

A Statistical Study on Impact of Electronic Gadgets on Cognitive Development among School Children

Dr.K.Manjula¹, *Dr.B.Vishali², A.Vani³ and Dr.M.Siva Parvathi⁴

¹Department of Applied Mathematics, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India.

²Department of Applied Mathematics, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India.

³Research Scholar, Department of Statistics, Sri Venkateswara University, Tirupati, Andhra Pradesh, India.

⁴Department of Applied Mathematics, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India.

Corresponding Author: * Dr.B.Vishali

KEYWORDS

Digital literacy,
Educational institutions,
Gender, Daily screen
time, Device

ABSTRACT:

This research explores the impact of educational institution category, biological sex, and daily electronic device usage duration on students' cognition, perspectives, and behaviors regarding digital technologies. The study employed a cross-sectional survey design with a sample of 396 students from government and private schools, selected using stratified random sampling. Data were collected through a self-administered questionnaire assessing demographic characteristics, knowledge about electronic devices, attitudes towards their usage, and device utilization practices. Statistical analysis included t-tests, ANOVA, and post-hoc analyses to examine differences between groups and the impact of daily gadget usage time.

The results suggest that private educational establishments may offer superior resources or opportunities for digital competence, thereby enhancing students' comprehension and perception of electronic devices. Gender-based analysis reveals no significant variations in knowledge, attitudes, or practices concerning gadget usage, indicating that Gender is not a determining factor in students' understanding or behavior towards digital technologies. Furthermore, the duration of daily electronic device usage emerged as a critical factor influencing students' practices, emphasizing the adverse effects of excessive screen exposure on their ability to effectively manage digital device utilization.

Introduction

The digital revolution has fundamentally transformed numerous aspects of human society, with education being no exception. Electronic devices, including smartphones, tablets, notebooks, and smart accessories, have become crucial components in modern learning environments, offering unparalleled access to information, educational resources, and interactive learning tools. For students in primary and secondary education, these gadgets fulfil a dual role facilitating academic pursuits while also serving as platforms for recreation and social interaction.

Although the integration of technology in education has the potential to enhance cognitive development and academic outcomes, there are growing concerns about its excessive and unmonitored use. Issues such as technology dependence, sedentary behavior, and adverse effects on mental well-being are increasingly scrutinized by educators, parents, and researchers. This study examines the complex implications of electronic device usage among school-aged children, aiming to achieve a balance between the benefits and potential risks associated with these technologies.

The widespread adoption of technology in education has significantly impacted the learning experiences of students across both government and private schools. The increasing accessibility and integration of digital devices, such as smartphones, tablets, and laptops, have transformed the way students engage with educational content and resources. (Nang & Harfield, 2019). Gadget usage among school children, particularly the utilization of smartphones, tablets, and laptops, has become increasingly prevalent in both government and private educational institutions. These digital devices have become an integral part of the learning experience, offering students new avenues for accessing educational content, collaborating with peers, and exploring the vast resources available online.

However, the extent to which these technologies are integrated and utilized in the classroom can vary significantly between government and private schools. A study conducted in Ghanaian secondary schools revealed that students in public schools tend to use information and communication technologies more extensively in their pedagogy compared to their counterparts in private schools (Buabeng-Andoh&Yidana, 2015). This finding suggests that the integration of technology in learning may be more prevalent in government-run educational institutions, potentially due to initiatives or policies aimed at promoting digital literacy and access.

Methodology

This study employed a cross-sectional survey design to investigate the knowledge, attitudes, and practices of school students regarding the use of electronic devices. A sample of 396 students from two private schools and two government schools was selected using a stratified random sampling technique. The participants, who were in 9th and 10th standard, were asked to complete a self-administered questionnaire that included items on their demographic characteristics, knowledge about electronic devices, attitudes towards their usage, and practices related to device utilisation.

The knowledge scale included items assessing the students' understanding of the features, functions, and potential impacts of electronic devices. The attitude scale consisted of items that measured the students' perceptions and beliefs about the use of electronic devices. The practice scale had items that evaluated the students' actual behaviors and habits related to device usage.

Experimental Results

The collected data were analyzed using SPSS statistical software using appropriate statistical techniques, including t-tests, ANOVA, and post-hoc analyses. The t-tests were used to compare the knowledge, attitudes, and practices between government and private school students, as well as between male and female participants. ANOVA was employed to examine the impact of daily gadget usage time on the measured variables. Post-hoc analysis was conducted to further investigate the significant differences identified in the ANOVA results. The study received ethical approval from the institutional review board, and informed consent was obtained from the participants and their parents or guardians. The data were kept confidential and were used solely for the purpose of the research.

