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Student Engagement and Learning Outcome in Digital Vs. Traditional Classroom – A Comparative Study

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Abstract: *This study aims to study and compare student engagement and learning outcomes in digital and traditional classrooms. It analyses the student preferences and perceptions towards digital and traditional learning environments. The rapid integration of technology in education urged the researcher to assess the role of teaching strategies, tools, and technologies in influencing student engagement in both modes. Using a structured questionnaire method, data were collected through a survey from students across both learning environments. The findings reveal different advantages and challenges in each mode. The study concludes there must be a balance in the mode of teaching, regardless of the delivery method.*

Keywords: Student Engagement Learning Outcomes, Digital Classroom, Traditional Classroom, Online Learning

I. INTRODUCTION

Education has changed a lot in recent years, especially with the use of digital technology. Traditional classrooms, where students learn face-to-face with teachers, are integrated with or replaced by online learning. This change has led to many questions about which method helps students learn better. Two important things to consider are how involved students are in their learning (student engagement) and how well they perform (learning outcomes). Traditional classrooms offer direct interaction and a set routine, while digital classrooms offer more flexibility and the use of technology. This study compares student engagement and learning outcomes in both digital and traditional classrooms to understand which one may be more effective.

II. REVIEW OF LITERATURE

Student engagement and learning outcomes are two fundamental indicators of educational effectiveness. As online learning is in the limelight now, comparing its impact with traditional classroom settings has become essential. This literature review explores key findings from existing studies to examine how each learning mode affects student engagement and academic achievement.

Student Engagement in Traditional Classrooms

Traditional classrooms have long emphasized face-to-face interaction, structured schedules, and direct feedback. These factors contribute significantly to student engagement. According to Freeman et al. (2014), students in traditional classrooms that use active learning techniques, such as discussions and group activities, achieve better than those in passive lecture-based environments. Their analysis found that attentive learning enhanced examination performance by nearly half a standard deviation and reduced failure rates.

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In addition, collaborative learning in traditional classrooms strengthens both academic outcomes and interpersonal skills. Johnson, Johnson, and Smith (2014) found that students engaged in cooperative learning environments show higher achievement and greater long-term retention of knowledge than those learning individually.

Digital Learning and Student Engagement

Digital classrooms, particularly during and after the COVID-19 pandemic, have introduced new ways of engaging students. Technology-enhanced learning environments often include video lectures, quizzes, simulations, and gamified elements. If it is used effectively, it surely increases interactivity and motivation. For example, a study by Huang et al. (2022) showed that students using a digital learning environment for mathematics saw a 24.2% improvement in test scores compared to 8.3% in the traditional paper-based group.

Furthermore, interactive tools such as live polling and quizzes can boost attention and participation. According to Vinuela and Kretzschmar (2023), live quizzes in computing lectures helped maintain student focus, especially in large classes. However, these tools must be used judiciously to prevent cognitive overload.

Learning Outcomes: Comparing Both Modes

Research suggests that both classroom types show positive output, but under different conditions. Bernard et al. (2009) conducted a meta-analysis comparing online and face-to-face instruction and concluded that no single method is superior across all contexts. However, online instruction, which includes collaborative activities, discussion forums, and feedback mechanisms, could exceed the effectiveness of traditional methods.

Similarly, a study by Means et al. (2013) revealed that students in online or blended learning environments performed modestly better than those in face-to-face settings. The key advantage was the ability of online systems to offer self-paced learning and repeated exposure to content.

Blended Learning: A Balanced Approach

Blended mode of learning often leads to the best learning outcomes. According to Graham (2013), blended learning environments leverage the strengths of both systems—personal interaction and digital flexibility. Students benefit from face-to-face mentorship while using online resources to review material at their own pace.

Studies by López-Pérez, Pérez-López, and Rodríguez-Ariza (2011) showed that students in blended learning courses had lower dropout rates and higher academic achievement than those in either purely online or traditional formats.

