E-Classroom Management System: A Model for Resolving Performance Evaluation Controversies of Onsite and Online Systems of Learning

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ABSTRACT

The advances in technology have made online learning more popular in educational institutions across the globe. Consequently, researchers have conducted investigations on the effects of online learning on students' academic performance using questionnaire as instrument for data collection. These have led to three divergent reports. While some researchers agreed that online learning is as good as onsite learning in terms of students' academic performance, others are of strong opinion that online learning is better than onsite learning. Still, a third school of thought affirmed that onsite learning is more effective than online learning. Since these studies relied on self-reported data from students and lecturers, who are participants, the contradictory results need to be further investigated using a method devoid of questionnaire as the participants may be biased when filling the questionnaire. It is against this background that an e-Classroom Management System was developed. The system was evaluated alongside onsite learning using College students. The results from the study showed that onsite learning gives a better academic performance than online learning.

Keywords: E-Classroom, Educational planners, Online, Onsite, Region.

INTRODUCTION

The advances in technology have made online education possible for students and other learners with busy schedules and limited work/office flexibility to obtain quality education. Secondly, the outbreak of covid-19 pandemic in 2020 which led to the sudden closure of schools worldwide made various world governments to begin to further explore the use of online teaching as there was no other choice due to the lockdown. As opposed to onsite teaching, online learning has made it possible to offer classes worldwide through the use of Internet Technology. However, the efficiency of the online mode of teaching has been put into questionable doubt. This has led to research investigations to ascertain which of the two methods, (online and onsite) brings better academic performance to the learners. Unfortunately, these investigations made use of questionnaire and reported contradictory results.

From the literature, there have been three main divergent findings among researchers on which of these two methods (online and onsite) gives a better students' academic performance. Furthermore, most studies found in literature on the effects of online and onsite methods of teaching on students' academic performance relied on self-reported data from the students and lecturers using questionnaire as a major instrument for data collection. While this study is not against the use of questionnaire in eliciting opinions or as data gathering instrument, research findings according to Persky et al. (2020) have shown a weak correlation between students' perceived learning and actual learning outcomes. In addition, researches conducted using questionnaire as an instrument for data gathering only give approximate results as the respondents may be biased when filing the questionnaire. Thus, relying on these contradictory findings may be a misleading conclusion to educational planners and policy makers. To address this missing gap, an e-Classroom Management System was proposed, developed and implemented.

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Problem Statement

Investigations on the efficiency of the online and onsite methods of teaching have relied solely on the use of questionnaire as can be found in the literature. Thus, there is urgent need to conduct a fresh investigation on this critical subject matter without the use of questionnaire.

Objectives of the Study

The objectives of this study are:

(1) To evaluate the effects of online and onsite methods of instruction delivery on the students' academic performance using an e-Classroom Management System.

(2) To put to rest the controversial reports using a method devoid of questionnaire.

Significant of the Study

The significant of this study are:

(1) To provide decision makers in education sector with the much-needed information to determine if students placed in either online or onsite classrooms are being equally treated.

(2) To provide reliable data that will guide teachers, students and parents in understanding the effects of online and onsite methods of teaching on students' learning outcome.

Research Questions

(1) Is there equity in academic performance between online and onsite students that are taught the same course?

(2) Can online method of teaching produce better learning outcomes than onsite method of teaching?

Hypothesis

The above research questions were subsumed into one null hypothesis thus:

H0: There is no significant difference in academic performance of students taught using online mode of instruction and those taught using the onsite mode of instruction.

LITERATURE REVIEW

In a study carried out by Paul & Jefferson (2019) to determine which teaching method proved more effective among students of Environmental Science Course in Fort Valley State University, USA, it was found that there is no significant difference in student performance between online and onsite learners. In a related development Chen & Jia (2016) compared the online and onsite student's learning outcomes and experiences using students of Peking University, China. Their finding revealed that there is no significant difference between the online and onsite learners' participants in terms of their scores. Similarly, Wrenn (2015) studied the effects of onsite and online modes of instruction on the students' achievement outcomes. The result of the study showed that there is no significant difference in performance scores between the online and traditional instructional models. According to Vivolo (2016), online learning works as effectively as traditional onsite learning. The work of Pei & Wu (2016) provided evidence that online learning is at least as effective as onsite learning. In their respective studies, Gacs et al. (2020), Montiel-Chamorro (2018) and Hockly (2015) found that there was neither superiority nor significant differences in the instructional delivery format between online and onsite modes of teaching. Thus, the first school of thought maintained that there is no significant difference in performance between students taught using online and onsite methods of instruction.

