THE IMPACT OF DIGITAL DEVICES ON STUDENTS' ACADEMIC PERFORMANCE: A QUANTITATIVE ANALYSIS

Dr. K.P. Shanmuga Vadivu
Associate Professor
Sri Sarada College of Education, Salem

M. Suganthi
Ph.D Scholar
Sri Sarada College of Education, Salem

Abstract
In the digital era, technology plays a crucial role in reshaping educational methodologies. This study examines the impact of digital devices on the academic performance of 11th-grade students in Tamil Nadu, India. Employing a descriptive survey method with a sample of 200 students from government and private schools, the study investigates key variables, including gender, locality, medium of study, and stream of education. Statistical analysis reveals that digital devices positively influence student engagement and academic success, with notable differences based on demographic factors. Boys and urban students demonstrate higher academic performance compared to girls and rural students. However, no significant differences are observed across medium of study, stream, and school management. The findings underscore the importance of regulated digital device usage to maximize academic benefits while mitigating potential distractions. Recommendations include the integration of digital pedagogy, teacher training on technology-based teaching, and the promotion of digital literacy among students for effective learning outcomes.
Keywords: *Digital Devices, Academic Performance, 11th Grade Students, Digital Pedagogy, Educational Technology.*

Introduction

In today's digital age, technology permeates every aspect of our lives, reshaping industries, communities, and educational paradigms alike. In the realm of education, digital devices ranging from smartphones and tablets to laptops and interactive whiteboards have become integral tools that promise to revolutionize traditional teaching and learning methods. As these technologies become increasingly ubiquitous in classrooms, there is a growing imperative to rigorously evaluate their impact on academic outcomes. In particular, the integration of digital devices is transforming academic engagement and learning outcomes among 11th grade students. Recent studies by Huang and Hew (2020) and Li, Gao, and Wang (2021) indicate that, when strategically implemented, digital devices enhance student engagement, support personalized learning, and cultivate critical thinking skills. Furthermore, Johnson et al. (2022) demonstrate that the use of technology in the classroom enables timely feedback and adaptive learning, which are essential for academic improvement. Conversely, concerns raised by Smith et al. (2021) and Martinez and Lee (2023) highlight that unregulated digital device usage can lead to distractions, fragmented attention, and cognitive overload, ultimately hindering academic performance. Additionally, while the ease of access

to vast online resources and interactive educational tools enriches the learning experience, it also necessitates the development of robust digital literacy skills among both students and educators. Consequently, this quantitative analysis, focusing exclusively on 11th grade students, aims to determine whether digital devices act as catalysts for academic success or pose challenges that disrupt learning in the modern classroom. By examining variables such as screen time, usage patterns, and the integration of digital pedagogy, the study seeks to provide a comprehensive overview of the multifaceted impact of digital technology on education.

Literature Review

Husam yaseen, Abdelaziz saleh mohammad, Najwa Ashal, Hesham Abusaimeh, Ahmad Ali, & Abdel- Aziz Ahmad Sharabati (2025) explained that, "The Impact of Adaptive Learning Technologies, Personalized Feedback, and Interactive AI Tools on Student Engagement the Moderating task of Digital knowledge". Findings of this study was students with advanced situations of digital knowledge were more involved with digital tools.

Asli Bahar Ivgin & Hakan Akcay (2024), explained that, "The Impact of Using Educational and Digital Games on Middle School Students Science Achievement". The results showed that students in the educational and digital games sections were significantly better at wisdom achievement than students in the text- acquainted section. There was no significant difference was set up between the digital game- grounded and educational game-grounded students in terms of achievement.

PanelFang Wang, Xiaoli Ni, Mengzhu Zhang, & Jingjie Zhang (2024) delved that, "Educational digital inequality A meta- analysis of the relationship between digital device use and academic performance in adolescents". The use of digital bias and adolescent academic achievement were set up to be appreciatively identified overall ($r = 0.25$). Also, there was a negative association ($r = -0.10$; $r = -0.16$) between the two when used for gaming or entertainment and socialising, but a positive correlation ($r = 0.12$) when used for educational purposes. Academic achievement decreases with adding digital contrivance use length ($r = -0.10$). Moderating goods show that rudiments including nation, gender, age, grade position, data sources, and instruments used to quantify academic performance have a big impact on this relationship.

