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Effect of Technology-Enhanced Competitive Learning Environment (TECLE) on Students' Academic Achievements and Interest in Junior Secondary Schools

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Abstract

The study examined the effect of technology-enhanced competitive learning environment (TECLE) on the academic achievement and level of interest of students in junior secondary schools in Delta State. The study utilised a quasi-experimental design. This design commonly utilised two cohorts: one cohort received the intervention (TECLE), while the second cohort served as a control without access to the intervention. The study focused on a specific group of individuals, namely 174,570 public junior secondary two (JSII) students studying Information Technology in Delta State. The study's sample consisted of 382 students in six intact classes. Data gathering involved the utilisation of two instruments: Information Technology Achievement Test (ITAT) and Information Technology Interest Scale (ITIS). The instruments underwent face validation by three specialists. The reliability of ITAT was determined through the utilisation of the Kuder-Richardson 21 method, resulting in a reliability coefficient of 0.73. The reliability of ITIS was determined by the use of Cronbach alpha, resulting in a reliability coefficient of 0.79. The ITAT and ITIS were administered as a pretest and posttest, respectively, both before and after the intervention. The pretest and posttest scores were collected and analysed using ANCOVA. The results indicated a significant difference in the mean achievement and interest scores of students who were exposed to a technology-enhanced competitive learning environment compared to those who were exposed to a traditional learning environment. The technology-enhanced learning environment was shown to be more favourable in terms of achievement. The study's findings indicated that the integration of technology-enhanced competitive learning environments has a beneficial effect on students' achievement and stimulates their interest for Information Technology. The study recommended, among other things, the implementation of technology-enhanced competitive learning environment for Information Technology instruction.

Keywords: Technology-Enhanced Learning Environment, Competitive Learning, Traditional Learning Environment, Academic Achievement, Interest.

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Introduction

A learning environment encompasses more than merely a classroom adorned with aesthetically pleasing elements and a motivating atmosphere. At the elementary school level, the learning environment is typically characterised by a lively and visually appealing atmosphere, featuring a desk arrangement that promotes freedom of movement and encourages physical expression. Usman andMadudili (2019) and Iroriteraye-Adjekpovu (2022) noted that at the secondary school level, the learning environment often prioritises the teacher's location at the front of the classroom, with rows of desks facing front and a limited amount of two-dimensional instructional resources for visual stimulation. Nevertheless, establishing an effective learning environment encompasses more than simply enhancing the visual appeal of the surroundings. Contemporary educators have the ability to shape the learning environment through their teaching methods, choice of instructional tools or materials, and the mood they establish in the classroom. They can enhance student learning by promoting student participation, offering constructive feedback that facilitates investigation, explanation, elaboration and appraisal among peers and diverse perspectives (Bossu et al., 2019; Iroriteraye-Adjekpovu, 2013). Research has demonstrated that creating conducive learning settings significantly enhances students' concentration and ability to retain material.

As students progress and develop their knowledge, it is important for the learning environments to similarly enhance and advance. Learning environments can undergo transformations as students develop, information advances and teachers continually enhance learning to accommodate student requirements. Teachers should have the freedom to continuously enhance their learning environment in order to assist students in achieving their individual and educational objectives. Educational goals can be achieved if individual students' goal is achieved. Failure to reach particular goal is created by competitive environment which can be applied between individual students or group of students in an appropriate setting.

In a competition learning environment, students perceive that they can achieve their goals if other students fail to do so (De Baker et al., 2020, Iroriteraye-Adjekpovu, 2012). They believe the reason for competition is for the sake of getting good grade, price, promotion or scholarship. They therefore position themselves to attain the reward attached to the task to be performed and increase attention on what it takes to outshine others (Burleigh & Meegan,2018).Therefore, it is crucial to provide an educational structure that promotes divergent reasoning, problem-solving abilities, and critical thinking in order to cultivate students' inherent curiosity and facilitate their learning process. One of such learning systems that can answer students' questions and meet the demand of keeping up with students' interest in learning is a technologically inclined learning system.Utilising technology in educational settings is abetterstudent-centered learning environment that can bring about a shift from poor academic achievement and interest to a heightened performance and curiosity to learn (Harris et al., 2020).Some researchers have attributed performance deficiencies to teaching approaches which is one of the reasons why researches on the effects of teaching methods are conducted. If learning is one way a student can acquire knowledge, experience,

skill and sound attitude, then the right way to learn,to make progress and to prosper in school and in society should be advocated (Hsu et al., 2017). This will make room for a civilized, refined, cultured and educated students and for a civilized and socialized society too. Modern Educators have tried to come up with innovative learning methods or strategies to be used in teaching a specific subject properly, so that students can maximize learning. The pursuit of an optimal, groundbreaking, imaginative, streamlined and productive approach to teaching and learning has posed a persistent challenge to contemporary educators. However, the advent of technology offers the potential to surmount numerous obstacles hindering the adoption of novel alternatives. This study aimed to project the utilisation of technology to improve a competitive learning environment and its subsequent outcomes.