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However, the second school of thought affirmed that online method of instruction is better than the traditional classroom method of teaching in terms of students' academic performance. The recent study of Wang et al. (2022) which supports this claim found from the survey of Chinese students' opinion, that studying Chinese language online is better than studying it onsite. According to Zheng et al. (2021), 16 out of the 17 courses compared in their study showed that the online cohort secured more A grades than the onsite. The study of Amin et al. (2020) found that students of National University, USA who took the database classes learned better in online than onsite classes. Furthermore, Amin et al. (2021) compared the performance of students taught using online and onsite modes in Introductory Electrical Circuit class. The result showed that online method is better than onsite method. It should be noted that most of the authors cited in this paragraph reported that online method is as good as or even better than onsite method. However, the latter was purposively chosen.

In contrast to the above two schools of thought, the third school of thought is of the strong opinion that onsite performs better than online classes. Supporting this school of thought, Bhaumik & Priyadarshimi (2020) study showed that 64.8% of the respondents agreed that onsite classes are more effective that online classes. In a recent survey conducted by Wang et al. (2022), it was found that students in the USA reported that onsite classes for Chinese language were significantly more effective in learning when compared with the online method. As reported by Means & Neisler (2021) in a USA national survey, more than 55% of students who participated in online learning during the pandemic did not learn as well as they did during the onsite learning before the pandemic. According to the finding of Kaczmarek et al. (2020), 50% of the participating dental lecturers at Harvard University perceived student learning to have worsened when online was used as a method of instruction during the pandemic, while 70% of the students felt the same. Similarly, Abbasi et al. (2020) reported that 86% of medical and dental students in a Pakistan college felt that they learned less in online.

Reports from these three schools of thought, which used questionnaire as instrument for data collection showed clearly three divergent opinions on the same subject matter. However, questionnaire only gives approximate result. This is the missing gap which this study tends to address.

METHODOLOGY

Research Design

The design of the research study is as outlined in the subsections below.

Design of e-Classroom Management System

The architecture of the e-Classroom Management System is presented in figure 1.

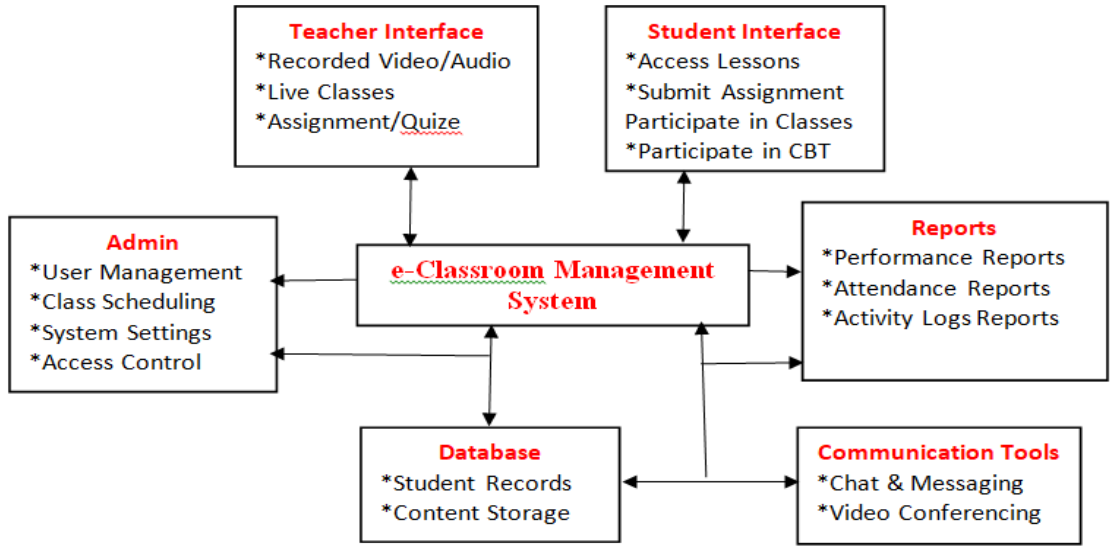

Figure 1: The Architecture of the e-Classroom Management System

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This study adopts a system design approach to develop an e-Classroom architecture that reflects practical teaching and learning needs in a digital environment. Rather than relying on a purely theoretical model, the design was guided by common challenges observed in conventional and online classrooms, such as limited interaction, difficulty in tracking student progress, and the need for flexible content delivery.