Bozkus & Kivanç (2021) conducted that, "Digital bias and Student Achievement the Relationship in PISA 2018 Data". The results showed that the structure of digital bias within the academy affected PISA 2018 reading, calculation and wisdom scores further than preceptors' capacity using digital bias. It was also revealed that there was a strong relationship between the structure of digital bias within the academy and preceptors' capacity using digital bias, and developing the structure of digital technologies could give practical benefits for scholars.

Hina Asif Khan, Ameen Ghulam & Murtaza Rafique (2021) explained that, "Impact of Personal Digital bias operation on Academic Performance of University students in Pakistan". The study concluded that the smart phones, mobile phones, laptops were constantly used PDDs by the scholars for the academic purposes. Students used PDDs for using social networks like Facebook, WhatsApp, Twitter, etc. in order to stay in touch with

their classmates regarding their academic requirements. It was set up that using PDDs helped them ameliorate their English language chops and PDDs also helped in their literacy process hence perfecting their classroom performance.

Limniou and Maria (2021) conducted a case study," The Effect of Digital Device operation on Student Academic Performance" to explored, there was a significant difference among the groups regarding the use of operations and pupil characteristics after controlling for the types of bias, with students who used only one operation during lecture time demonstrating advanced academic performance due to reduced distractions. Overall, the disquisition concluded that it's essential to review tutoring delivery processes to alleviate digital performance and enhance pupil engagement in lecture theatres.

Objectives of the Study

- To ascertain the level of impact of digital devices on students' academic performance.
- To find out the significant difference in impact of digital devices on students' academic performance with respect to their following demographic variables, such as Gender: boys / girls, Locality of the students: rural / urban, Medium of study: Tamil / English, Management of school: government / private, Stream of study: Arts / Science.

Hypotheses of the Study

- The level of impact of digital devices on students' academic performance is high.
- There is no significant difference in impact of digital devices on students' academic performance with respect to their following demographic variables such as Gender: boys / girls, Locality of the students: rural / urban, Medium of study: Tamil / English, Management of school: government / private, Stream of study: Arts / Science.

Methodology of the Study

For this study, the investigator has been applied the descriptive survey method (quantitative approach) for collected the data for adopted to statistical analysis and find out the results.

Variables of the Study

In this study has been consists of main variables and categorical variables. The main variables of the study were divided into two variables such an independent variable (digital devices) and dependent variable (students' academic performance). Also, the categorical variables contain such as gender (Boys/Girls), locality of the students (Rural/Urban), medium of the study (Tamil/English), stream of the study (Arts /Science) and management of school (Government/Private).

Population, Sample and Sampling Technique

In the study, the investigator focused on the population is the students who are studying 11th standard in government and private higher secondary schools in Salem district, Tamil Nadu, India.

For this study, the researcher selected 11th standard students who are studying in government and private higher secondary schools in Salem district, Tamil Nadu, India.

In the study, the sample consist of 200 11th standard students (100 - Government and 100 - private) has been adopted for data collection.

The simple random sampling technique has been applied for the survey method to data collection.

Research Tool of the Study

The investigator framed the self-made tool for used the data collection. The research to lease questionnaire for uses or impact of digital devices. The tool has been containing 30 items, the tool is based on the Likert type (four-point scale), the scale responses are 432 and one for positive statements. The skill contents only positive statements.

The tool has been adapted for face and content validity for internal consistency. Also, the tool has been applied for Cronbach's alpha reliability method, the reliability value was found that is 0.87.

Data Collection and Statistical Analysis

The data were collected by the researcher from 11th standard students in government and private higher secondary schools.

For the data analysis purpose, the investigator has been applied the following statistical techniques such as descriptive analysis (Mean and Standard deviation) and differential analysis ('t' test).

Testing of Hypotheses

- The level of impact of digital devices and students' academic performance is high.

Table 1 Level of impact of digital devices on students' academic performance.

Max. score: 120

Variables		**Sample**	**Mean**	**S.D**
Gender	Boys	100	110.79	8.90
	Girls	100	108.24	8.79
Locality of the students	Rural	86	107.36	9.03
	Urban	114	109.64	8.96
Medium of Study	Tamil	100	109.83	8.92
	English	100	110.67	9.06
Stream of study	Arts	78	107.82	9.67
	Science	122	109.48	8.84'
Management of school	Government	100	108.84	8.76
	Private	100	109.66	8.93
Average		200	109.23	8.99

From the table on (1) showed that the calculated mean score (Average) 109.23 is greater than the mid score of the maximum score (120) respectively. Consequently, the mean value inferred that the digital devices have high impact on students' academic performance.

