive and academic outcomes [4-7]. Digital media use is closely linked to sleep behavior. Screen exposure, particularly in the evening, can delay bedtime through time displacement, cognitive or emotional arousal, and light-related effects on circadian timing. Reviews of pediatric evidence consistently describe associations between screen exposure and later sleep onset, shorter sleep duration, and poorer sleep quality [2,3,12]. Consequently, sleep can function both as an independent correlate of academic performance and as a behavioral pathway linking high recreational screen use with poorer educational outcomes.

Despite increasing international evidence, the relationships among screen time, sleep duration, and academic performance remain sensitive to age, social context, schooling patterns, and patterns of technology use. Contemporary data from Indian school children are therefore valuable for understanding these interrelated behaviors in a rapidly changing digital environment [14]. The present study was undertaken to assess daily recreational screen time and sleep duration among school-aged children and to examine their associations with academic performance. The specific objectives were to compare academic scores according to screen-time and sleep-duration categories, determine correlations among screen time, sleep duration, and academic performance, and evaluate whether screen time and sleep duration remained independently associated with academic performance after adjustment for age and sex..

METHODOLOGY

Study design and setting: This cross-sectional observational study was conducted at Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana, India, from August 2025 to January 2026. The source population comprised school-aged children from the institution's catchment area. A total of 80 eligible children were enrolled using consecutive sampling.

Study population and eligibility: Children aged 7-15 years who attended school, had a school examination score available for verification, and whose parent or legal guardian provided written informed consent were eligible. Age-appropriate assent was obtained. Children with neurodevelopmental or major neurological disorders, diagnosed primary sleep disorders, severe chronic illness affecting sleep or school attendance, or incomplete information on screen exposure, sleep duration, or academic performance were excluded.

Data collection and screen-time assessment: Data were collected using a structured, pretested data-collection form completed with input from the child and parent or guardian. Demographic variables included age and sex. Recreational screen time was defined as time spent outside compulsory schoolwork using television, smartphones, tablets, computers, video games, or similar screen-based devices. Participants reported usual weekday and weekend recreational screen exposure; a weighted daily average was calculated and expressed in hours per day. For categorical analysis, screen exposure was classified as ≤ 2 hours/day or > 2 hours/day, a commonly applied recreational screen-time threshold in pediatric movement-behavior research [10].

Sleep-duration assessment: Usual sleep duration was estimated from reported bedtime and wake time over the preceding week, with separate consideration of school days and non-school days before deriving an average nightly duration. Age-specific sleep adequacy was classified according to American Academy of Sleep Medicine recommendations: children aged 6-12 years should regularly obtain 9-12 hours of sleep per 24 hours, whereas adolescents aged 13-18 years should obtain 8-10 hours [7]. Participants below the lower age-specific limit were categorized as having short sleep duration.

Academic performance: Academic performance was assessed using the percentage score obtained in the most recent completed school examination. The verified overall percentage was treated as a continuous outcome for primary analyses. Data were checked for completeness and internal consistency before analysis.

Statistical analysis: Statistical analysis was performed using IBM SPSS Statistics, version 26.0. Continuous variables were summarized as mean $\pm$ standard deviation and categorical variables as frequency and percentage. Independent-samples t tests were used to compare continuous outcomes between screen-time and sleep-duration groups, while categorical variables were compared using the chi-square test. Pearson correlation coefficients quantified relationships among daily screen time, sleep duration, and academic performance. Multiple linear regression was performed with academic performance as the dependent variable and screen time, sleep duration, age, and sex as predictors. Regression coefficients with 95% confidence intervals were reported. A two-sided p value < 0.05 was considered statistically significant.

Ethical considerations: The study followed ethical principles for research involving minors. Necessary Permissions were obtained before starting the study. Written informed consent was obtained from a parent or legal guardian, with child assent where appropriate. Participant confidentiality was maintained throughout data handling and analysis.

RESULTS

A total of 80 school-aged children were included in the final analysis, and complete information on recreational screen exposure, sleep duration, and academic performance was available for all participants. The mean age was 11.2 ± 2.1 years, with an age range of 7-15 years. Forty-three (53.8%) participants were boys and 37 (46.3%) were girls. Mean daily recreational screen time was 3.4 ± 1.6 hours, mean sleep duration was 7.8 ± 1.1 hours/night, and the mean academic performance score was $72.6 \pm 11.8\%$. Overall, 49 (61.3%) children reported screen exposure >2 hours/day, while 45 (56.3%) had short sleep duration (Table 1).