Challenges in Digital Learning

Despite its advantages, digital learning comes with challenges. It is observed that not all will have the right access to technology or stable internet, contributing to a "digital divide." According to Selwyn (2016), students from lower levels often face more difficulties engaging with online platforms, leading to lower academic outcomes.

Moreover, digital learning needs good self-regulation. A lack of time management and motivation can hinder progress in online courses (Broadbent & Poon, 2015). Traditional classrooms, by contrast, provide more external structure and accountability.

III. OBJECTIVES

- To analyze student preferences and perceptions towards digital and traditional learning environments
- To compare the level of student engagement in digital classrooms and traditional classrooms
- To examine the role of teaching strategies, tools, and technologies in influencing student engagement in both modes
- To identify challenges faced by students in both digital and traditional classrooms.

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IV. CONCEPTUAL FRAMEWORK

The move from traditional to digital classrooms has greatly changed the face of education. The main objective of the research is to investigate the differences in student engagement and learning outcomes between digital and traditional learning environments. It outlines the relationship between the key variables, grounded in educational theories and supported by empirical research.

Hypothesis

H01: There is no significant difference in student preference between digital and traditional learning environments.
H11: There is a significant difference in student preference between digital and traditional learning environments.
H02: There is no significant difference in student perception between digital and traditional learning environments.
H12: There is a significant difference in student perception between digital and traditional learning environments.
H03: There is no significant difference in student engagement between digital and traditional classrooms.
H13: There is a significant difference in student engagement between digital and traditional classrooms.
H04: Teaching strategies, tools, and technologies do not significantly influence student engagement in digital and traditional classrooms.
H14: Teaching strategies, tools, and technologies significantly influence student engagement in digital and traditional classrooms.
H05: There is no significant difference in the challenges faced by students in digital and traditional classrooms.
H15: There is a significant difference in the challenges faced by students in digital and traditional classrooms.

V. RESEARCH DESIGN

5.1 Sample and participants' profile

In the present research, the researchers used an online survey method to collect the primary data. The questionnaire was created and circulated through forms and distributed to 500 people in the age group between 18-41. The 131 responses were received and taken for further study. Out of 131, 53 are male and 78 are female. 84 postgraduates, 07 graduates, 38 undergraduates, and others.

Statistical tools used

The study has employed the mean, median, chi-square, Paired Sample Test, and Wilcoxon Signed-Rank Test.

VI. DATA ANALYSIS AND INTERPRETATION

Descriptive statistics

Table 1

		Age	Gender	Educational qualification
N	Valid	131	131	131
	Missing	0	0	0
Mean		1.07	1.60	2.38
Std. Deviation		.309	.493	.924
Variance		.095	.243	.853
Skewness		4.891	-.393	-.717
Std. Error of Skewness		.212	.212	.212
Kurtosis		24.981	-1.874	-1.249
Std. Error of Kurtosis		.420	.420	.420
Range		2	1	3

Source: Primary Data

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The descriptive statistics show the sample's demographic profile. Age shows a mean of 1.07 with highly positive skewness (4.891), indicating the sample is concentrated in the youngest category. The very high kurtosis (24.981) suggests a sharply peaked distribution. Gender has a mean of 1.60 with skewness close to zero (–0.393), reflecting a fairly balanced male–female distribution. Its negative kurtosis (–1.874) indicates a relatively flat spread without a dominant category. Educational Qualification yields a mean of 2.38 with moderately negative skewness (–0.717), pointing to more responses in the higher categories (Graduate and Postgraduate). The flat kurtosis (–1.249) suggests no strong peak, but rather a clustering around the middle-to-upper categories. Overall, the metrics highlight a predominantly younger, graduate-to-postgraduate sample with fairly balanced gender representation.

Hypothesis Testing

H11- There is a significant difference in student preference between digital and traditional learning environments.

