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Original Research Article

Study on the Impact of Digital Learning Tools on the Academic Performance of Secondary School Students in Osmanabad

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Abstract

Background**:* The adoption of digital resources and tools at the secondary level has been a popular strategy for improving student engagement and achievement. In rural and semi-urban districts such as Osmanabad, in Maharashtra, the use of technology like smartboards, e-learning, and the blended classroom model is an indication of the educational opportunity and systemic challenge at the same time. This research aims to understand how these tools impact students' learning within the context of the localized educational and infrastructural realities of the area. ***Objective**:* This study aimed to explore the academic influence of three main digital interventions, viz, smartboards, e-learning apps, and blended classrooms in the secondary education of students (Grades 9-10) in the Osmanabad District. It attempted to determine the effectiveness of these tools and the contextual factors that mediated their success, including the accessibility, teacher facilitation, and student motivation. ***Methods**:* Using a qualitative-descriptive method, data were generated via semi-structured interviews with 10 teachers and 80 students, and 6 non-participant classroom observations in 6 schools. The method of thematic analysis was adopted to aggregate repetitive patterns and draw an interpretive understanding. ***Results: It shows the smartboards facilitated concept applications and active student participation, especially in Mathematics and Science. E-learning applications were valuable to students as they enabled self-based learning, albeit constrained by access deprivation. Mixed classrooms proved to be the best model, mixing flexibility with ongoing contact with the teacher. Yet digital inequity, poor infrastructure, and differences in pedagogical preparedness determined these on the whole. ***Conclusion:*** In summary, digital learning tools have the potential to significantly boost academic outcomes, but the payoff is greatest when the tools are pedagogically integrated, equitably available, and supported by trained educators. The findings of this study have implications for policy interventions that need to strike a balance between the advancement of technology and human-centred support for learning, particularly in underprivileged areas such as Osmanabad.

Keywords: Smartboards, E-learning apps, Blended classrooms, Academic performance, Digital education, Student engagement, Rural schools.

1. INTRODUCTION

1.1 Background and Context

Digital learning tools have transformed the pedagogical space for secondary-level education in both rural and urban India. In such districts as Osmanabad, where the educational infrastructure has always been in distress because of a variety of socio-economic and geographical barriers, the implementation of smartboards, e-learning apps, and blended classroom models is an opportunity as well as a challenge. These tools hold the power to fill in learning gaps, increase engagement, and democratize quality instruction (Akar, 2020; Cheema, 2018).

1.2 Rationale

A drought-affected district of Maharashtra, Osmanabad, has received phased digital infrastructure infusion through Government programs such as the Digital India Campaign, in addition to Rastriya Madhyamik Shiksha Abhiyan (RMSA). Yet, little is known about the potential of these instruments in enhancing performance in school. This study attempts to address this research gap by analysing the impact of digital learning tools on student performance in a region of the world where teacher shortages, limited access to the internet, and socioeconomic disparities are present (Sai, A., 2019).

1.3 Problem Statement

Despite large-scale spending in the technology-based learning intervention, there is scant evidence from semi-urban and rural districts like Osmanabad that either of these digital tools leads to an increase in academic performance. That there has been no previous work within the country is a policy blind spot, and investments that are not right-sized can foster unhealthy backlash.

1.4 Objectives of the Study

- To evaluate the effect of smartboards on student involvement and understanding in secondary education.
- To assess the impact of e-learning tools on enhancing academic performance.
- A study of the impact of blended learning in Osmanabad on improving learning outcomes.

1.5 Significance of the Study

Adding to the emerging literature of context-aware digital education is the present study from a rural Indian district. The results will directly contribute to educational policy, school administration, and curriculum design for the applications of the digital learning support tools in the under-resourced environment.

1.6 Scope and Delimitations

The present study is a study of secondary schools of Osmanabad district at the level of 9th and 10th standard students only. It focuses on three digital interventions — smartboards, e-learning apps, and blended classrooms

2. REVIEW OF LITERATURE

2.1 Conceptualizing Digital Learning Tools

Digital learning tools are a variety of software platforms intended to improve the process of teaching and learning (Neufeld, D. J., 2018). Supported MOBTS technologies include interactive whiteboards, m-learning applications, and blends of traditional and online learning. Personalization of learning, accessibility, and impression of 21st-century skills (Demir & Akpinar, 2018). ADF's integration into secondary education (Demir & Akpinar, 2018).