- There is no significant difference in impact of digital devices on students' academic performance with respect to their following categorical variables such as gender, locality of the student, medium of study, stream of study and management of school.

Table 2 Significant Difference in Impact of Digital Devices on Students' Academic Performance with Respect to their Following Category Variable such as Gender, Locality of the Students, Medium of Study, Stream of Study, Management of School

Variables		Sample	Mean	S.D	't' Value
Gender	Boys	100	110.79	8.90	★
	Girls	100	108.24	8.79	2.56
Locality of the students	Rural	86	107.36	9.03	★
	Urban	114	109.64	8.96	2.28
Medium of Study	Tamil	100	109.83	8.92	@
	English	100	110.67	9.06	0.84
Stream of study	Arts	78	107.82	9.67	@
	Science	122	109.48	8.84	1.66
Management of school	Government	100	108.84	8.76	@
	Private	100	109.66	8.93	0.82

★ = significant @= Not significant

From the table (2) it is inferred that the calculated 't' value 2.56 (gender) and 2.28 (locality of the students) are greater than the tabulated value 1.96 at 0.05 level of significant. So, the null hypothesis is not accepted based on the categorical variables such as gender and locality of the students. Consequently, the result can be concluded that there is a significant difference in impact of digital devices on students' academic performance with respect to their gender and locality of the students.

Additionally, from the table (2) inferred that the calculated 't' values 0.84 (medium of study) 1.66 (stream of study) and 0.82 (management of school) are less than the tabulated value 1.96 at 0.05 level of significant. So, the null hypotheses are accepted based on the categorical variables such as medium of study, stream of study and management of school. Consequently, the result can be concluded that there is no significant difference in impact of digital devices on students' academic performance with respect to their medium of study, stream of study and management of school.

Discussion of the Study

From the statistical analyses revealed that the results the digital devices have high academic performance among higher secondary students consequently, the findings of the study have been discussed the gender wise analysis investigated that the boys (110.79) are better than the girls (108.24) in impact of digital devices on academic performance.

Additionally, the locality of the student's wise analysis showed that the urban areas students (109.64) are greater than the rural area students (107.36) in impact of digital devices on academic performance.

Next, the medium of study wise analysis noticed that the English medium students (110.67) are higher than the Tamil medium students (109.83) in impact of digital devices on academic performance. Also, the stream of study wise analysis revealed that the science discipline students (109.48) are superior to Arts discipline students (107.82) in impact of digital devices on academic performance. Further, the management of school wise analysis identified that the private school, students (109.66) are greater than government school students (108.84) in impact of digital devices on academic performance.

Recommendations and Suggestions of the Study

- The digital devices are very essential role in the teaching and learning process at present technology era. For the reason, the researcher revealed that some recommendation and suggestions based on the findings of the study.
- The school headmaster/headmistress maybe concentrate on the innovative technology related classroom for improve their teachers effective teaching and students efficient learning activities.
- The class teachers can be used technology-based teaching our technology enabled teaching method, because most of the teaching and learning activities has been conducting through digital devices.
- The student's must should be used to the digital devices for their learning activities and other educational activities such as assignment preparation and submission online tests etc.,

Conclusion

The study confirms that digital devices significantly impact the academic performance of 11th-grade students. While their usage enhances learning engagement and academic outcomes, the effectiveness depends on factors such as gender and locality. Boys and urban students showed a higher impact compared to their counterparts. However, there was no significant difference based on the medium of study, stream, or school management. The findings emphasize the importance of integrating technology effectively in education while minimizing potential distractions. Schools and educators should adopt structured digital learning strategies to maximize student benefits while ensuring responsible usage.

