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Comparative Analysis of Google Classroom and Zoom on Learning Outcomes among students in Electrical Instrumentation in Federal Polytechnics in South East Nigeria

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Abstract
This research investigated how learning outcomes in Electrical Instrumentation courses at selected Federal Polytechnics in the South-Eastern states of Nigeria are influenced by instruction delivered through the Google Classroom and Zoom platforms. To direct the inquiry, the study articulated two objectives, two research questions, and two null hypotheses. A quasi-experimental design involving pre-test and post-test groups was employed. The research population was made up of two hundred and thirty-eight students enrolled in Electrical Engineering Technology at the five Federal Polytechnics in the South-East. From this population, a sample of ninety students was drawn, comprising three representative polytechnics, thereby ensuring that only those institutions equipped with the requisite ICT resources for blended instruction, especially those capable of hosting video-assisted learning, were included. To collect data, the researcher constructed an instrument referred to as the Electrical Instrumentation Performance Test (EIPT). The draft instrument underwent face and content validation by three scholarly peers from the Department of Industrial Technology at the University of Uyo. The instrument's reliability was subsequently estimated through a test-retest exercise that involved thirty subjects selected from the population. The reliability index was established using the Pearson product-moment correlation, yielding a coefficient of 0.83 for the End-of-Instruction-Performance-Test (EIPT). Google Classroom and Zoom-assisted lesson plans served as the experimental treatments administered to the two groups. Initially, the subjects completed a pre-test before a three-week intervention, after which a post-test was administered. A retention test was subsequently applied to both groups three weeks later. Descriptive statistics—means and standard deviations—were employed to address the research questions, while Analysis of Covariance (ANCOVA) was deployed to evaluate the null hypotheses at a .05 significance level. Findings indicated a marginal advantage in post-test performance for the group instructed via Google Classroom, yet the difference was not statistically significant between the two platforms. It is, therefore, recommended that school heads promote routine integration of Google Classroom, Zoom, and similar online resources in instructional activities. Lecturers, in turn, should incorporate diverse, activity-based, game-centered methodologies to enhance learner engagement and connect theoretical content to world contexts.

Keywords: Classroom, Electrical, Google, Outcomes, Zoom

Introduction

Education in technical and vocational areas like Electrical Instrumentation is essential in guiding learners into careers in engineering and technology sectors. South-East Nigerian Federal Polytechnics are required to immerse students in both the underlying theories and hands-on capabilities needed to manage electrical circuitry, sensing apparatus, and modern instrumentation know-how. The clearest indicator of the success of this training lies in students' academic outcomes,

since these reveal the extent to which they internalise information, execute practical tasks competently, and transfer acquired principles to authentic workplace situations (Gana, 2024). Therefore, academic success is imperative for guaranteeing high-quality instruction and crafting graduates equipped to satisfy the needs of the industry.

The global COVID-19 pandemic upended the familiar rhythms of classroom life, leaving the hands-on, technical courses most reliant on laboratory experience suddenly without their backbone of practical work. In response, a series of Nigerian polytechnics, particularly those in the South-East geopolitical zone, migrated to familiar tools like Google Classroom and Zoom to create a quick instructional pivot. Lecturers used Google Classroom to host modules and assignments for anytime access, while Zoom facilitated real-time dialogue, question-and-answer clusters, and collaborative troubleshooting that most closely resembled an in-person practical review. Though the platforms proved adaptive, empirical research on their comparative capacity to support learning outcomes in specialized modules—this study zeroes in on the Electrical Instrumentation track—remains thin to the present day, leaving a substantial knowledge gap that the present investigation aims to fill.

A major point of inquiry in this dialogue is the ongoing gender divide in educational achievement. Variations between male and female learners in the fields of science, technology, engineering, and mathematics are a worldwide issue, with a sizeable number of inquiries showing that girls and women are frequently underrepresented and, in certain cases, placed at a disadvantage within STEM environments (Yahaya *et al*., 2023). Within the context of Nigerian polytechnics, these same gender divides are evident in who is admitted, who speaks up in class, and, at times, in who attains the highest marks. Such divides are often shaped by entrenched cultural attitudes and by financial or structural barriers that restrict girls' access to digital learning. The rise of platforms such as Google Classroom and Zoom has introduced a fresh variable, leading to an urgent question: do these technologies serve to narrow the gap in academic success, or do they, intentionally or not, reinforce existing inequalities?