At the center of the proposed framework is the e-Classroom Management System, which functions as the core platform through which all activities are coordinated. The system was structured in a modular way to ensure that each component performs a specific role, while still maintaining smooth interaction with other parts of the platform. This approach was considered suitable for scalability and future improvements of the model.

The development process involved identifying the key users of the system and mapping their interactions with the platform. Based on this, two primary user interfaces, one for instructors and the other for students were identified and designed to fit into the system. The teacher interface was developed to support different modes of instruction. Instructors are able to upload recorded lessons, conduct live sessions, and create assessments such as assignments and quizzes. These features were included to allow flexibility in teaching methods, especially in situations where real-time interaction may not always be possible. For students, the interface was designed with ease of use as a priority. Learners can access course materials, participate in live classes, submit assignments, and take computer-based tests within the same environment. The intention here was to create a simple but functional workflow that does not require advanced technical skills, thereby making the system accessible to a wider range of users.

To address the need for interaction, a communication layer was integrated into the system. This includes messaging and video conferencing tools that enable direct engagement between teachers and students. The inclusion of these features was based on the understanding that learning is more effective when there is active communication, even in a virtual setting.

An administrative module was also incorporated to manage the overall operation of the system. This module handles tasks such as user registration, scheduling of classes, access control, and adjustment of system settings. By centralizing these controls, the system can be maintained more efficiently without interfering with the learning process.

In addition, a reporting component was designed to provide feedback on system usage and student performance. Reports such as attendance records, performance summaries, and activity logs are generated to support monitoring and decision-making. These outputs can help educators identify learning gaps and adjust their teaching strategies accordingly.

All system components are supported by a centralized database, which stores user information and instructional content. The database design emphasizes data consistency, data integrity, and accessibility, ensuring that information can be retrieved when needed without unnecessary delays.

In summary, the framework/architecture of the proposed e-Classroom Management System follows a practical and iterative design perspective, where the architecture is shaped by user needs and functional requirements rather than rigid theoretical assumptions. This makes the proposed system adaptable to different educational contexts while still maintaining a clear and organized structure.

Implementation

The system was implemented using PHP and JAVA. The login interface is presented in figure 2.

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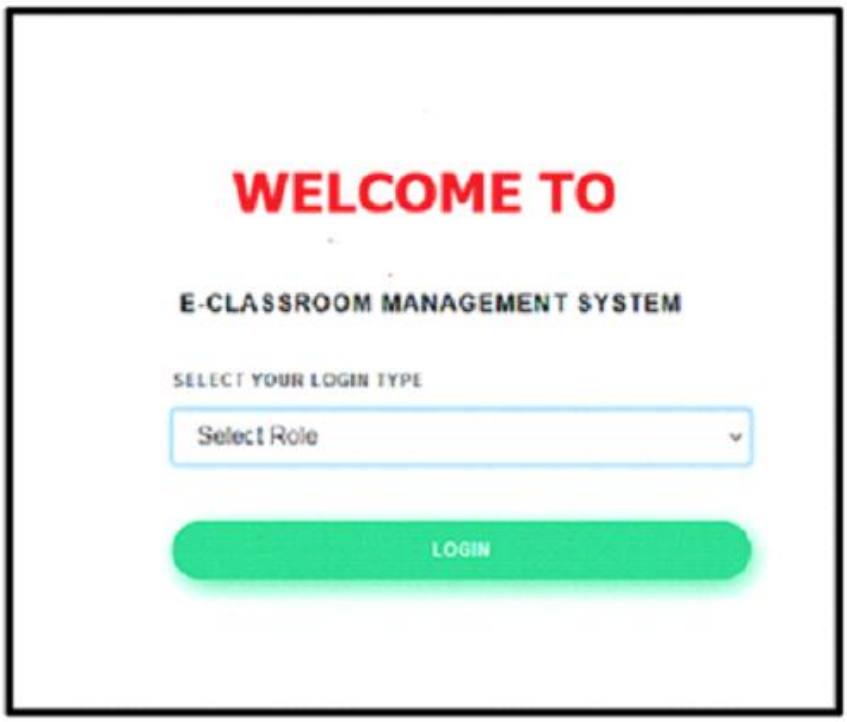

Figure 2: Login Interface

Pilot Test

Before the large scale deployment of the system, we carried out a pilot test using a total of One Hundred and Thirty Eight (138) students comprising of Seventy (70) students for 2020/2021 and Sixty Eight (68) students for 2021/2022 academic sessions respectively.

