

Impact of screen time on language development and sleep patterns in children: An observational cohort study



Rajasekhar Reddy T¹, SOVS Satish Reddy²

¹Associate Professor, ²Assistant Professor, Department of Paediatrics, Santhiram Medical College, Nandyal, Andhra Pradesh, India

Submission: 14-01-2025

Revision: 04-02-2025

Publication: 01-03-2025

ABSTRACT

Background: Language development is a crucial aspect of a child's growth, particularly during the formative years when cognitive and communication skills are rapidly evolving. Screen time exposure has been linked to developmental challenges in children. **Aims and Objectives:** This study aimed to explore the relationship between screen time and language development in children aged 6 years, with a specific focus on the role of screen content, sleep patterns, and socioeconomic factors. **Materials and Methods:** An observational cohort study was conducted over 12 months among 300 children enrolled in local schools in Nandyal. Screen time, sleep duration, and language development scores were assessed using standardized tools. The impact of screen content (educational, entertainment, and gaming) and socioeconomic status on language development was also evaluated. Statistical analyses included correlation and regression tests. **Results:** The average daily screen time was 3.5 ± 1.2 h, increasing with age. Language development scores were inversely correlated with screen time ($r = -0.62$, $P < 0.001$), with younger children (6–8 years) being most affected ($r = -0.68$, $P < 0.001$). Children with screen time < 2 h/day had higher language scores (82.7 ± 10.2) than those with > 4 h/day (68.9 ± 11.8). Sleep duration decreased with higher screen time, mediating 25% of the adverse impact on language scores. Educational content positively influenced language scores (80.5 ± 9.7), while gaming had the lowest scores (70.2 ± 11.6). Socioeconomic status further modulated the relationship, with the strongest negative effects observed in low-income groups ($\beta = -0.75$, $P < 0.001$). **Conclusions:** Excessive screen time negatively impacts language development and sleep in children, with younger age groups and low socioeconomic status being the most vulnerable. Limiting screen time and promoting educational content may mitigate these effects.

Key words: Screen time; Language development; Sleep patterns; Children; Socioeconomic status; Educational content

INTRODUCTION

Language development is a crucial aspect of a child's growth, particularly during the formative years when cognitive and communication skills are rapidly evolving.¹ In today's digital era, screen time has become an integral part of children's daily routines, influencing their behavior, habits,

and development.^{2,3} While digital media can serve as an educational tool, excessive or inappropriate screen exposure has raised concerns about its impact on developmental milestones, particularly language acquisition.⁴

Studies suggest that prolonged screen time may interfere with critical interactions and activities essential for language development, such as verbal exchanges with caregivers,

Access this article online

Website:

<https://ajmsjournal.info/index.php/AJMS/index>

DOI: 10.71152/ajms.v16i3.4412

E-ISSN: 2091-0576

P-ISSN: 2467-9100

Copyright (c) 2025 Asian Journal of Medical Sciences



This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Address for Correspondence:

Dr. Rajasekhar Reddy T, Associate Professor, Department of Paediatrics, Santhiram Medical College, Nandyal, Andhra Pradesh, India.

Mobile: 9573054545. **E-mail:** rajasekharreddyt@myyahoo.com

playtime, and sleep.^{5,6} Furthermore, the type of screen content—whether educational, entertainment, or gaming—plays a pivotal role in determining its influence. For instance, educational content may enhance cognitive and language skills, while entertainment or gaming content may offer limited developmental benefits.^{7,8}

Sleep patterns, which are essential for optimal cognitive functioning, are also adversely affected by excessive screen exposure, further compounding developmental delays.⁹ Socioeconomic status has been identified as a moderating factor, influencing access to resources, screen content, and parental guidance, which can exacerbate or mitigate the effects of screen time.¹⁰

Aims and objectives

The study aimed to assess the average daily screen time among children aged 6–14 years and evaluate its relationship with language development scores. It also explored how different types of screen content, such as educational, entertainment, and gaming, influenced language skills. By understanding these associations, the study sought to identify patterns in screen usage that contribute positively or negatively to developmental outcomes. In addition, the study analyzed the impact of screen time on sleep duration and its mediating effect on language development. It further examined the moderating role of socioeconomic status in shaping the relationship between screen time and language skills. Based on these findings, evidence-based recommendations were developed to guide optimal screen time management, promoting healthy language and cognitive development in children.

