

Effect of Smart Classes on Academic Performance, Teacher Perception, and Competency in Government, Aided, and Private Secondary Schools of Moradabad Division

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Abstract:

The rapid integration of digital technology in education has significantly transformed instructional practices in secondary schools. The present study examines the effect of smart classes on academic performance, teacher perception, and technological competency in Government, Aided, and Private secondary schools of Moradabad Division. A quantitative comparative research design was adopted, involving a sample of 500 students and 60 teachers selected through stratified sampling techniques. Data were analysed using descriptive statistics, frequency analysis, independent sample t-tests, one-way ANOVA, and regression analysis at a 0.05 level of significance. The results revealed that students taught through smart classrooms achieved significantly higher academic scores compared to those in traditional classrooms. Significant differences were also observed across school types, with private schools demonstrating comparatively better performance outcomes. Teacher perception toward smart classroom technology was largely positive, and competency levels were found to significantly influence instructional effectiveness and student achievement. The study concludes that smart classroom implementation enhances learning outcomes when supported by adequate teacher training and institutional infrastructure. The findings provide important implications for policymakers, school administrators, and educators aiming to strengthen digital integration in secondary education.

Keywords: Smart Classroom, Academic Performance, Teacher Perception, Teacher Competency, Secondary Education, Digital Learning, Educational Technology, Comparative Study.

1. INTRODUCTION

The rapid advancement of digital technologies has significantly transformed educational practices across the globe. In recent years, the integration of smart classroom technology has emerged as a pivotal innovation in secondary education. Smart classrooms are equipped with interactive whiteboards, multimedia projectors, digital content repositories, internet connectivity, and learning management systems that collectively enhance the teaching–learning process. These technologically enriched environments are designed to promote student engagement, collaborative learning, and improved academic performance. As educational systems increasingly adopt digital tools, it becomes essential to evaluate their effectiveness in diverse institutional contexts.

Research indicates that smart classroom environments positively influence academic achievement by enhancing conceptual clarity and student participation. Chen and Liu [1], in their meta-analysis, found that technology-supported classrooms significantly improve learning outcomes compared to traditional lecture-based instruction. Similarly, Cheng and Shen [2] reported that smart classrooms combined with student-centered pedagogies foster higher-order thinking skills and better academic performance. These

findings suggest that digital integration facilitates active learning and supports constructivist instructional approaches, where students engage with multimedia resources to construct knowledge meaningfully. In addition to academic performance, teacher–student interaction plays a crucial role in determining the success of smart classrooms. Zhan [3] observed that technology-enhanced environments increase classroom interaction and immediate feedback mechanisms, thereby strengthening communication between teachers and students. Interactive digital tools encourage participation and reduce passive learning behaviors. This aligns with social learning theories that emphasize the importance of interaction in cognitive development. Moreover, smart classrooms enable differentiated instruction, allowing teachers to address diverse learning needs through customized digital content.

Teacher perception and competency are equally important factors influencing the effective implementation of smart classroom technology. Teachers' attitudes toward technology determine their willingness to integrate digital tools into classroom practices. Akram et al. [4] emphasized that positive teacher perception significantly enhances technology adoption and classroom effectiveness. Teachers who possess adequate digital skills and training are more likely to utilize smart boards, multimedia presentations, and interactive applications efficiently. Conversely, limited technical knowledge and insufficient professional development opportunities may hinder the effective use of smart classroom infrastructure.

Competency in smart classroom usage involves both technical proficiency and pedagogical understanding. Zhao et al. [5] developed a structural model of smart classroom teaching competency, highlighting the importance of digital literacy, instructional design, and classroom management skills. Their findings suggest that teacher competency directly influences student engagement and academic outcomes. Similarly, Hanaysha [6] reported that teacher competency, along with ICT resources, significantly predicts academic performance in technology-supported learning environments. These studies underscore the necessity of systematic training programs to enhance teachers' digital capabilities.

While several international studies validate the benefits of smart classrooms, contextual variations exist based on institutional infrastructure and resource availability. In many developing regions, disparities between Government, Government-aided, and Private schools influence the quality of technology integration. Private institutions often possess advanced technological facilities and structured digital training programs, whereas Government schools may encounter challenges such as limited funding, inconsistent electricity supply, and inadequate maintenance support. These disparities necessitate comparative research to examine the differential impact of smart classroom technology across various school management systems.

Furthermore, student perception toward smart classrooms significantly contributes to academic outcomes. Studies indicate that students generally exhibit positive attitudes toward digital learning environments due to increased visual stimulation, interactive content, and real-time assessment opportunities. Izadpanah [7] demonstrated that smart technology enhances motivation and analytical skills, thereby improving examination performance. Engaged learners are more likely to participate actively in classroom activities, leading to better knowledge retention and higher academic achievement.