Table 2

Chi-Square Test results for student preference towards digital and traditional learning environments

Test	Chi-Square (χ^2)	df	Asymp. Sig.(p-value)	Minimum Expected Cell Frequency
Most preferred mode of learning	62.130	3	<0.001	32.8

Source: Primary Data

The chi-square test results yielded a statistically significant outcome ($\chi^2 = 62.13$, df = 3, $p < 0.000$). This indicates that students' learning preferences are not equally distributed across digital, traditional, blended, and no-preference categories. The test meets the validity condition, as no cells have expected frequencies less than 5. Therefore, H01 is rejected and H11 is accepted, confirming that most of the students significantly favored traditional learning.

H12- There is a significant difference between the students' perception towards digital and traditional learning environments

Table 3

Wilcoxon Signed-Rank Test results for student perception towards digital and traditional environments

Variables	Z	Asymp. Sig. (2-tailed) (p-value)
Quality of content delivery	-3.881	.000
Clarity in understanding the concept	-3.948	.000
Interaction with faculty	-6.121	.000
Peer interaction	-5.519	.000
Motivation to learn	-4.426	.000
Access to learning materials	-2.856	.004
Comfort and convenience	-3.652	.000

Source: Primary Data

The Wilcoxon Signed-Rank Test was used to compare students' perception of digital learning and traditional learning across seven aspects. The results revealed significant differences in all aspects ($p < 0.05$). Students rated traditional learning significantly higher than digital learning in terms of content delivery ($Z = -3.881$, $p < 0.001$), clarity in

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understanding (Z = -3.948, p < 0.001), interaction with faculty (Z = -6.121, p < 0.001), peer interaction (Z = -5.519, p < 0.001), motivation to learn (Z = -4.426, p < 0.001), access to learning materials (Z = -2.856, p = 0.004), and comfort and convenience (Z = -3.652, p < 0.001). It shows that students perceive traditional classrooms as more effective and engaging across all measured dimensions. Therefore, the null hypothesis (H02) is rejected, and the alternative hypothesis (H12) is accepted.

H13- There is a significant difference between the level of student engagement in digital classrooms and traditional classrooms.

Table 4

Wilcoxon Signed-Rank Test results for the level of student engagement in the digital classroom and traditional classroom

Variables	Z	Asymp. Sig. (2-tailed)
Pay full attention during class	-2.583	.010
Participate in discussions	-3.597	.000
Ask questions when you have doubts	-3.071	.002
Take notes actively	-4.898	.000
Submit assignments on time	-3.838	.000
Engage with peers in learning	-4.448	.000
Stay motivated throughout the session	-3.339	.001

Source: Primary Data

The Wilcoxon Signed-Rank Test compared student engagement in digital classrooms and traditional classrooms across seven activities and it was statistically significant differences in all engagement activities (p < .05). Students reported higher engagement in traditional classrooms than in digital ones, including paying attention, participating in discussions, asking questions, note-taking, timely assignment submission, peer collaboration, and maintaining motivation. It says that traditional classrooms promote stronger student engagement compared to digital classrooms across multiple aspects. Thus, the null hypothesis (H03) is rejected, and the alternative hypothesis (H13) is accepted.

H14: Teaching strategies, tools, and technologies significantly influence student engagement in digital and traditional classrooms.

Paired sample correlation

Table 5

Variable	N	Correlation	Sig
Effectiveness of tools/technologies in enhancing engagement in digital and Traditional classrooms	131	.402	.000

Source: Primary Data

To check the association between perceived effectiveness of tools/technologies in digital and traditional classrooms The Paired Sample Test was applied. Results showed a moderate positive correlation between the two learning modes (r = .402, p < .001). It means that digital classrooms are more positive for engagement, and tend to give relatively

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higher ratings to traditional classrooms. It implies that student perception of engagement is somewhat consistent across both learning modes. Therefore, H04 is rejected, and H14 is accepted.

H15: There is a significant difference in the challenges faced by students in digital and traditional classrooms.