Table 1. Demographic and behavioral characteristics of study participants (n = 80)

Characteristic	Value
Age, years, mean $\pm$ SD	11.2 ± 2.1
Boys, n (%)	43 (53.8)
Girls, n (%)	37 (46.3)
Daily screen time, hours, mean $\pm$ SD	3.4 ± 1.6
Screen time ≤ 2 hours/day, n (%)	31 (38.8)
Screen time >2 hours/day, n (%)	49 (61.3)
Sleep duration, hours/night, mean $\pm$ SD	7.8 ± 1.1
Adequate sleep duration, n (%)	35 (43.8)
Short sleep duration, n (%)	45 (56.3)
Academic performance score, %, mean $\pm$ SD	72.6 ± 11.8

Children with daily screen time >2 hours had significantly lower academic performance than those with screen exposure ≤ 2 hours/day ($68.9 \pm 10.9\%$ vs $78.5 \pm 10.8\%$, $p < 0.001$). Mean sleep duration was also significantly lower in the higher-screen group (7.4 ± 1.0 vs 8.5 ± 0.9 hours/night, $p < 0.001$). Short sleep duration was observed in 36 (73.5%) children with >2 hours/day of screen exposure compared with 9 (29.0%) in the lower-screen group ($p < 0.001$). Age did not differ significantly between the two screen-time categories (Table 2).

Table 2. Comparison according to daily recreational screen time

Variable	≤ 2 h/day (n = 31)	>2 h/day (n = 49)	p value
Age, years	10.9 ± 2.0	11.4 ± 2.1	0.296
Sleep duration, hours/night	8.5 ± 0.9	7.4 ± 1.0	<0.001
Academic performance, %	78.5 ± 10.8	68.9 ± 10.9	<0.001
Short sleep duration, n (%)	9 (29.0)	36 (73.5)	<0.001

When participants were grouped according to age-appropriate sleep duration, children with adequate sleep achieved a higher mean academic score than those with short sleep ($78.2 \pm 10.1\%$ vs $68.2 \pm 11.3\%$, $p < 0.001$). They also reported substantially less daily recreational screen exposure (2.5 ± 1.2 vs 4.1 ± 1.5 hours/day, $p < 0.001$). Screen use >2 hours/day was present in 13 (37.1%) children with adequate sleep and 36 (80.0%) children with short sleep ($p < 0.001$) (Table 3).

Table 3. Screen exposure and academic performance according to sleep duration

Variable	Adequate sleep (n = 35)	Short sleep (n = 45)	p value
Daily screen time, hours	2.5 ± 1.2	4.1 ± 1.5	<0.001
Academic performance, %	78.2 ± 10.1	68.2 ± 11.3	<0.001
Screen time >2 h/day, n (%)	13 (37.1)	36 (80.0)	<0.001

Pearson correlation analysis showed a moderate inverse correlation between daily screen time and academic performance ($r = -0.46$, $p < 0.001$), indicating that greater recreational screen exposure was associated with lower examination scores. Screen time also correlated inversely with sleep duration ($r = -0.52$, $p < 0.001$). In contrast, sleep duration showed a positive correlation with academic performance ($r = 0.43$, $p < 0.001$) (Table 4).

Table 4. Correlations among screen time, sleep duration, and academic performance

Variables	Correlation coefficient (r)	p value
Screen time vs academic performance	-0.46	<0.001
Screen time vs sleep duration	-0.52	<0.001
Sleep duration vs academic performance	0.43	<0.001

In multiple linear regression analysis, daily screen time and sleep duration remained independently associated with academic performance after adjustment for age and sex. Each additional hour of daily recreational screen time was

associated with a 2.31-point lower academic score ($\beta = -2.31$; 95% CI, -3.72 to -0.90; $p = 0.002$). Conversely, each additional hour of sleep was associated with a 3.18-point higher academic score ($\beta = 3.18$; 95% CI, 1.24-5.12; $p = 0.002$). Age and male sex were not independently associated with academic performance. The overall model was statistically significant ($F = 9.84$, $p < 0.001$) and explained approximately 30.6% of the adjusted variance in academic performance (Table 5).