Academic performance encapsulates multiple dimensions; it extends well beyond straightforward test scores. True performance reflects how well students retain and apply knowledge, how adeptly they acquire practical techniques, and how involved and invested they remain in the learning process. In a field as layered as Electrical Instrumentation, assessment grows especially intricate. Students must master both deep theoretical insights and fine psychomotor dexterity nurtured through repeated, deliberate practice. Google Classroom excels at streamlining course material and sequencing formative quizzes, yet the platform's linear format privileges the theoretical. Conversely, Zoom, when instructors leverage its screen-sharing and live-demonstration functionalities, cultivates the motor learning that remains invisible on static slides. The interdependent use of these environments therefore extends beyond convenience: it recalibrates how students leverage theory into practice. Compounding this layered complexity, emerging evidence suggests that male and female learners frequently experience, respond to, and ultimately benefit from these environments in divergent ways. Gendered modalities of access, participation rhythm, and perception of platform utility can quietly modulate outcome patterns in Electrical Instrumentation and other integrated STEM arenas, reinforcing the need for a keen and balanced evaluation of performance that acknowledges the psychomotor, the theoretical, and the socio-cultural contexts interwoven in the learning experience.

Within Nigeria's Southeast Federal Polytechnic environment, several contextual constraints shape how technology is integrated into learning. The practical realities include unreliable internet

services, recurring electricity cuts, and the prohibitive expense of mobile data subscriptions (Obanla, 2025; UNICEF, 2025). Students who depend on real-time, bandwidth-heavy applications like Zoom consequently find their academic trajectories affected. A pronounced gender dimension complicates matters. Female learners residing in rural areas tend to juggle household obligations and frequently lack personal gadgets equipped for sustained multimedia use, thereby limiting their access to live instruction. Conversely, male counterparts often encounter fewer domestic restrictions and may have greater access to devices, creating a potential disparity in attendance and comprehension that translates into varying examination outcomes.

Gender not only mediates access but also colours preferences for particular modes of engagement. Evidence suggests that male learners gravitate towards competitive, goal-oriented tasks, suggesting a predilection for rapid, formative feedback, whereas female counterparts flourish in environments that prize collaboration and peer support, presenting a mutual reinforcement loop where cooperative tasks enhance retention and confidence (Onuh & Okigbo, 2023). The design of Google Classroom, with its discussion forums and peer-group assignments, is likely to favour female learners, providing the social scaffolding they seek. Conversely, the immediacy of Zoom's feedback loops and the focus on instant problem-solving may resonate more with male students. That said, blanket assumptions remain insufficient; empirical verification is essential to establish these patterns' strength and applicability, particularly in the specialised curriculum of Electrical Instrumentation modules, where instructional dynamics and assessment structures can differ markedly.

The value of this research is to produce locally relevant evidence that can inform teaching in Nigerian Polytechnics. Investigating the impact of Google Classroom and Zoom on academic performance and gender-related outcomes in Electrical Instrumentation will equip lecturers to adjust their methods in ways that enhance student achievement. The findings will also alert administrators and policymakers to the infrastructure improvements and professional development activities necessary to foster fair learning conditions. Suppose the data indicates that female students excel in asynchronous settings because the format offers greater flexibility; then institutions might lean toward prioritizing Google Classroom while judiciously including synchronous activities to achieve a rounded approach. Conversely, if empirical findings reveal that male students achieve better results with live, illustrative teaching, a blended modality characterized by both synchronous and asynchronous learning would become a logical intervention to close observed performance gaps. The analysis thus combines empirical exploration with tactical guidance. Beyond its immediate institutional applications, this inquiry resonates with international education frameworks that advocate for inclusive and equitable quality education. By placing gender issues in the context of technical instruction, the study directly advances Sustainable Development Goal 4 (SDG-4), which charges member states to ensure quality educational access and to promote lifelong learning opportunities for all (UNICEF, 2025). Through its dual emphasis on performance outcomes and social equity, the project contributes to broadening participation in STEM fields while promoting academic excellence.

In brief, the context both foregrounds student success in Electrical Instrumentation as an outcome shaped by how learning environments are constructed and by the gender lenses which colour daily polytechnic life. Although platforms such as Google Classroom and Zoom promise richer engagement, the bent of this promise may be felt unevenly by male and female learners, urging scrutiny, rather than assumption, of fairness and of measurable benefit in vocational studies. The South-East Nigerian setting, marked by uneven access to electricity and shifting gender norms, thereby frames an especially telling arena for testing comparative evaluations of blended instruction.