MATERIALS AND METHODS

Study design and setting

This was an observational cohort study conducted over 12 months in Pediatrics Department, Santhiram Medical College, Nandyal, Andhra Pradesh. The study aimed to assess the impact of screen time on language development and sleep patterns in children aged 6–14 years enrolled in local schools.

Study population

A total of 300 children were recruited using stratified random sampling, ensuring representation across three age groups (6–8 years, 9–11 years, and 12–14 years). The children were chosen from schools in and around Santhiram Medical College, Nandyal. To maintain the validity of the findings, children with diagnosed developmental or neurological disorders were excluded from the study.

Data collection tools

Screen time assessment

Parents and children provided self-reported data on daily screen usage, categorized by content type (educational,

entertainment, and gaming) and duration on weekdays and weekends.^{10,11}

Language development

Standardized language assessment tools appropriate for each age group were used to evaluate language skills.¹² Scores were recorded on a scale of 0–100.

Sleep patterns

Sleep duration was recorded using a validated sleep diary maintained by parents for 7 consecutive days.

Variables studied

Independent variables

Screen time (total duration and type of content), socioeconomic status.

Dependent variables

Language development scores, sleep duration.

Statistical analysis

Data were analyzed using SPSS version 26. Descriptive statistics (mean, SD, percentages) summarized demographic characteristics and screen time patterns. Pearson's correlation was used to assess relationships between screen time and language development. Multiple regression analysis evaluated the moderating effects of socioeconomic status and sleep duration. $P < 0.05$ was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee at Santhiram Medical College, Nandyal, Andhra Pradesh. Written informed consent was secured from parents, and verbal assent was obtained from children before participation. Confidentiality and anonymity of all participants were maintained throughout the study.

RESULTS

Demographic characteristics

The study included 300 children aged 6–14 years, with an even distribution across age groups and a nearly equal gender ratio (Table 1). Among the participants, 52% were male and 48% were female. Socioeconomic stratification revealed that 40% of the participants were from low-income families, 45% from middle-income families, and 15% from high-income families.

SCREEN TIME PATTERNS

The average daily screen time for the cohort was 3.5 ± 1.2 h, with a noticeable increase in screen time across age groups

Table 1: Demographic characteristics of the study population

Characteristic	Number (%)
Total participants	300 (100)
Gender distribution	
Male	156 (52)
Female	144 (48)
Socioeconomic status	
Low	120 (40)
Middle	135 (45)
High	45 (15)

(Table 2). Children aged 6–8 years reported an average screen time of 2.7 ± 0.9 h/day, while those aged 12–14 years had the highest screen time at 4.3 ± 1.1 h/day (Figure 1).

Language development scores

Language development scores decreased with increasing screen time (Table 3). Children with screen time of <2 h/day achieved the highest mean language development score (82.7 ± 10.2), while those with screen time exceeding 4 h/day scored the lowest (68.9 ± 11.8) (Figure 2).

Correlation between screen time and language development

A significant negative correlation was observed between screen time and language development scores across all age groups (Table 4). The correlation coefficient was most pronounced in younger children aged 6–8 years ($r = -0.68$, $P < 0.001$), followed by children aged 9–11 years ($r = -0.59$, $P < 0.001$) and 12–14 years ($r = -0.54$, $P < 0.001$). The overall correlation coefficient was $r = -0.62$ ($P < 0.001$).

Impact of screen time on sleep duration

Screen time was inversely associated with sleep duration (Table 5). Children with screen time of <2 h/day reported the longest sleep duration (8.3 ± 0.6 h), whereas those with screen time exceeding 4 h/day had the shortest sleep duration (6.5 ± 0.8 h) (Figure 3).

Impact of screen content on language development

The type of screen content consumed significantly influenced language development scores (Table 6). Children primarily exposed to educational content (25% of screen time) scored the highest (80.5 ± 9.7), while those engaging predominantly with gaming content (20% of screen time) had the lowest scores (70.2 ± 11.6) (Figure 4).