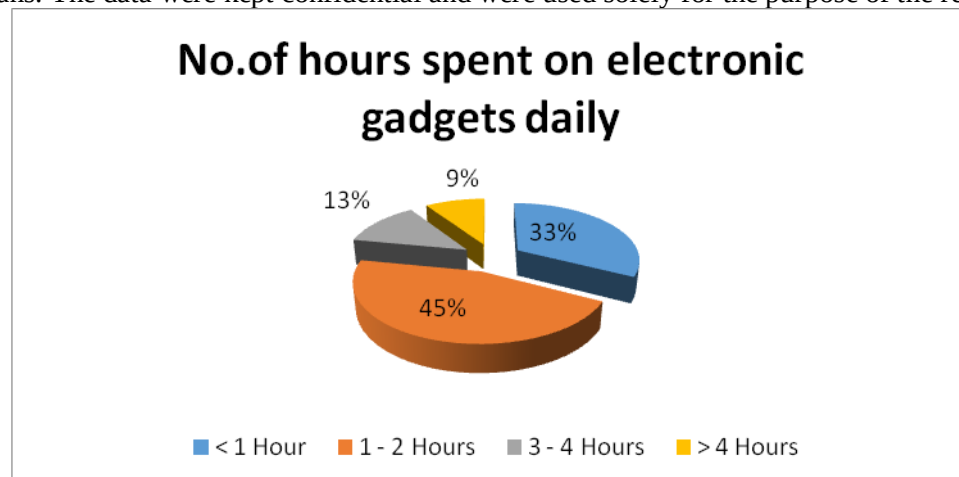


Fig 1: Number of hours spent on Electronic Gadgets Daily

The pie chart illustrates the distribution of daily electronic device usage among students. The data indicates that a significant proportion, 45% of the student population, engages with gadgets for 1–2 hours per day, suggesting a moderate level of interaction. This is contrasted with 33% of students who demonstrate limited device usage, allocating less than an hour daily. A smaller segment, comprising

13% of students, utilizes electronic devices for 3–4 hours each day, while a minority of 9% exhibits extensive usage exceeding 4 hours. These findings emphasize that the majority of students fall within the moderate usage category, with a relatively small fraction engaging in prolonged periods of electronic device interaction.

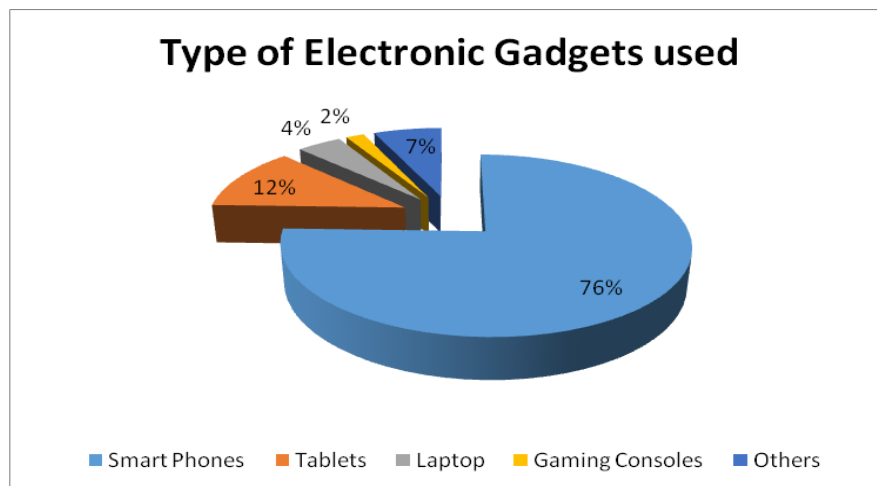


Fig 2: Type of Electronic Gadgets used

The pie chart illustrates the distribution of electronic devices utilized by students. It demonstrates that 76% of students predominantly employ smartphones, rendering them the most widely used device. Tablets are the second most prevalent, utilized by 12% of students, followed by laptops, which account for 7%. Gaming consoles are employed by 4%, while other devices constitute a minimal 2%. The chart elucidates the overwhelming reliance on smartphones compared to other devices, underscoring their significance in students' daily activities.