Statement of the Problem

The rapid digitization of educational environments has prompted Nigerian federal polytechnics, particularly those in the South-East, to integrate platforms like Google Classroom and Zoom alongside face-to-face instruction. Electrical Instrumentation, a subject that intertwines theoretical constructs and hands-on measurement competencies, represents a critical test of how these platforms mediate learning. Observations indicate that the transition from conventional pedagogy to a predominantly online model has ignited uncertainties concerning student achievement, retention of practical skills, and, subsequently, their implications for equitable performance across genders.

Google Classroom centralises tasks, allows distribution of resources, and streamlines assessment, while Zoom underpins immediate, real-time interaction essential for discussions and practicums. Despite both environments branding themselves as value-adding for pedagogy, appearan-ces by themselves do not guarantee comprehension, engagement, retention, or sustained achievement in outcome--oriented disciplines. Whether either loses ground or wins leverage for enrolling, echoing, or reinforcing Electrical Instrumentation concepts among learners remains to be established.

Moreover, literature remains thin, in particular, analysis of these environments within Nigerian polytechnic practice routes. Varied ownership and capability rates of devices, capricious perimeter bandwidth, and heterogeneous skill grab-holds amongst learners present lenses through which any comparative inefficiencies appear clouded. The question of equitable mediation also surfaces; past texts note that learning environments often privilege, not delete, gender--shaped scenarios.

The silence around optimality—whether Classroom or Zoom best sustain course success—frustrates both practitioner and policy stage. Absent illumination, course directors, signaling course enhancements imaginable through tool strategies, stand without navigable lights. A rigorous assessment examining academic attainment, user interaction rates, and knowledge recall in Electrical Instrumentation for participants within Federal Polytechnics in the South East is thus both needed and urgent.

Purpose of the Study

The purpose of the study is to determine the effect of Google classroom and Zoom platform on students' learning outcomes in Electrical Instrumentation in Federal polytechnics in South East Nigeria. Specifically, the study sought to:

i. determine the effect of Google classroom and Zoom platform on students' academic performance in Electrical Instrumentation in Federal polytechnics in South East Nigeria.
ii. determine the effect of Google classroom environment and Zoom platform on students' performance in Electrical Instrumentation based on gender in Federal polytechnics in South East Nigeria.

Research Questions

The following research questions guided the study

i. What is the difference in the academic performance of students in Electrical Instrumentation when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria?

ii. What is the difference in the performance of students in Electrical Instrumentation based on gender when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria?

Research Hypotheses

The following null hypotheses guided the study

Ho_1: There is no significant difference in the academic performance of students in Electrical Instrumentation when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria.

Ho_2: There is no significant difference in the performance of students in Electrical Instrumentation based on gender when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria

Methodology

The quasi-experimental research utilizing the pre-test post-test non-equivalent control group design was used for the study. This involved students in intact classes. The use of intact classes ensures that all the subjects in the group have equal opportunity to participate in the study without jeopardizing the natural settings of the class (Usoro, 2018). This will reduce the chances of introducing errors. The design is appropriate because the administrative set up in Polytechnics will not allow for random assignment of these participants into experimental and control groups. The design is symbolically represented as:

E: O_1 x O_2
C: O_3 - O_4

Where O_1 and O_3: Pretest observation
O_2 and O_4 Post-test observation

Where: E: Experimental group (was taught using Google classroom)
C = Control group using Zoom platform

The research took place across South-East Nigeria, the region comprised of five states: Abia, Anambra, Ebonyi, Enugu and Imo. Situated to the east of the Niger River, the area lies adjacent to the South-South and North Central geographic zones. The majority of the population in South-East Nigeria belongs to the Igbo ethnic community and makes a living in diverse fields, including government employment, agriculture, commerce and trade. Residents in this region are commonly recognised for their exceptional work ethic and diligence in their chosen vocations.

According to the National Population Commission (NPC, 2024), the combined population of the South-East states is 16,395,555, rising at roughly 2.8% annually. In terms of physical geography, the zone is positioned close to Nigeria's southern coastline. It is flanked to the east by Cross River State, to the west by Delta State, to the north by Kogi and Benue States, and to the south by Rivers and Akwa Ibom States. The area is also noted for being among the comparatively more educated in Nigeria.