2.2 Smartboards and Interactive Learning

Smartboards are being used as an instructional technology that allows for active and interactive visualizations, instantaneous feedback, and multimodal content presentation in the classroom. Akar (2020) carried out a meta-analysis of 47 studies based on experiments and found a large, d = 0.94, statistically significant effect of smartboard use for academic achievement. The research has emphasized the following pros:

- Increased clarity of conceptualization by use of visuals
- Increased student participation and motivation
- Support for differentiated instruction

Nevertheless, problems exist, such as a lack of teacher training and the danger of over-reliance on technology that could hinder critical thinking if not scaffolded pedagogically (Akar, 2020).

2.3 E-learning Applications and Personalized Instruction

E-learning applications—such as play-to-learn courses and curriculum-rated mobile apps — have become popular as they provide students with flexibility and self-direction. Demir and Akpinar (2018) stated that mobile learning applications had a significant effect on the academic achievement and motivation of university students. Key insights include:

- Gamification increases engagement and retention
- Personality Trait Wizard: Select what you want to activate from the widgets and listen to the results to view the effect of your choice.
- Cognitive overload can result from a lack of instructional coherence in app design

These results are similar to those by Cheema (2018), who emphasized the need for e-learning to be adapted to context to reduce the impact of the digital divides.

2.4 Blended Classrooms and Hybrid Pedagogy

The term blending learning refers to the practice of using both online and face-to-face instruction to achieve the intended instructional end, and evidence has shown its efficacy in increasing learning gains. Kumar et al. (2020) carried out a meta-analysis and found that the average effect size was large (1.46), which referred to the students obtaining significant increases in performance. Benefits include:

- Learner autonomy and flexibility
- Enhanced critical reasoning and the fostering of community learning.
- Improved teacher-student engagement on digital platforms

However, the efficacy of blended models is contingent upon infrastructure preparedness, teachers' digital fluency, and institutional endorsement (Kumar *et al.,* 2020).

3. RESEARCH METHODOLOGY

3.1 Research Design

The paper uses a qualitative-descriptive research design focusing on thematic understanding of the impact of the use of digital learning tools on academic outcomes for secondary school students. Not grounded in the representation of numbers, the emphasis is instead on in-depth involvement in context, shaped by and shaping experience, action, and understanding within real educational settings. I aim to help document

the myriad ways in which smartboards, e-learning software, or blended classrooms are impacting teaching and learning in Osmanabad's secondary schools.

3.2 Study Area

The study took place in Osmanabad, a district in Maharashtra, at an intersection of newly emerging digital infrastructure and longstanding educational disparities. The area has been witnessing a slow infusion of technology in the classrooms through various measures by the state and central governments. Yet, the gaps in digital access, infrastructure dependability, and instructional continuity render it an informative site for considering the implications of this educational technology on student learning.

3.3 Population and Sample

The research focused on students (Grades 9 and 10) and subject teachers in secondary schools who are using any one form of digital mode in their classroom instruction. These were purposively sampled and include the following:

- 80 students: balanced representation by gender, levels of study, and exposure to digital tools.
- 10 teachers: engaged with making and teaching lessons on smartboards, apps, or mixed environments.

Sampling was done to have a mix of public and private-based health facilities to represent resource-rich and resource-poor setups in Osmanabad.

3.4 Data Collection Methods

Two major approaches were used for data collection:

- Semi-Structured Interviews: With students and teachers Who Had used the tools to investigate lived experiences, pedagogical barriers, and impressions of the effect of digital tools on academic engagement and achievement. The open question format served to accommodate participants with structured and unstructured feedback.
- Non-participant Classroom Observations- These were observed in real setting to offer direct experience on how the integration of digital tool became seamless using the not-yet design product, the teachers-students interaction, the classroom attentiveness and patterns of interactions.

Approvals were granted for all interviews and observations, which were then confidentially recorded and anonymized. Students were obtained by parental consent, by the ethical guidelines.

3.5 Data Analysis

The analysis was conducted using a thematic coding approach to identify recurring themes and emerging categories within the data sets. The analysis involved:

- Open Coding: Capture initial concepts and themes in the transcripts and field notes.
- Axial Coding: To group these under main sub-themes – engagement, comprehension, access, and digital readiness.
- Selective Coding: Integrating findings back with the three digital interventions (smartboards, e-learning apps, and blended learning models), to deduce interpretive constructs.

This was an iterative process allowing for the expected and unexpected findings to emerge and ensuring that participants' voices were represented.