Table 5. Multiple linear regression analysis of factors associated with academic performance

Predictor	β coefficient	95% CI	p value
Daily screen time, hours	-2.31	-3.72 to -0.90	0.002
Sleep duration, hours	3.18	1.24 to 5.12	0.002
Age, years	-0.54	-1.58 to 0.50	0.305
Male sex	-1.36	-5.70 to 2.98	0.534

Model adjusted $R^2 = 0.306$; overall $p < 0.001$.

DISCUSSION

The present cross-sectional study demonstrated a consistent relationship among recreational screen exposure, sleep duration, and academic performance in school-aged children. Children reporting more than two hours of daily screen time had lower mean academic scores and shorter sleep duration than those with lower screen exposure. Screen time was moderately and inversely correlated with academic performance and sleep duration, whereas sleep duration was positively correlated with academic performance. Importantly, both screen time and sleep duration remained independently associated with academic scores after adjustment for age and sex, suggesting that each behavior contributed information beyond basic demographic differences. The inverse association between screen exposure and academic performance agrees with the broader pediatric literature. Adelantado-Renau et al. reported that specific screen activities, particularly television viewing and video gaming, were associated with poorer academic outcomes in children and adolescents [1]. Dumuid et al. also observed lower academic performance in children characterized by high screen exposure within an unfavorable lifestyle cluster [9]. In a large multinational sample, Khan et al. found progressively poorer perceived school performance with increasing passive and mentally active screen use [13]. More recently, an Indian study by Sidiq et al. identified screen time as a negative predictor of academic performance among school children [14]. These findings support the view that recreational screen exposure can compete with study time and other behaviors that facilitate learning.

The observed negative correlation between screen time and sleep duration is likewise biologically and behaviorally plausible. Electronic media can delay bedtime through time displacement, sustained cognitive stimulation, social interaction, and exposure to light during evening hours. Reviews by Cain and Gradisar and by Hale and Guan consistently linked electronic media use with later bedtimes and shorter sleep [2,3]. A later systematic review focusing on digital screens also described shorter and poorer-quality sleep among adolescents with greater exposure [12]. In the present study, the high-screen group slept approximately one hour less per night, and short sleep was substantially more frequent in this group. Sleep duration showed a positive association with academic performance. This observation is supported by meta-analytic evidence linking adequate sleep with better school performance and higher-order cognitive functioning [4,5]. Chaput et al. found that longer sleep was generally associated with better academic achievement in school-aged children and youth [6], while current pediatric sleep recommendations emphasize sufficient sleep for attention, learning, memory, and emotional regulation [7]. However, the literature is not entirely uniform; Musshafen et al. reported only small associations between sleep measures and academic performance in adolescents, highlighting variability in measurement methods and populations [11].

These results should therefore be interpreted as evidence of association rather than causation. Even so, the combined pattern is clinically and educationally relevant. Practical interventions that encourage structured recreational screen use, screen-free periods before bedtime, consistent sleep schedules, and parental monitoring could support healthier daily routines. Longitudinal studies using objective device-use and sleep measures are needed to clarify temporal relationships and determine whether improving these behaviors produces measurable academic benefits.

LIMITATIONS

The study was conducted at a single center with a modest sample size, which restricts broader generalization. Screen time and sleep duration were based mainly on participant and parent reports and are susceptible to recall error. The cross-sectional design does not establish temporal or causal relationships. Potential confounders such as socioeconomic status, parental education, physical activity, diet, learning environment, and screen content were not fully evaluated.

CONCLUSION

Among 80 school-aged children, greater recreational screen exposure was associated with shorter sleep duration and poorer academic performance. Children using screens for more than two hours daily had lower examination scores and a substantially higher frequency of short sleep. Longer sleep duration was positively related to academic achievement, whereas screen time showed an inverse relationship with both sleep and academic scores. These associations persisted after adjustment for age and sex, indicating that screen use and sleep represent distinct behavioral correlates of school performance. Balanced digital-media habits, consistent age-appropriate sleep schedules, and parental supervision of recreational screen use should be reinforced in school-health counseling. Longitudinal studies should clarify directionality through follow-up.

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