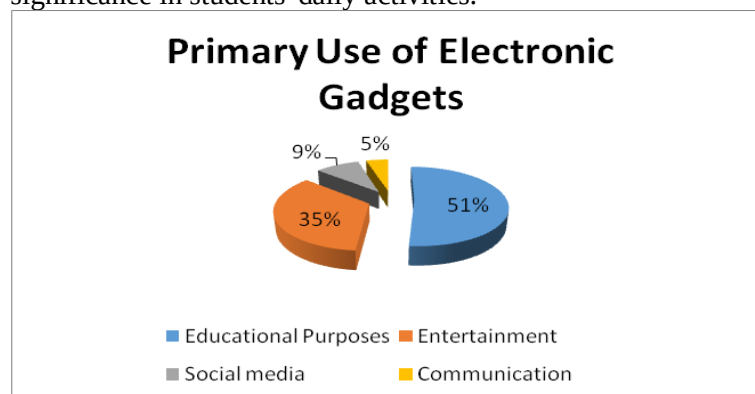


Fig 3: Primary Use of Electronic Gadgets

The pie chart illustrates the principal applications of electronic devices among the student population. A majority of 51% employ these gadgets for educational objectives, emphasizing the integral role of technology in contemporary learning environments. Entertainment purposes account for a substantial 35% of usage, indicating the significant recreational value students derive from digital devices. Social media engagement constitutes 9% of primary device utilization, while communication functions represent the smallest proportion at 5%. These statistics underscore the predominance of academic and leisure-oriented activities in students' interactions with electronic gadgets, providing valuable insights into the diverse ways technology is integrated into their daily routines.

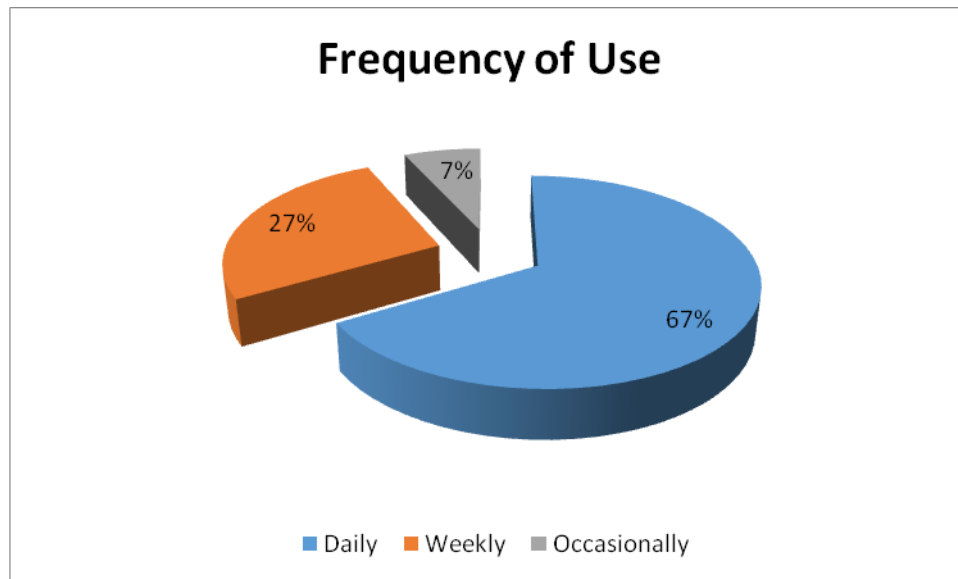


Fig 4: Frequency of use

The frequency of use graph illustrates the prevalence of electronic device usage among students. A significant majority, 67%, utilize such devices on a daily basis, underscoring their integral role in students' routines. A smaller cohort, 27%, employs these devices weekly, indicating a less frequent but still regular engagement with technology. Only 7% of students use electronic devices occasionally, highlighting a minimal reliance on such technology. These findings demonstrate that daily usage constitutes the most common pattern among students, with weekly and occasional use being less prevalent.

The study examines how knowledge, attitudes, and practices concerning electronic devices vary according to school type, gender, and daily screen time.