3.6 Ethical Considerations

This study followed ethical norms for educational research. All school authorities, participants, and guardians consented. Participants were explained in full their rights (anonymity and confidentiality, their consent to participate was voluntary, they could withdraw from the study at any time). Records were kept confidential and only utilized for academic research.

4. RESULTS AND ANALYSIS

4.1 Overview of Data Interpretation

The results from the interviews and classroom observations are presented in this section in such a way that they have been arranged according to the three main tools thematically, followed by those of the three tools: smartboards, e-learning applications, and blended learning tools. Student and teacher voices feature prominently in the interpretation, and major themes are presented in summary tables.

4.2 Smartboards: Enhancing Multisensory Learning

The majority of teachers indicated that smartboards increased student attention and engagement, especially during science and math instruction. Students found it easier to understand information when it was presented visually and interactively, rather than in a static textbook.

Table 1: Student Perceptions of Smartboard Use (n = 80)

Perception	Frequency	Percentage (%)
Lessons are more engaging	52	65
Concepts are easier to understand	61	76
Limited access due to technical issues	25	31

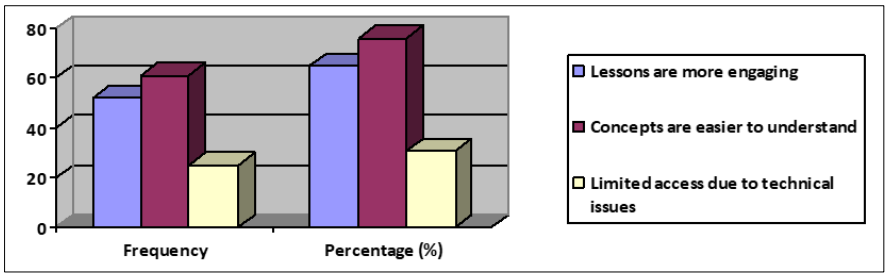

Figure 1: Student Perceptions of Smartboard Use (n = 80)

More than three-fourths of students believed the smartboard helped in understanding difficult topics. A third, however, were frustrated by erratic access caused by power cuts or equipment failures.

4.3 The Effect of E-Learning Applications on Performance

E-learning apps were lauded for the extent to which they have allowed for customized learning at home. But differential access to digital devices left these inequities of access, with rural students sharing smart phones between their family members, or missing sessions due to poor connectivity.

Table 2: E-Learning Usage Trends by Setting

Setting	Regular Use (%)	Irregular Use (%)	No Use (%)
Urban	72	18	10
Semi-urban	54	32	14
Rural	39	45	16

Early learning apps promoted revision & Homework completion, but regular use was relatively higher among urban students. The data indicates clear imperatives for infrastructure parity for delivering equitable learning gains.

4.4 Blended Classrooms: Bridging Flexibility and Academic Rigor

Blended learning, in which in-person classes are interspersed with digital resources, was found to be associated with greater self-directed learning. Teachers also observed better questioning skills among the students and increased students' responsibility for their academic work.

Table 3: Teacher Observations on Blended Learning Impact (n = 10)

Observed Outcome	Teachers Reporting (%)
Improved student autonomy	80
Higher homework completion	90
Difficulty managing time	40

Teachers, and to some extent students, reported that they saw strong increases in student initiative in blended models. However, one theme that emerged was that students were finding it difficult to manage online and offline workloads in an effective manner, particularly if students did not have support at home.

4.5 Insights Across Tools and Emergent Themes

The thematic coding yielded four recurring patterns in the digital tools:

- It similarly increases with interactivity and decreases when technical problems arise.
- Access disparity continues to be a barrier, and it is especially worse for rural students.
- Digital exposure needs parental and teacher support to translate into learning.
- When tools are matched to curriculum and assessment designs, they are more powerful.

Table 4: Summary of Key Themes Identified

Theme	Manifestation in Data
Digital Divide	Rural students underutilize e-learning tools.
Pedagogical Alignment	Smartboards are most effective when linked to lesson goals.
Learner Autonomy	Highest in blended environments
Infrastructure Constraints	Technical issues reduce tool reliability.

These themes across studies demonstrate that technology alone does not lead to good performance, the pedagogical use of it, its fit to the context and human facilitation are equally important.

5. DISCUSSION

5.1 Interpretation of Key Findings

The present research found that digital learning tools, when properly integrated into the curriculum, lead to improved academic performance of secondary school students in Osmanabad. Smartboards increased understanding and engagement, e-learning apps promoted individualized learning, and blended classrooms promoted self-regulation and sense-making in students. Yet the power of these tools was mediated by the availability of infrastructure, teacher facilitation, and socio-economic inequality.