Table 6 Multiple Response
Source: Primary Data

digital challenge (N=131)	Percent of Cases	Traditional challenge (N=131)	Percent of Cases
Poor internet connectivity	66.4%	long travel time to campus	51.9%
lack of concentration	55.7%	rigid class schedules	37.4%
health issue	40.5%	inadequate classroom infrastructure	24.4%
lack of motivation	39.7%	limited use of visual/digital aids	35.9%
Difficulty in understanding the concept	35.9%	less flexibility in accessing recorded materials	26.7%
limited interaction with teachers	36.6%	limited interaction due to large class size	20.6%
Difficulty in accessing study materials	32.8%	noise/ distractions in the classroom	26.7%
technical problem	46.6%	other	6.1%
Other	11.5%		

Students face different sets of challenges in digital and traditional learning modes. In digital classrooms, challenges are mainly technology-related and personal factors (internet, distractions, motivation, and technical issues). In traditional classrooms, challenges are mainly logistical and structural (travel time, schedule rigidity, infrastructure, class size). Since the pattern of challenges differs substantially in both modes, H05 is rejected and H15 is accepted. There is a significant difference in the challenges faced by students in digital vs. traditional classrooms. The poor internet connectivity is the common challenge of digital learning (66.4%), and long travel time is the problem of the traditional mode (51.9%). Digital challenges were mainly technology-related, whereas traditional challenges were related to logistical aspects.

Findings

Most students significantly preferred traditional classrooms over digital classrooms for learning.
Students' preference for the traditional learning method is rated higher.
Students rated traditional classrooms higher than digital ones in content delivery, clarity, interaction with faculty/peers, motivation, access to materials, and overall comfort.
Students perceive traditional classrooms as more effective and engaging across all measured dimensions.
Traditional classrooms promoted stronger engagement in all activities (attention, discussions, asking questions, note-taking, timely submissions, peer collaboration, and motivation).
Students reported higher engagement in traditional classrooms than in digital ones.
There was a moderate positive correlation (r = 0.402) between the effectiveness of tools/technologies in digital and traditional classrooms.
Effective use of technology enhances engagement in both modes.
In the Digital classroom, poor internet (66.4%) is the main challenge of the digital mode.
In Traditional classrooms, long travel time (51.9%) is the main challenge of the traditional mode.

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Suggestions

Based on the above findings, the combined strengths of both digital and traditional environments to maximize student engagement and outcomes

Enhance Digital Infrastructure through improving internet accessibility and affordability, and provide digital devices or support schemes for students lacking resources.

Strengthen Engagement in Online Learning through interactive tools like quizzes, breakout discussions, gamification, and collaborative platforms, and train faculty in digital pedagogy to maintain student attention and motivation.

Improve Traditional Classroom Experience through reducing rigid schedules by offering hybrid options and incorporating more digital/visual aids in face-to-face learning.

Student Support Systems provide mentoring and motivation programs for digital learners to overcome self-regulation issues and establish academic counseling for both modes to address challenges like workload and stress.

VII. CONCLUSION

The study has explored the impact of digital and traditional classroom environments on student engagement and learning outcomes. The findings reveal that both modes have unique strengths and limitations. Traditional classrooms provide direct interaction, structured learning, and collaborative activities that enhance engagement and academic performance, particularly through face-to-face communication and social learning dynamics. In contrast, digital classrooms offer flexibility, accessibility, and interactive technologies that can significantly boost motivation and self-paced learning—when effectively designed and supported.

However, digital learning environments also present challenges, such as unequal access to technology and the need for strong self-regulation skills. The effectiveness of both learning modes appears to depend more on pedagogical quality, student support mechanisms, and the intentional use of engagement strategies than on the mode itself. Blended learning emerges as a promising model that integrates the strengths of both digital and traditional settings, potentially leading to improved engagement, fewer absences, and enhanced academic achievement.

In conclusion, there is no universally superior model. Instead, educational effectiveness is maximized when instructional design is responsive to learner needs, technological access, and contextual factors. Future research and policy should focus on optimizing blended models, supporting digital equity, and training educators to connect the benefits of these modes for students.

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