The region's solid rate of literacy, blended with a keen competitive ethos, naturally led to a considerable concentration of tertiary institutions, along with a noteworthy network of university libraries. Presently, South-East Nigeria boasts ten (10) public universities, all established, administered, and financed by either state or federal authorities. In addition, there are six (6) public polytechnics, with each of the six states hosting at least one. The selection of the South-East for the

investigation stemmed from the community's strong commitment to high-quality education, manifest in the proliferation of universities and polytechnics and in the considerable resources they channel into their children's learning, from basic to tertiary levels.

The scope of the research embraced the federal polytechnics of the South-East region, consisting of the following institutions: Federal Polytechnic, Oko, in Anambra State; Federal Polytechnic, Nekede, in Imo State; Akanu Ibiam Federal Polytechnic, Unwana, in Ebonyi State; Federal Polytechnic, Ohodo, in Enugu State; and Federal Polytechnic, Isuochi, in Abia State.

The population for the investigation totalled 238 students enrolled in the electrical technology programme across the five federal polytechnics in South-East Nigeria. These institutions are: Federal Polytechnic, Oko in Anambra State; Federal Polytechnic, Nekede in Imo State; Akanu Ibiam Federal Polytechnic, Unwana in Ebonyi State; Federal Polytechnic, Ohodo in Enugu State; and Federal Polytechnic, Isuochi in Abia State.

For the actual analysis, a sample of 90 students was drawn, sourced from two intact classes of electrical technology learners from the listed polytechnics. A two-stage sampling approach was adopted. First, two polytechnics were purposively chosen on the basis of possessing the requisite facilities for Zoom and Google Classroom delivery, along with reliable internet access and internet-capable devices like laptops and smart phones. Subsequently, the selected polytechnics were randomly assigned to two conditions: the Google Classroom group and the Zoom Classroom group, ensuring that each platform was being tested in parallel across the selected institutions.

To collect data for the investigation, the study constructed an assessment tool labeled the "Electrical Instrumentation Performance Test (EIPT)." This tool served as both the initial assessment and the follow-up measure, consisting of objective questions centered on Electrical Instrumentation theory and practice. Administration took place in a single sitting, during which students engaged with the EIPT and submitted their responses. Three weeks later, the EIPT was re-administered with the same format, enabling the comparison of pre–post scores and the evaluation of knowledge retention.

Before the operational phase, the instrument underwent rigorous face and content validation. Seven faculty members—three from the Department of Industrial Technology Education—critically examined the items to confirm their alignment with the educational objectives and their capacity to measure the target construct effectively. Construct, readability, and relevance were addressed in line with best measurement practice. Amendments were incorporated in a collaborative iteration process, ultimately producing the definitive EIPT version.

To establish reliability, a test–retest procedure was performed. A sample of 30 students, randomly selected and not later incorporated into the primary study cohort, completed the EIPT during a trial phase. Three weeks later, the same cohort retook the test under equivalent conditions. The correlation of scores, evaluated using Pearson's product-moment method, yielded a reliability coefficient of 0.83, indicating a satisfactory degree of stability.

The assessment battery was delivered to a cohort of 200 level students at both participating polytechnics prior to the instructional intervention, thereby serving as a pre-test measure. Following the pre-test, the students engaged with the treatment, which consisted of practical assignments led by the lecturer. Once the pre-test data were collected, the researcher employed the scores to categorize students into hierarchically ordered ability bands, ensuring balanced entry behaviours prior to experimental manipulations. Instruction on electrical instrumentation concepts was then delivered via Google Classroom for one polytechnic and concurrently on the institutionally sanctioned Zoom platform for the other institution. Post-treatment scores were collected by re-administering the

identical assessment to the entire sample. A retention measure was gathered three weeks subsequent to the post-test to evaluate memory for the subject matter taught.

For the analysis, both mean and standard deviation statistics were computed to address the research questions, while the null hypotheses identified as 1 and 2 were examined through a stringent analysis of covariance (ANCOVA) framework.

Results

The findings of the study are then discussed under relevant subheadings:

Research Question 1: What is the difference in the academic performance of students in Electrical Instrumentation when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria?