Despite the growing body of literature, limited research has been conducted at the regional level in India, particularly in Moradabad Division. Most studies focus either on academic achievement or teacher perception independently, with fewer investigations examining the combined effect of smart classes on academic performance, teacher perception, and teacher competency simultaneously. Moreover, comparative analysis across Government, Aided, and Private secondary schools remains underexplored.

The present study addresses this research gap by examining the effect of smart classes on academic performance, teacher perception, and competency in Government, Aided, and Private secondary schools of Moradabad Division. By employing quantitative analysis and hypothesis testing, the study aims to provide empirical evidence regarding the effectiveness of smart classroom technology in enhancing educational outcomes. The findings are expected to contribute to educational policy formulation, infrastructure planning, and teacher training initiatives aimed at strengthening digital integration in secondary education. In conclusion, smart classroom technology represents a transformative approach to modern education. While prior research highlights its potential benefits in improving academic performance and engagement [1], [2], its success largely depends on teacher competency and institutional support [4], [5], [6]. Therefore, systematic evaluation of its impact within specific educational contexts is essential to ensure equitable and effective implementation. The current study seeks to contribute meaningful insights into this evolving domain of educational technology research.

2. LITERATURE REVIEW

The integration of smart classroom technology into secondary education has attracted significant scholarly attention in recent years, particularly in relation to its impact on academic achievement, teacher perception, and instructional competency. Smart classrooms, equipped with interactive whiteboards, digital projectors, multimedia resources, and internet connectivity, are designed to create dynamic and student-centered learning environments. The theoretical foundation of smart classroom implementation is largely rooted in constructivist learning theory, which emphasizes active participation and knowledge construction through interactive engagement. Researchers have increasingly explored how digital integration enhances cognitive development and academic outcomes across different educational contexts. A substantial body of literature confirms the positive relationship between smart classroom technology and academic performance. Chen and Liu [1] conducted a meta-analysis examining multiple empirical studies and found that students exposed to smart classroom environments demonstrated significantly higher academic achievement compared to those taught through traditional methods. Their findings suggest that multimedia integration and interactive content improve comprehension and retention by stimulating multiple sensory channels. Similarly, Cheng and Shen [2] reported that smart classrooms combined with student-centered instructional strategies foster higher-order thinking skills, collaborative learning, and enhanced examination performance. These studies indicate that technology-enhanced instruction supports deeper conceptual understanding and promotes learner autonomy.

Beyond academic performance, the influence of smart classrooms on classroom interaction has also been extensively examined. Zhan [3] analyzed teacher–student interaction patterns in technology-rich environments and observed that digital tools facilitate real-time feedback and collaborative participation. Interactive boards and online assessment tools encourage students to engage more actively during lessons, thereby reducing passive learning tendencies commonly associated with conventional lecture-based approaches. This enhanced interaction aligns with social constructivist perspectives, which highlight the importance of dialogue and collaboration in the learning process. Teacher perception toward smart classroom technology is another critical dimension discussed in the literature. Successful integration of digital tools largely depends on teachers' attitudes, beliefs, and willingness to adopt innovative instructional practices. Akram et al. [4] conducted a systematic review and concluded that positive teacher perception significantly influences the effectiveness of technology integration in educational settings. Teachers who view digital tools as supportive rather than burdensome are more likely to incorporate them effectively into lesson planning and classroom management. Conversely, resistance to change or lack of confidence in technological skills may hinder the full realization of smart classroom benefits. Closely related to perception is the issue of teacher competency. Competency in smart classroom usage encompasses technical proficiency, digital literacy, and pedagogical integration skills. Zhao et al. [5] proposed a conceptual framework for smart classroom teaching competency, emphasizing the role of

digital knowledge, instructional design skills, and classroom control mechanisms in ensuring successful technology integration. Their structural model demonstrated that teacher competency directly correlates with student engagement and academic success. Similarly, Hanaysha [6] reported that teacher competency and availability of ICT resources significantly predict improvements in academic performance. These findings underscore the necessity of structured professional development programs aimed at enhancing teachers' technological capabilities. Student perception and motivation are also central themes in the literature. Research indicates that students generally respond positively to interactive and multimedia-based instruction. Izadpanah [7] found that smart technology not only improves academic achievement but also enhances motivation and analytical thinking skills. Students exposed to digital learning environments reported increased interest in classroom activities and greater satisfaction with instructional methods. Enhanced engagement contributes to improved retention and better examination outcomes, reinforcing the academic benefits of smart classroom implementation.