Socioeconomic status and screen time impact

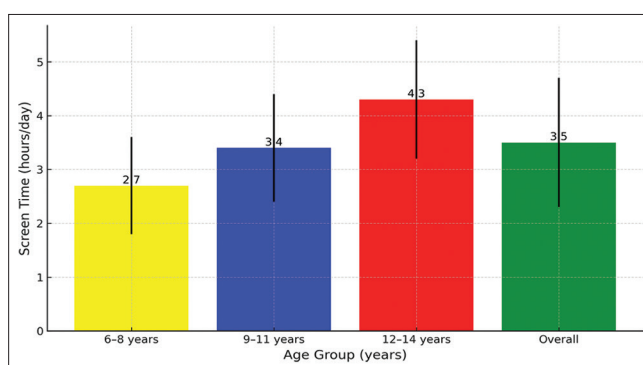
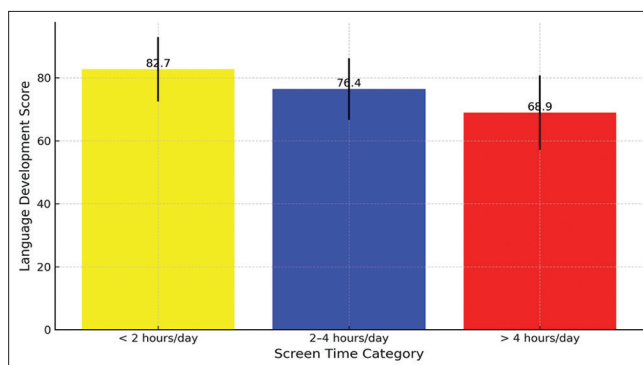
The impact of screen time on language development was stratified by socioeconomic status (Table 7). Children from low socioeconomic groups exhibited the strongest negative association between screen time and language development ($\beta = -0.75$, $P < 0.001$), followed by those from middle ($\beta = -0.63$, $P < 0.01$) and high ($\beta = -0.52$, $P = 0.03$) socioeconomic groups.

Table 2: Average daily screen time by age group

Age group (years)	Screen time (h/day) (Mean \pm SD)
6–8	2.7 ± 0.9
9–11	3.4 ± 1.0
12–14	4.3 ± 1.1
Overall	3.5 ± 1.2

Table 3: Screen time and language development scores

Screen time category	Language development score (Mean \pm SD)
<2 h/day	82.7 ± 10.2
2–4 h/day	76.4 ± 9.8
>4 h/day	68.9 ± 11.8

**Figure 1: Average daily screen time by age group****Figure 2: Screen time and language development scores**

DISCUSSION

This study highlights the significant impact of screen time on language development and sleep patterns in children aged 6–14 years, with younger children being particularly vulnerable. The findings revealed an inverse relationship between screen time and language development scores, consistent with prior studies that emphasize how excessive screen exposure reduces opportunities for verbal interaction, play, and engagement, which are critical for language acquisition.^{10,11} Rayce et al.,¹¹ also reported similar results in toddlers, highlighting that higher mobile device

Age group (years)	Correlation coefficient (r)	P-value
6–8	-0.68	<0.001
9–11	-0.59	<0.001
12–14	-0.54	<0.001
Overall	-0.62	<0.001

Screen time category	Sleep duration (h) (Mean±SD)
<2 h/day	8.3±0.6
2–4 h/day	7.4±0.7
>4 h/day	6.5±0.8

Screen content type	Screen time (%)	Language development score (Mean±SD)
Educational content	25	80.5±9.7
Entertainment content	55	72.3±10.4
Gaming content	20	70.2±11.6

Socioeconomic group	Regression coefficient (β)	P-value
Low	-0.75	<0.001
Middle	-0.63	<0.01
High	-0.52	0.03

usage is strongly associated with poorer language outcomes, further supporting the need to limit screen time during critical developmental stages.¹³

The role of screen content was a particularly noteworthy finding in this study. Children primarily exposed to educational screen content had significantly better language development scores compared to those focused on entertainment or gaming content. This aligns with evidence suggesting that well-designed educational programs can positively influence language and cognitive skills by providing structured learning opportunities.^{12,14} However, the predominance of entertainment content, which accounted for 55% of screen time in this cohort, indicates that parental guidance is essential to maximize the developmental benefits of screen exposure.¹²