During the pilot test, two (2) Groups were created. They were online mode of instruction and onsite mode of instruction shortened as online and onsite groups respectively. In 2020/2021 academic session, members of the groups were chosen from the Seventy (70) students using stratified random sampling, hence each group has Thirty-Five (35) students. The two groups were taught CSC211 and CSC221 by the same lecturer to avoid serious variations in teaching methods that may impact the outcome of the research.

Similarly, in 2021/2022 academic session, a new set of Sixty-Eight (68) Computer Science students were used for further pilot testing. Thus, Thirty-Four (34) students each were selected from the Sixty-Eight (68) students and assigned into online and onsite groups using stratified random sampling. The two groups were taught CSC211 and CSC221 by the same lecturer to avoid serious variations in teaching methods that may sway the research outcome.

It should be noted that the online group was given unhindered access to the Internet free of charge. This was done to remove any limitation on the use of e-Classroom Management System due to lack of fund to buy data. Secondly, the choice of stratified random sampling was chosen to ensure each group has a fairly equal number of students with the same level of intelligent using their 100 level results. At the end of the two (2) years, that is, 2020/2021 and 2021/2022, the examination results were collected for analyses with the consent of the participants. The result of the pilot test is presented in table 1. In addition, the feedback from the participants helped in improving the software for large scale deployment.

Table 1: Mean score, standard deviation, t test and sig. value

Variable	N	Mean	SD	T	Df	Sig. (P)
Online	138	2.27	1.09			
				2.73	274	0.007
Onsite	138	2.67	1.36			

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From table 1, it shows that there is a significant difference in academic achievement of students taught with online and their counterpart taught with onsite method (t=2.73, df=274, p=0.007). Again, students taught with onsite method performed better (mean=2.67, SD=1.36) than their counterpart taught with online method (mean=2.27, SD=1.09). Apart from this, all feedbacks on the working of the system were addressed. Thus, this served as sound validation and reliability test of the system before large scale deployment/use.

Population of the Study for Large Scale Implementation

The population of the study was the entire 200 level students of 2022/2023. This comprised of students from various disciplines in the College. The entire students' population in the College offer the general course (GSE213-Introduction to Computer Studies II). The purpose of using 200 level students is to enable us use their academic performances in 100 level in assigning them into groups.

Sample Size for the Large Scale Implementation

For this study, the entire population is the sample size. In other words, the sample size of this study was One Thousand Two Hundred and Twenty Eight (1,228) 200 level students for the 2022/2023 academic session. Stratified random sampling was employed in grouping the entire students into online and onsite groups in order to ensure that each group has a fairly equal number of students with same level of intelligent using their 100 level results. Thus, each group has Six Hundred and Fourteen (614) students.

The two groups were taught by the same lecturer in order to minimize variation in teaching methods that may influence the outcome of the study. Similarly, the online groups were given unhindered access to internet facility at no cost to the students. At the end of the semester, both groups were subjected to the same examinations and the results were collected for analyses with the consent of the participants.

Data Analyses and Discussion of Findings

Data Analyses

The data analyses are presented in tables 2 and 3.

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ONLINE	614	34	78	48.65	9.542
ONSITE	614	40	85	54.53	9.623
Valid N (listwise)	614				

Table 2 presents the descriptive statistics comparing students' performance under online and onsite instructional mode of teaching. The analysis reveals clear differences in central tendency and dispersion between the two learning environments.

The mean score for the onsite mode (M = 54.53, SD = 9.623) is noticeably higher than that of the online mode (M = 48.65, SD = 9.542). This indicates that, on average, students performed better in the traditional face-to-face setting compared to the online environment. The difference in mean scores (approximately 5.88 points) is not trivial and suggests a meaningful gap in academic outcomes between the two modes.

In terms of score distribution, both modes exhibit comparable variability, as reflected in their standard deviations. This implies that while performance levels differ, the spread of scores within each group is relatively consistent. The minimum and maximum values further reinforce this observation, with onsite scores ranging from 40 to 85 and online scores from 34 to 78. The slightly higher upper bound in the onsite setting suggests that top-performing students may benefit more from in-person instruction.

In summary, the descriptive statistics point toward a systematic advantage of onsite learning over online learning in terms of student achievement, while maintaining a similar level of score variability across both modes.