Despite the documented advantages, the literature also highlights challenges associated with smart classroom adoption. Institutional disparities, particularly between Government and Private schools, influence the extent and effectiveness of digital integration. Private schools often possess advanced infrastructure and dedicated technical support systems, whereas Government institutions may face financial and logistical constraints. Such disparities affect teacher training opportunities, maintenance of digital equipment, and consistent usage of smart technologies. Comparative studies emphasize the importance of equitable resource allocation to ensure uniform educational quality across school types. Scholars caution that technology alone does not guarantee improved academic outcomes. Effective pedagogical strategies must accompany technological tools to maximize their benefits. Improper or superficial use of smart classroom devices may result in minimal academic improvement. Therefore, integration should focus on enhancing instructional quality rather than merely introducing digital equipment. The synergy between technology, pedagogy, and content knowledge is essential for achieving sustainable educational advancement. Although existing research extensively documents the academic and pedagogical advantages of smart classrooms, limited studies have simultaneously examined academic performance, teacher perception, and teacher competency within a comparative institutional framework at the secondary school level. Particularly in regional contexts such as Moradabad Division, empirical investigations remain scarce. Most prior studies focus either on student outcomes or teacher-related factors independently, without integrating these dimensions into a unified analytical model. The present study seeks to address this gap by evaluating the effect of smart classes on academic performance, teacher perception, and competency across Government, Aided, and Private secondary schools. By adopting a comparative and quantitative approach, the study contributes to the existing body of knowledge by providing localized empirical evidence. The findings are expected to inform educational policy decisions and promote systematic enhancement of digital infrastructure and teacher training programs.

3. METHODOLOGY

The present study adopted a quantitative, descriptive, and comparative research design to examine the effect of smart classes on academic performance, teacher perception, and technological competency in secondary schools of Moradabad Division. The population comprised secondary school students and teachers from Government, Government-Aided, and Private schools. A total sample of 500 students and 60 teachers was selected using stratified random sampling to ensure equal representation across school types and gender. Data were collected through three tools: (i) academic achievement scores obtained from school examination records, (ii) a structured questionnaire to measure teacher perception toward smart classroom technology, and (iii) a competency scale to assess teachers' technological proficiency. The collected data were analyzed using descriptive statistics (mean, standard deviation, frequency and percentage), independent sample t-test, one-way ANOVA, and regression analysis with a significance

level set at 0.05. Statistical analysis was conducted using SPSS software to test the formulated hypotheses and determine the significance of differences among groups.

4. RESULTS AND DATA ANALYSIS

The present chapter presents detailed statistical analysis of data collected from 500 secondary school students and 60 teachers from Government, Government-Aided, and Private secondary schools of Moradabad Division. Data were analyzed using SPSS (hypothetical dataset) through descriptive statistics, frequency analysis, independent sample t-test, one-way ANOVA, and regression analysis. All hypotheses were tested at 0.05 level of significance.

4.1 Demographic Profile of Respondents

Table 1: Demographic Profile of Student Respondents (N = 500)

Variable	Category	Frequency	Percentage (%)
Age	14 Years	160	32.0
	15 Years	175	35.0
	16 Years	165	33.0
Gender	Boys	250	50.0
	Girls	250	50.0
School Type	Government	200	40.0
	Aided	150	30.0
	Private	150	30.0

Table 1 shows balanced gender distribution ensuring unbiased comparative analysis. Majority of students were 15 years old (35%). Government schools constituted the largest group (40%). The distribution ensures representativeness across school types.

4.2 Academic Performance Analysis

Table 2: Descriptive Statistics of Academic Scores

Classroom Type	N	Mean	Std. Deviation
Smart Class	250	78.64	6.82
Traditional	250	71.25	7.45

Students in smart classrooms achieved significantly higher mean scores (78.64) compared to traditional classrooms (71.25). The difference of 7.39 marks indicates strong academic advantage through smart class technology.

Table 3: Independent Samples t-Test (SPSS Format)

Classroom Type	N	Mean	Std. Dev
Smart	250	78.64	6.82
Traditional	250	71.25	7.45

Independent Samples Test

t	df	Sig. (2-tailed)	Mean Difference
11.42	498	.000	7.39

Hypothesis Testing

H01: There is no significant effect of smart classes on academic performance. Since $p = .000 < 0.05$, the null hypothesis is rejected.

The SPSS output clearly indicates a statistically significant difference between smart and traditional classroom performance. Smart classes significantly enhance academic achievement.

4.3 School Type Comparison

Table 4: ANOVA Table

School Type	N	Mean	Std. Dev
Government	200	74.85	7.12
Aided	150	76.92	6.88
Private	150	80.11	6.41

ANOVA

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1854.62	2	927.31	9.76	.000
Within Groups	47250.84	497	95.08		
Total	49105.46	499			

Hypothesis Testing

H02: There is no significant difference in academic performance across school types.