5.2 Interpretation in the Context of the Literature

These results are in line with Akar (2020), who indicated a high effect size (d=0.94) for the use of smartboard for academic achievement, highlighting their support for visual learning and instantaneous feedback. Likewise, Demir and Akpinar's (2018) study indicated that the use of mobile learning applications had positive effects on student motivation and academic achievement, especially when accompanied by consistent and learner-oriented instructional design.

The most comprehensive model, Relax, emerged in this work, which is consistent with Kumar et al. (2020), had found in their review of blended approaches a high average effect size of 1.46. Osmanabad educators noted that students in the blended-classroom environment have increased homework completion, analytical skills, and self-regulation skills needed for academic success in the future.

5.3 Contextual Relevance to Osmanabad

Osmanabad's education ecosystem offers a unique mix of hope and limitation. Digital infrastructure has gotten better through government efforts, but uneven access to devices and the reliability of the internet remain. In rural backwaters, students often share a single smartphone or grapple with frequent power cuts, preventing them from using e-learning tools. These results are aligned with Cheema (2018), had issued a warning about digital learning and the risks to further entrench educational inequalities if not implemented equitably.

Yet the research showed that, when combined with traditional instruction, the digital tools can help give the students a better grasp of material, as well as greater engagement and resilience in school. This indicates that hybrid models can be appropriate in semi-urban and rural areas, as in Osmanabad.

5.4 Role of Teachers and Pedagogical Mediation

How teachers facilitated and mediated the use of the tool was an important factor for the efficacy of the tool. Smartboards were most effective when they were used interactively by the teacher using simulations, quizzes, and collaborative activities. This upholds Batdı's (2017) claim that it is the pedagogic application of smartboards, rather than the smartboard as a technology, which ensures that learning gains are achieved. Likewise, while e-learning apps became more impactful when teachers curated the content and did some scaffolding, they didn't seem to succeed when the students tried to navigate the platforms on their own.

5.5 Equity, ethics, and access issues

And the digital divide is as pronounced as ever. Pupils from poorer backgrounds or more isolated parts of the country were less likely to take advantage of e learning tools, given restricted access. This corresponds to the results of Fathima Ruksana (2019), in which, although the use of interactive whiteboards and digital resources adds value to learning, the dividend is not due for all. It is thus imperative that the ethical use of digital education focuses on inclusivity, accessibility, and localised support.

5.6 Policy and practice implications

The findings have important implications regarding:

- Focused teacher training on digital pedagogy
- Infrastructure investment in under-resourced schools
- Curriculum alignment with digital content
- Supporting home-based learning through community engagement

These are the steps that must be planned to support the fact that digital tools are to augment, not replace, human-centred teaching and learning.

6. CONCLUSION

The present study aimed to investigate the impact of digital learning tools (smartboards, e-learning applications, and blended classrooms) on the academic performance of secondary school students in Osmanabad. By way of a qualitative-descriptive methodology (naturalistic), based on the experience of the being, the study revealed the transformative potential and environmental constraints of technology within the scope of education.

Smartboards proved to be powerful visual engagement and conceptual transparency devices, especially as teachers used them interactively. COVID-19 e-learning apps provided autonomy and tailored learning, but that aid was not evenly distributed due to infrastructure and socioeconomic differences. Hybrid instruction, which fused the best of digital and face-to-face teaching, emerged as the most viable and equitable approach to promoting learning gains and learner autonomy.

But the effect of these tools was never disentangled from the human and institutional ecologies in which they were situated. Successful integration depended upon technological access as well as thoughtful pedagogical development, teacher readiness, student digital proficiency, and environmental infrastructure. What mattered was not the simple presence of digital tools but how, why, and for whom they were being used.

In the Osmanabad context, where technology's embrace links with persistent structural inequalities, the results provoke renewed attention to equity and inclusion and pedagogical intentionality. Online education should not be seen as a replacement for in-person teaching, but as a complement that can enhance what we can learn. As leaders, educators, and legislators plan for the future of education, this research is a reminder that such a transformation is well within the bounds of what is possible when technology is orchestrated with empathy, ethics, and educational intent.

7. Conflicts of Interest

The author has no conflicts of interest related to this study. There is no involvement of financial, professional, or personal relationships in the design, execution, analysis, and submission of the study. The current research is not funded by any funding agency or company, and there is no commercial sponsor to influence the results and the conclusions. Ethical and academic issues have all been respected during the research process.

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