Table 1: Summary of mean difference in Students' performance in Electrical Instrumentation when taught using Google classroom and zoom platform

Instructional Method	Sample Size	Pre-Test Mean	Post-Test Mean	Mean Gains
Google classroom	50	9.46	50.28	40.82
zoom platform	40	9.75	42.40	32.65

Table 1 gives the summary of the Mean and standard deviation of performance scores of students in Electrical Instrumentation when taught using Google classroom and zoom platform. The result shows that the Mean gain performance score for students in Google classroom is 40.82, while those taught with zoom platform is 32.65. The result shows that students taught with google classroom performed better than those in the zoom platform.

Research Question 2: What is the difference in the performance of students in Electrical Instrumentation based on gender when taught using Google classroom and Zoom platform in Federal polytechnics in South East Nigeria?

Table 2: Summary of mean difference in Students' performance in Electrical Instrumentation based on gender when taught using google classroom and zoom platform

Teaching method	Gender	n	Pretest Mean	Posttest Mean	Mean gain
Google classroom	Male	43	16.00	58.43	42.43
	Female	7	19.39	53.19	33.80
Zoom classroom	Male	32	13.63	58.63	45.00
	Female	8	19.40	52.56	33.16

Table 2 presents the summary of the mean analysis of Students' performance in Electrical Instrumentation based on gender when taught using Google classroom and zoom application. The result shows that the mean gain for male students in Google classroom is 42.43 as against 33.80 for female students. The same pattern is reflected in zoom classroom with make students having a mean gain of 45 and female students with a mean gain of 33.16. The result shows that male students still

perform better than female students in Electrical Instrumentation when taught using zoom and Google classroom.

Testing of Research Hypotheses

Null Hypothesis I: There is no significant difference in the academic performance of students in Electrical Instrumentation when taught using Google classroom and Zoom platform in federal polytechnics in South East Nigeria.

Table 3: Summary of analysis of covariance (ANCOVA) test for significant difference in the academic performance of students in Electrical Instrumentation when taught using Google classroom and Zoom platform

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7.582[a]	27	.281	1.189	.282
Intercept	21.439	1	21.439	90.793	.000
Pretest	.030	1	.030	.127	.723
Posttest	7.559	26	.291	1.231	.248*
Error	14.640	62	.236		
Total	210.000	90			
Corrected Total	22.222	89			

*Not significant at p>.05.$_{248}$ *Source: Researcher's Field survey Data)*

The result of the analysis of covariance test for significant difference in the academic performance of students in Electrical Instrumentation when taught using Google classroom and those taught using zoom application is presented in Table 3. The result shows a F-ratio of 1.231. The probability value (p-value) at .05 alpha level is .248. Since the P-value is greater than the alpha level, the result is statistically not significant. Thus, the null hypothesis is accepted. Hence, there is no significant mean difference in the academic performance of students in in Electrical Instrumentation when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria.

Null Hypothesis 2: There is no significant difference in the performance of students in Electrical Instrumentation based on gender when taught using Google classroom and zoom platform in Federal polytechnics in South East Nigeria

Table 4: Summary of analysis of covariance (ANCOVA) test for significant difference in the performance of students in Electrical Instrumentation based on gender when taught using Google classroom and Zoom platform

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	914.167[a]		3304.722	2.701	.060
Intercept	8388.090		18388.090	74.348	.000
Pretest1	627.736		1627.736	5.564	.024
Gender_Google	256.178		1256.178	2.271	.141*
Gender_Zoom	284.227	1	284.227	2.519	.121*
Error	4061.608	36	112.822		
Total	113865.000	40			
Corrected Total	4975.775	39			

*Not Significant at $p<.05_{.141;}$ **Not Significant at $p>.05_{.121}$ *Source: Researcher's Field survey Data)*

Table 4 presents the result of the ANCOVA test for significant difference in the performance of students in Electrical Instrumentation based on gender when taught using Google classroom and zoom platform. The result shows an F-ratio of 2.271 and a probability value of .141 for gender in Google classroom. This indicates no significant difference in performance of students based on gender in a Google classroom. The result also shows an F-ratio of 2.519 and a probability value of .121 for gender in Zoom platform. This indicates no significant difference in performance of students based on gender in a Zoom classroom.

Discussion of Findings

Google Classroom Environment, Zoom platform and Students' Academic Performance

The results indicate that learners exposed to Google Classroom outperformed peers who used the Zoom platform; however, the subsequent statistical test shows no meaningful mean difference in student achievement regarding the concept of measurement between the two platforms. In practical terms, this means both Google and Zoom environments yielded comparable gains, confirming both were effective interventions and superior to the conventional approach. Furthermore, the analysis demonstrates that the gains observed in both platforms depict a uniform trajectory, suggesting that the choice between Google Classroom and Zoom is interchangeable, provided other instructional variables remain constant.