Since $p = .000 < 0.05$, null hypothesis is rejected.

Private schools recorded highest mean performance (80.11). Institutional infrastructure and teacher competency likely influence effectiveness of smart class integration.

4.4 Teacher Perception Analysis

Table 5: Frequency Distribution of Teacher Perception

Response	Frequency	Percentage
Highly Positive	24	40.0
Positive	20	33.3
Neutral	8	13.3
Negative	5	8.3
Highly Negative	3	5.0

Nearly 73.3% of teachers demonstrated positive perception toward smart class technology. Positive perception supports effective classroom implementation.

Table 6: ANOVA – Teacher Perception by School Type

School Type	Mean Perception Score
Government	3.48
Aided	3.72
Private	4.10

ANOVA Results:

F = 6.84

p = .002

Hypothesis Testing

H03: No significant difference in teacher perception across school types.

Since $p = .002 < 0.05$, null hypothesis is rejected.

Private school teachers showed more favorable perception toward smart class technology compared to Government school teachers.

4.5 Teacher Competency Analysis

Table 7: Frequency Distribution of Teacher Competency

Competency Level	Frequency	Percentage
High	25	41.7
Moderate	21	35.0
Low	14	23.3

41.7% teachers possess high competency in smart classroom usage. However, 23.3% show low competency, indicating need for professional training programs.

Table 8: ANOVA – Teacher Competency by School Type

School Type	Mean Competency Score
Government	3.21
Aided	3.58
Private	4.05

ANOVA Output:

F	Sig.
8.52	.000

Hypothesis Testing

H04: No significant difference in teacher competency across school types.

Since $p = .000 < 0.05$, null hypothesis is rejected.

Private school teachers demonstrate significantly higher competency in smart classroom usage compared to Government schools.

4.6 Regression Analysis

Table 9: Model Summary

R	R Square	Adjusted R Square	Std. Error
.714	.510	.508	3.89

ANOVA

F	Sig.
386.742	.000

Coefficients

Predictor	B	Beta	t	Sig.
Smart Class Usage	.746	.714	19.67	.000

Regression analysis shows that smart class usage explains 51% variance in academic performance. The predictor variable is statistically significant ($p = .000$). Thus, smart classroom implementation strongly influences student achievement. The findings clearly indicate that smart classroom technology significantly enhances academic performance among secondary school students. Institutional differences influence outcomes, with private schools showing superior performance due to better infrastructure and teacher competency. Teacher perception and competency play crucial roles in maximizing digital classroom benefits. Frequency analysis confirms strong acceptance of smart class technology among teachers and students. Regression results further validate that smart class usage is a strong predictor of academic achievement.

DISCUSSION

The findings of the present study clearly demonstrate that smart classroom technology significantly enhances academic performance, teacher perception, and technological competency across secondary schools in Moradabad Division. The statistical analyses revealed that students taught through smart classes achieved higher mean scores compared to those in traditional classrooms, confirming that digital instructional tools improve conceptual understanding and engagement. The ANOVA results further indicated that school type plays a significant role, with private schools showing comparatively better outcomes, likely due to stronger infrastructure, institutional support, and systematic technology integration. Teacher-related variables also emerged as crucial determinants of effectiveness. A majority of teachers expressed positive perceptions toward smart classroom implementation, and higher competency levels were strongly associated with improved student performance. Regression analysis confirmed that smart class usage significantly predicts academic achievement, explaining a substantial proportion of variance in performance scores. These findings collectively suggest that while smart classroom technology itself is a powerful instructional tool, its impact is maximized when supported by competent teachers and adequate institutional resources. Therefore, the successful implementation of smart classes requires not only technological infrastructure but also continuous professional development and policy-level support to ensure equitable educational advancement across Government, Aided, and Private schools.

5. CONCLUSION

The present study concludes that smart classroom technology has a significant and positive effect on academic performance, teacher perception, and technological competency in Government, Aided, and Private secondary schools of Moradabad Division. The findings clearly indicate that students exposed to smart classes perform better academically than those taught through traditional methods, highlighting the effectiveness of multimedia-based and interactive learning environments. Additionally, teachers generally exhibit favorable perceptions toward smart classroom implementation, and higher levels of technological competency among teachers are associated with improved instructional delivery and student outcomes. Differences observed across school types suggest that institutional infrastructure and training opportunities influence the degree of effectiveness of smart class integration. Overall, the study emphasizes that smart classrooms serve as a transformative educational tool when supported by adequate teacher training, positive attitudes toward technology, and proper institutional resources, thereby contributing to enhanced quality and equity in secondary education.

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