Table 1: Comparison of Knowledge, Attitudes, and Practices Toward Electronic Gadgets by Type of School

Type of School		N	Mean	Std. Deviation	t	P Value
Knowledge	Government	199	14.92	1.87	2.729	.007
	Private	197	15.43	1.83		
Attitude	Government	199	9.48	1.84	2.065	.040
	Private	197	9.83	1.52		
Practice	Government	199	29.48	4.41	.360	.719
	Private	197	29.62	3.36		

Regarding the type of school, private school students exhibited significantly superior knowledge and attitudes toward electronic gadgets compared to their counterparts in government schools. Private school students attained higher scores on knowledge ($M = 15.43$, $SD = 1.83$) than government school students ($M = 14.92$, $SD = 1.87$), with a statistically significant difference ($t = 2.729$, $p = .007$). Similarly, private school students demonstrated a more favorable attitude ($M = 9.83$, $SD = 1.52$) compared to government school students ($M = 9.48$, $SD = 1.84$), as evidenced by the significant result ($t = 2.065$, $p = .040$). However, no significant difference was observed in their practices related to gadget usage ($t = 0.360$, $p = .719$), suggesting that students from both types of schools manage their gadget usage in a comparable manner. These findings indicate that private schools may provide superior resources or opportunities for digital literacy, which could enhance students' comprehension and perception of gadgets.

Table 2: Gender-Based Differences in Knowledge, Attitudes, and Practices toward Electronic Gadgets

Gender		N	Mean	Std. Deviation	t	P Value
Knowledge	Male	167	15.36	1.78	1.715	.087
	Female	229	15.03	1.91		
Attitude	Male	167	9.65	1.61	-.039	.969
	Female	229	9.66	1.75		
Practice	Male	167	29.82	3.79	1.160	.247
	Female	229	29.36	4.01		

An analysis of gender-based disparities in gadget-related knowledge, attitudes, and practices revealed no statistically significant differences. Male participants ($M = 15.36$, $SD = 1.78$) and their female counterparts ($M = 15.03$, $SD = 1.91$) displayed comparable levels of knowledge, with no substantial variation observed ($t = 1.715$, $p = .087$). The assessment of attitudes towards gadgets yielded similar results for both males ($M = 9.65$, $SD = 1.61$) and females ($M = 9.66$, $SD = 1.75$), as indicated by the non-significant outcome ($t = -0.039$, $p = .969$). Furthermore, gadget usage practices were found to be virtually indistinguishable between male ($M = 29.82$, $SD = 3.79$) and female ($M = 29.36$, $SD = 4.01$) participants, with no noteworthy distinctions ($t = 1.160$, $p = .247$). These results suggest that gender is not a determining factor in students' understanding, perceptions, or behaviors concerning gadget utilization.

The analysis revealed that daily usage duration was a crucial determinant, particularly in behaviors associated with electronic device utilization. Although knowledge scores exhibited borderline significance ($F = 2.615$, $p = .051$), participants engaging with devices for 1–2 hours per day ($M = 15.43$, $SD = 1.65$) displayed marginally superior knowledge compared to those with usage exceeding four hours ($M = 14.62$, $SD = 1.85$). Attitudinal measures remained uniform across varying usage periods ($F = 1.429$, $p = .234$). Nonetheless, daily usage duration significantly impacted practices ($F = 3.004$, $p = .030$). Subjects whose device engagement was less than one hour daily ($M = 30.08$, $SD = 3.41$) exhibited more favorable practices relative to those with usage surpassing four hours per day ($M = 27.97$, $SD = 5.59$).

Table 3: Impact of Daily Gadget Usage Time on Knowledge, Attitudes, and Practices

Hours Spent on Gadgets		N	Mean	Std. Deviation	F Test	P Value
Knowledge	< 1 Hour	129	15.0078	2.01361	2.615	.051
	1 - 2 Hours	180	15.4278	1.65462		
	3 - 4 Hours	50	15.0800	2.07846		
	> 4 Hours	37	14.6216	1.84619		
	Total	396	15.1717	1.86257		
Attitude	< 1 Hour	129	9.5581	1.78495	1.429	.234
	1 - 2 Hours	180	9.7389	1.66248		
	3 - 4 Hours	50	9.9200	1.60153		
	> 4 Hours	37	9.2432	1.60564		
	Total	396	9.6566	1.69384		
Practice	< 1 Hour	129	30.0853	3.41191	3.004	.030
	1 - 2 Hours	180	29.6000	3.50833		
	3 - 4 Hours	50	29.1800	4.75819		
	> 4 Hours	37	27.9730	5.59010		
	Total	396	29.5530	3.91811		

Table 4: Post-Hoc Analysis of Gadget Usage Time and Practices

> 4 Hours	< 1 Hour	.023
	1 - 2 Hours	.126
	3 - 4 Hours	.919

Post-hoc analysis revealed a significant difference between these two groups ($p = .023$). This finding elucidates the detrimental impact of excessive screen time on students' capacity to manage electronic device usage effectively.