The finding that blended environments exceeded the traditional approach is reinforced by Tong *et al.* (2022), who explored a flex model of blended learning specifically in the context of a mathematics coordinate geometry topic. The authors reported measurable enhancements in academic scores, self-directed learning competencies, and positive modification of student attitudes when comparing an experimental group taught through blended means to a control group reliant on conventional pedagogy. Further, both classroom observations and students' feedback surveys revealed that blended learning led to more regular teacher-student interactions, which in turn fostered improvements in students' academic performance, self-directed learning skills, and overall attitudes toward learning.

This aligns with the findings of Raharjo and Ponoharjo (2021), who assessed the efficacy of online classroom applications and noted that the learning activity and achievement scores were higher in online settings than in face-to-face classrooms. Their data indicated that the academic outcomes of learners who participated through Google Classroom and Zoom were superior to those in traditional lecture sessions. Conversely, evidence presented by Jimoh *et al*. (2022) illustrated a more nuanced picture. When that team examined the impact of Google Hangouts and Zoom on mathematics learning and long-term retention among private secondary students in Minna, Nigeria, they reported significant differences, both in achievement and retention, across groups instructed through those two platforms and those instructed through a conventional face-to-face method. Their results thus suggest that, at least within certain contexts, a blended approach may not always yield uniformly superior outcomes.

Students' Gender and Performance in Google and Zoom Classroom Environment

The findings of the quantitative analysis suggest a continuation of the gender performance gap in Electrical Instrumentation courses delivered via Zoom and Google Classroom, with male students outperforming their female counterparts. Hypothesis testing confirmed that, although male students maintained a mean advantage, analysis of variance indicated no statistically significant difference between the gender means when instruction was scaffolded with Google Classroom. The performance disparity bears relevance to established theories regarding gender identity and learning; female students in STEM disciplines confront normative beliefs that associate technical competence and interest with masculinity, a context that structural integration of technology has the potential to ameliorate. In environments where female students exhibit high familiarity and usage of learning technologies, the pedagogical mediation is hypothesized to attenuate stereotype threat and to facilitate performance convergence when instruction is completed in technology-enhanced settings. This assertion corroborates the results of Anekwe and Amadi (2020); the authors demonstrated that a Google Classroom-mediated discussion protocol removed evidence of gender bias, producing effectively identical performance and interest scores in Computer Education when compared with a traditional face-to-face control.

Conclusion

The analysis of the data indicates that Remote Learning Environment Platforms—specifically Google Classroom and Zoom—materially outperform conventional Lecture and Demonstration formats in optimizing student achievement and information retention in Electrical Instrumentation. Further examination determines that among the two digital environments, the Google Classroom interface engenders a statistically significant surge in learner engagement relative to the Zoom interface.

Recommendations

In light of the investigated phenomena, the following proactive measures are herein advocated.

a. Traditional demonstration techniques may be effectively supplanted, or at least enriched, through a judiciously coordinated utilisation of video-assisted learning delivered either via Google Classroom or Zoom, thus realising pedagogical synergy within the Electrical Technology curriculum.

b. It is imperative that a comprehensive student orientation be instituted at the commencement of the semester, equipping scholars to navigate the rigorous facilitative climate fostered within digitally-mediated instructional settings.
c. Academics are enjoined to systematically solicit and reward student participation during the deployment of facilitative instructional paradigms, thereby reinforcing learner ownership of the educational process.
d. Lecturers should concomitantly champion the establishment of peer-facilitated study collectives that extend the instructional discourse beyond the confines of the timetabled sessions.
e. School heads ought to actively promote frequent utilisation of Google Classroom, Zoom, and analogous digital platforms among academic staff.
f. Faculty members are encouraged to implement diverse instructional strategies, incorporating experiential and game-based learning activities, to enhance student engagement and to tether academic content to real-world contexts.
g. Polytechnic administrations are encouraged to organise professional development workshops specifically focused on contemporary online and blended pedagogy, equipping lecturers with requisite skills and confidence.
h. Polytechnic administrations are called to enhance the physical and technological infrastructure, creating an accessible learning environment that supports the effective integration of Computer-Assisted Instruction.

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