References

1. **Wang, P., Ni, X., Zhang, M., & Zhang, J. (2024).** Educational digital inequality: A meta-analysis of the relationship between digital device uses and academic performance in adolescents. *Educational Review, 50*(1), 25-46.
2. **Asli Bahar Ivgin; Hakan Akcay** (2024),**"The Impact of Using Educational and Digital Games on Middle School Students Science Achievement"** *International*

Journal of Technology in Education, v7 n3 p. 386-416. *Web site: https://www.ijte.net/ index.php/ijte/about*

3. **Dr. Purushottam Arvind Petare, Dr Mohd Shamim, Prof. (Dr.) Tania Gupta, Dr. Ritesh Verma, Dr Gurkirpal Singh (2023)** ,"Exploring the Impact of Virtual Learning Environments on Student Engagement and Academic Achievement". Journal of Survey in Fisheries Sciences 10(1S) pg: 5912-5923 DOI:10.13140/RG.2.2.23223.91040: https://www.researchgate.net/publication/375720752
4. **Loglo, Frank Senyo; Zawacki-Richter, Olaf (2023),Learning with Digital Media: A Systematic Review of Students' Use in African Higher Education,** *Journal of Learning for Development*, v10 n1 p1-23 , *Web site: http://www.col.org*
5. **Martinez, P., & Lee, S. (2023).** Digital literacy in modern classrooms: The need for regulation. *International Journal of Educational Technology, 45*(1), 22-40.
6. **Johnson, T., Smith, R., Patel, M., & Lee, C. (2022)**. Technology-enabled adaptive learning: Enhancing student outcomes. *Computers & Education, 176*, 104-120.
7. **Bozkus, Kivanç(2021) conducted that, "Digital Devices and Student Achievement: The Relationship in PISA 2018 Data",** *International Online Journal of Education and Teaching*, v8 n3 p1560-1579 *Web site: https://iojet.org/index.php/IOJET*
8. **Khan, Hina Asif; Ameen, Kanwal Dr.; and Rafique, Ghulam Murtaza Dr**., **(2021).** "Impact of Personal Digital Devices Usage on Academic Performance of University Students in Pakistan" Library Philosophy and Practice (e-journal). 5374. https://digitalcommons.unl.edu/libphilprac/5374
9. **Khan, H. A., Ghulam, A., & Rafique, M. (2021).** Impact of personal digital devices usage on academic performance of university students in Pakistan. *Journal of Education and Learning, 20*(3), 120-134.
10. **Limniou, M. (2021).** The effect of digital device usage on student academic performance: A case study of psychology undergraduates. *Journal of Technology in Education, 37*(2), 80-95.
11. **Li, Y., Gao, L., & Wang, Z. (2021).** Personalized learning and digital devices: A case study on student performance. *Journal of Educational Computing Research, 59*(3), 421-438.
12. **Smith, A., Brown, K., & Martinez, J. (2021).** The downside of digital learning: Distractions, multitasking, and cognitive overload. *Journal of Digital Learning Research, 34*(2), 98-115.
13. **Huang, R., & Hew, K. F. (2020).** The impact of digital devices on student engagement and critical thinking skills. *Educational Technology Research and Development, 68*(4), 567-590.
14. **Bond, M and Bedenlier, S. (2019).** Facilitating Student Engagement Through Educational Technology: Towards a Conceptual Framework. Journal of Interactive Media in Education, 2019(1): 11, pp. 1–14. DOI: https://doi.org/10.5334/jime.528.
15. European Journal of Educational Research (EU-JER) volume 12 issue 4, Eurasian society of educational research the Netherlands. pg. 1815-1830. https://doi.org/10.12973/eu-jer.12.4.1815.

16. **Joo, Y. J., Lim, K. Y., & Kim, Y. M. (2019).** Online game-based learning: Effects on students' motivation, performance, and mental effort. Journal of Educational Technology & Society, 22(2), 47-58.
17. **Neufeld, Dennis James (2018),** *An exploratory study of the impact of digital learning tools on student engagement, self-efficacy and ownership of learning.* Masters thesis, Memorial University of Newfoundland. pages 70-74 http://research.library.mun.ca/id/eprint/13222.
18. **Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017).** *Computer-based technology and student engagement: a critical review of the literature. International Journal of Educational Technology in Higher Education, 14*(1), 25. This review critically examines the relationship between computer-based technology and student engagement, offering insights relevant to the use of digital devices in education. educationaltechnologyjournal.springeropen.com
19. **Hwang, G. J., & Wu, P. H. (2014).** Applications, impacts and trends of mobile technology-enhanced learning: A review of 2008-2012 publications in selected SSCI journals. International Journal of Mobile Learning and Organisation, 8(2), 83-95.