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Table 3: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ONLINE-ONSITE	-5.879	.817	.033	-5.944	-5.815	-178.340	613	.000

Table 3 reports the results of the paired samples t-test conducted to determine whether the observed difference between online and onsite performance is statistically significant.

The analysis shows a mean difference of -5.879 (online minus onsite), indicating that online scores are significantly lower than onsite scores. The magnitude of this difference is reinforced by a very small standard error (SE = 0.033), suggesting high precision in the estimate of the mean difference. The 95% confidence interval for the difference ranges from -5.944 to -5.815. Notably, this interval does not cross zero, providing strong evidence that the difference is not due to random variation. Instead, it reflects a consistent and reliable disparity between the two modes of instruction.

The t-value is exceptionally large in absolute terms (t = -178.340, df = 613), and the associated p-value (Sig. = .000) indicates statistical significance at well beyond the conventional thresholds. This confirms that the difference in performance between online and onsite learning environments is highly significant.

Putting together the analyses from descriptive statistics and paired samples test, the results provide a compelling statistical evidence that students perform significantly better in onsite settings compared to online settings.

DISCUSSION OF FINDINGS

The findings of this study reveal a clear and consistent pattern: students achieve higher academic outcomes in onsite learning environments than in online settings. This difference is not only observable at the descriptive level but is also strongly supported by inferential statistics, leaving little room for ambiguity.

One of the most striking aspects of the results is the magnitude and stability of the performance gap. The difference of nearly six points between the two modes, coupled with a narrow confidence interval, suggests that this is not a situational or context-specific outcome. Rather, it reflects a structural disparity between how learning is experienced and internalized in online versus onsite environments.

A plausible explanation for this pattern lies in the nature of engagement and interaction. Onsite learning environments typically provide immediate feedback, richer communication cues, and a more structured academic atmosphere thereby enhancing critical thinking, which ultimately impacts on students' intelligence and academic performance. This is in line with Agholor (2025) finding that human-based learning method has effectively promoted critical thinking that fosters intelligence. These elements can enhance concentration, deepen understanding, and foster accountability among learners. In contrast, online learning often requires a higher degree of self-regulation and may be hindered by distractions, limited real-time interaction, or technological constraints. For many students, these factors can collectively reduce the effectiveness of learning, thereby affecting academic performance.

Another important consideration is the role of instructional delivery and assessment conditions. In physical classrooms, instructors can adapt dynamically to students' responses, clarify misunderstandings instantly, and maintain a controlled learning environment. This aligned with the finding of Peacock & Cowan (2019), which showed that one of the most important factors influencing students' academic performance in any learning environment is a sense of belonging, the feeling of being connected with and supported by the teachers and classmates. Online settings, despite their flexibility, may dilute these advantages, especially when not

optimally designed or supported. This is supported by the finding of Chan et al. (2020) that while teaching can be held online because of advances in Internet Technology, virtual peer interaction on such a platform has been perceived by medical students not to have the same positive effect as physical interaction.

It is also worth noting that the similarity in standard deviations across both modes suggests that the difference is not driven by extreme cases or outliers. Instead, the advantage of onsite learning appears to be broadly distributed across the student population. This strengthens the argument that the mode of instruction itself plays a decisive role in shaping outcomes.

From a practical standpoint, these findings carry significant implications. They call for a critical re-examination of how online learning is implemented, particularly in contexts where it is expected to substitute traditional classroom instruction. Enhancing interactivity, improving digital infrastructure, and providing structured support systems may help bridge the observed performance gap.

CONCLUSION

In conclusion, the evidence points decisively towards the superiority of onsite learning in this context. While online education remains a valuable and often necessary alternative, its current form may not fully replicate the academic benefits associated with face-to-face instruction. Future efforts should therefore focus not only on expanding access to online learning but also on strengthening its quality and effectiveness to match, or at least approach, the outcomes observed in onsite settings.

RECOMMENDATION

From the finding, we recommend that more research work should be conducted on how to improve the technology that drives the online method of teaching.

Areas of Future Research Work

Apart from the issue of students' academic performance, little attention has been given to factors affecting students' acceptance of online learning. Thus, investigation into user acceptance of online learning taking cognizance of the sub-Saharan Africa local contents such as socioeconomic status, epileptic power supply, among others will be an interesting research direction.

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Conflict of Interest

The author declares here that there is no conflict of interest.

Ethical Compliance

The author complied with all relevant ethical guidelines.

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