Conclusion

The findings of this investigation underscore the necessity for targeted interventions to promote responsible device utilization among students. Educational institutions in the public sector could potentially benefit from the implementation of digital literacy curricula to enhance students' knowledge and attitudes toward electronic devices, thereby ensuring effective and responsible technology use. Furthermore, parental guidance assumes a critical role, with caregivers being encouraged to impose limitations on their children's device usage to 1–2 hours per day to foster improved practices and enhance knowledge. Lastly, awareness initiatives led collaboratively by educational institutions and parents can serve to educate children on responsible device utilization, with the objective of maximizing cognitive benefits while minimizing potential adverse effects. Gender does not exhibit a significant influence on device-related knowledge, attitudes, or practices. However, excessive device use (>4 hours) is associated with less favorable practices, underscoring the importance of moderate usage (1–2 hours) for achieving an equilibrium between educational benefits and responsible device use. These findings emphasize the necessity for targeted interventions, such as digital literacy programs for government schools and awareness campaigns for parents, to promote responsible device use and optimize its benefits for students' learning and development.

Acknowledgments:

The authors gratefully acknowledge Sri Padmavati Mahila Visvavidyalayam, Tirupati, for providing seed funding under reference number SPMVV/F4/UGC/2024, dated 31.01.2024, which supported the conduct of the presented work.

References:

1. Andreas Schleicher, Director Of The Directorate For Education And Skills, Oecd, Impacts Of Technology Use on Children: Exploring Literature on the Brain, Cognition And Well-Being OECD Education Working Paper No. 195, 2019.
2. Anuradha Yadav, Kavita Yadav, Manisha Sankhla, Poonam Punjabi, I. D. Gupta, & Kusum Lata Gaur. (2022). Magnitude of Internet Addiction and Its Associating Risk Factors in Young Medical Students of Western Rajasthan, India. *International Journal of Health and Clinical Research*, 5(3), 105–109.
3. Azizi, S.M., Soroush, A. & Khatony, A. The relationship between social networking addiction and academic performance in Iranian students of medical sciences: a cross-sectional study. *BMC Psychol* 7, 28 (2019).
4. Balhara, Y. S., Kumar, S., Singh, S., Singh, K., Rajkumar, S. 2019. Prevalence and pattern of problematic internet use among engineering students from different colleges in India. *Indian Journal of Psychiatry*, 61(6):578–578.
5. Bruno Sauce, Magnus Liebherr, Nicholas Judd & Torkel Klingberg, The Impact of Digital Media on Children's Intelligence While Controlling for Genetic Differences in Cognition and Socioeconomic Background, *Scientific Reports* | (2022) 12:7720.

6. Buabeng-Andoh, C., &Yidana, I. (2015). Implementation of ICT in Learning: A Study of Students in Ghanaian Secondary Schools. In *Procedia - Social and Behavioral Sciences* (Vol. 191, p. 1282). Elsevier BV. <https://doi.org/10.1016/j.sbspro.2015.04.555>.
7. Cherian, A., Anand, N., Jain, P., Prabhu, S., Thomas, C., Bhat, A., Prathyusha, P. V., Bhat, S., Young, K. 2018. Prevalence of excessive internet use and its association with psychological distress among university students in South India. *Industrial Psychiatry Journal*, 27(1):131–131.
8. Christopher AmalrajVallaba Doss et al., Prevalence and risk factors of internet addiction among health science college students in South India, *Int. J. Res. Pharm. Sci.*, 2020, 11 (SPL4), 2556-2563.
9. Daniel R. Anderson, KaveriSubrahmanyam, Digital Screen Media and Cognitive Development, *Pediatrics* (2017) 140 (Supplement_2): S57–S61.
10. Kumar S, Kumar A, Badiyani B, Singh SK, Gupta A, Ismail MB. Relationship of internet addiction with depression and academic performance in Indian dental students. *Clujul Medical*. 2018;91(3):300.
11. Limniou, M. The Effect Of Digital Device Usage On Student Academic Performance: A Case Study. *Educ. Sci.* 2021, 11, 121.
12. Nang, H. M. P., &Harfield, A. (2019). The Nature of Technology Consumption among School Children in Lower Northern Thailand. In *International Journal of Interactive Mobile Technologies (iJIM)* (Vol. 13, Issue 5, p. 137). kassel university press. <https://doi.org/10.3991/ijim.v13i05.10309>.