Sleep duration emerged as a critical mediator in the relationship between screen time and language development. High screen exposure (>4 h/day) was associated with reduced sleep duration, likely contributing to cognitive fatigue and impaired language acquisition. Studies by Sekhar et al.,¹² and Lin et al.,¹⁵ reinforce this finding, highlighting

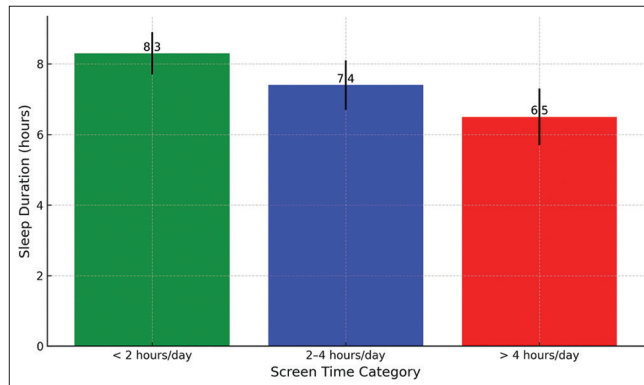


Figure 3: Screen time and sleep duration

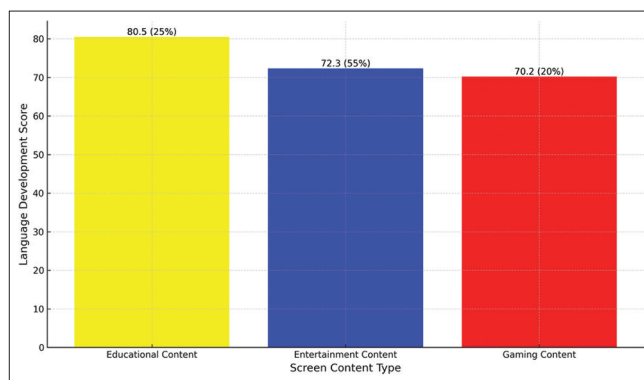


Figure 4: Impact of screen content on language development

that excessive screen time negatively impacts sleep patterns, further exacerbating developmental challenges. The disruption of sleep routines due to screen use before bedtime has been extensively documented, reinforcing the importance of promoting healthy screen habits.^{11,14}

Socioeconomic disparities significantly influenced the relationship between screen time and language development. Children from low socioeconomic backgrounds experienced the strongest negative effects, potentially due to limited access to educational resources and less parental supervision. Muppalla et al.¹⁰ noted that socioeconomic factors often exacerbate the adverse effects of screen time by reducing access to high-quality screen content and appropriate guidance. This emphasizes the need for targeted interventions, such as parental education and awareness programs, to address these inequities effectively.

Limitations of the study

Limitations of the study include the reliance on self-reported data, which may introduce recall bias regarding screen time and sleep patterns. The observational design limits causal inference, and the study only considered children from a specific region, potentially affecting generalizability. Socioeconomic status was assessed via proxies, which may not fully capture its complexity. Additionally, the study did

not control for other developmental or environmental factors influencing language development.

CONCLUSION

This study revealed a significant inverse relationship between screen time and language development in children aged 6–14 years, with younger children being most affected. Excessive screen time (>4 h/day) was associated with lower language scores and reduced sleep duration, which mediated its adverse effects. Educational screen content positively influenced language development, while gaming and entertainment content showed detrimental impacts. Socioeconomic disparities amplified these effects, with children from low-income households experiencing stronger negative outcomes. These findings highlight the need for strategies to limit screen time, promote educational content, and ensure adequate sleep, particularly for vulnerable groups. Targeted interventions and parental awareness programs are essential to support optimal language and cognitive development in children.

REFERENCES

1. Massaroni V, Delle Donne V, Marra C, Arcangeli V and Chieffo DP. The relationship between language and technology: How screen time affects language development in early life—a systematic review. *Brain Sci.* 2023;14(1):27. <https://doi.org/10.3390/brainsci14010027>
2. Madigan S, McArthur BA, Anhorn C, Eirich R and Christakis DA. Associations between screen use and child language skills: A systematic review and meta-analysis. *JAMA Pediatr.* 2020;174(7):665-675. <https://doi.org/10.1001/jamapediatrics.2020.0327>. Erratum in: *JAMA Pediatr.* 2022;176(5):528. <https://doi.org/10.1001/jamapediatrics.2022.0738>
3. Byrne R, Terranova CO and Trost SG. Measurement of screen time among young children aged 0-6 years: A systematic review. *Obes Rev.* 2021;22(8):e13260. <https://doi.org/10.1111/obr.13260>
4. Ponti M. Screen time and preschool children: Promoting health and development in a digital world. *Paediatr Child Health.* 2023;28(3):184-202. <https://doi.org/10.1093/pch/pxac125>
5. Guellai B, Somogyi E, Esseily R and Chopin A. Effects of screen exposure on young children's cognitive development: A review. *Front Psychol.* 2022;13:923370. <https://doi.org/10.3389/fpsyg.2022.923370>
6. Mustonen R, Torppa R and Stolt S. Screen time of preschool-aged children and their mothers, and children's language development. *Children (Basel).* 2022;9(10):1577. <https://doi.org/10.3390/children9101577>
7. Korres G, Kourklidou M, Sideris G, Bastaki D, Demagkou A, Riga M, et al. Unsupervised screen exposure and poor language development: A scoping review to assess current evidence and suggest priorities for research. *Cureus.* 2024;16(3):e56483. <https://doi.org/10.7759/cureus.56483>
8. Priftis N and Panagiotakos D. Screen time and its health consequences in children and adolescents. *Children (Basel).* 2023;10(10):1665. <https://doi.org/10.3390/children10101665>
9. Oswald TK, Rumbold AR, Kedzior SG and Moore VM. Psychological impacts of “screen time” and “green time” for children and adolescents: A systematic scoping review. *PLoS One.* 2020;15(9):e0237725. <https://doi.org/10.1371/journal.pone.0237725>
10. Muppalla SK, Vuppapalapati S, Reddy Pulliahgaru A and Sreenivasulu H. Effects of excessive screen time on child development: An updated review and strategies for management. *Cureus.* 2023;15(6):e40608. <https://doi.org/10.7759/cureus.40608>
11. Rayce SB, Okholm GT and Flensburg-Madsen T. Mobile device screen time is associated with poorer language development among toddlers: Results from a large-scale survey. *BMC Public Health.* 2024;24:1050. <https://doi.org/10.1186/s12889-024-18447-4>
12. Sekhar CG, Haarika V, Tumati KR and Ramisetty UM. The impact of screen time on sleep patterns in school-aged children: A cross-sectional analysis. *Cureus.* 2024;16(2):e55229. <https://doi.org/10.7759/cureus.55229>
13. Mutlu N and Dinleyici M. Evaluation of screen time in children under five years old. *Cureus.* 2024;16(2):e54444. <https://doi.org/10.7759/cureus.54444>
14. Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario. Screen time and young children: Promoting health and development in a digital world. *Paediatr Child Health.* 2017;22(8):461-468. <https://doi.org/10.1093/pch/pxx123>. Erratum in: *Paediatr Child Health.* 2018;23(1):83. <https://doi.org/10.1093/pch/pxx197>
15. Lin Y, Zhang X, Huang Y, Jia Z, Chen J, Hou W, et al. Relationships between screen viewing and sleep quality for infants and toddlers in China: A cross-sectional study. *Front Pediatr.* 2022;10:987523. <https://doi.org/10.3389/fped.2022.987523>

Authors Contribution:

RRT- Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript. Statistical analysis and interpretation, revision of manuscript; **SSR-** Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript. Statistical analysis and interpretation.

Work attributed to:

Santhiram Medical College, Nandyal, Andhra Pradesh, India.

Orcid ID:

Rajasekhar Reddy T - <https://orcid.org/0009-0003-4342-7020>
SOVS Satish Reddy - <https://orcid.org/0009-0003-4307-8406>

Source of Support: Nil, **Conflicts of Interest:** None declared.