Technological-enhanced competitive learning refers to the application of technological tools and resources to enhance and optimise the learning process in a competitive environment (Iroriteraye-Adjekpovu, 2012; Egbule, 2020). This approach integrates pedagogical techniques with technological innovations to establish a captivating and competitive learning encounter for individuals or collectives. It utilizes various technologies, such as online platforms, educational software, virtual simulations, and collaborative tools, to enhance the learning experiences of students. These technologies can facilitate interactive and dynamic learning environments, foster a competitive atmosphere where learners actively engage in challenges, competitions, or activities that stimulate critical thinking, problem-solving, and knowledge acquisition. This can take place through applying game elements, such as points, badges, leaderboards, and rewards, to the learning process to make it more enjoyable and motivating. Gamification can create a sense of competition and achievement, encouraging learners to actively participate in learning.It fosters a culture of ongoing learning, motivating personnel to acquire new skills and knowledge in order to maintain competitiveness. Technology enables easy access to current information and resources, enhancing the teaching and learning process. A technology-enhanced competitive learning environment aims to enhance the learning process by utilising the possibilities of modern technologies, making it more dynamic, engaging and effective. This approach is often used in educational settings, professional development programs, and corporate training environments to enhance learners' motivation and other outcomes (Usman & Madudili, 2019).

A technology-enhanced competitive learning environment utilises technology to organise interconnected learning themes into relevant settings, typically in the form of a challenge or goal, which effectively integrate its features and activities (Schmid et al., 2020). They offer engaging and complementing activities that allow individuals to explore their specific learning interests and needs, study various degrees of complexity, and enhance their understanding. They create circumstances that enhance cognitive processes and knowledge acquisition and utilise technology to facilitate adaptable approaches for supporting these processes. In the view of Iroriteraye-Adjekpovu(2013), digital learning offers numerous benefits, including time efficiency and convenience for research, which contribute to cost reduction, resource optimisation, sustainability promotion and increased reach and influence for both students and teachers. Technology is ubiquitous and intricately interconnected in

numerous facets of contemporary existence and civilization. The field of education is being increasingly impacted by the global digital revolution (Haleem et al., 2022). The rapid advancement of technology is expected to revolutionise the learning experience for students, leading to improved affordability and accessibility of education.

Numerous studies have indicated that technology-enhanced learning environments positively influence students' academic achievement. A study conducted by Schmid et al. (2020) shown that the utilisation of instructional technology resulted in enhanced academic achievement across many academic fields. The researchers ascribed this enhancement to the customised learning encounters facilitated by technology, enabling students to progress at their individual speed and obtain prompt feedback. Furthermore, technology has facilitated students' active participation and acquisition of knowledge in unprecedented ways inside a traditional classroom environment (Harris et al., 2020). Furthermore, a meta-analysis conducted by Tamim et al. (2011) comprising of 46 studies revealed that technology-enhanced learning environments have a substantial and favourable influence on students' academic achievement in the domains of science, mathematics and reading. The analysis emphasized the effectiveness of digital simulations, multimedia presentations, and online collaborative learning platforms in enhancing academic performance.

Studies have demonstrated that integrating technology into educational settings can significantly enhance students' interest and active involvement in the learning process. De Backer et al. (2020) and Lawrence and Egbule (2021)found that students had elevated levels of interest and motivation when engaging with educational platforms that utilise technology. The interactive and multimedia nature of these environments catered to different learning styles, stimulating curiosity and engagement. Furthermore, Hsu et al. (2017) did a study to investigate the impact of an educational setting that integrates sophisticated technology on students' level of interest towards the domain of science. The research found that students who experienced technology-enhanced learning showed a significant increase in their interest and willingness to pursue science-related careers. The authors attributed this to the engaging nature of digital tools, which provided real-life applications and hands-on experiences. Nevertheless, these studies were carried out outside Delta State. This created a gap in knowledge this study sought to fill. It is in light of this that this study investigated the effect of technology-enhanced competitive environment on students' achievements and interest in junior secondary schools in Delta State.

Purpose of the Study

The study examined the effect of technology-enhanced competitive learning environment on students' academic achievement and level of interest in junior secondary schools in Delta State. More precisely, the purpose of the study was to ascertain the:

i. difference between the mean achievement scores of students in traditional learning environment and technology-enhanced competitive learning environment;
ii. difference between mean interest scores of students in traditional learning environment and technology-enhanced competitive learning environment;

iii. difference between the mean achievement scores of male and female students exposed to technology-enhanced competitive learning environment;
iv. difference between the mean interest scores of male and female students exposed to technology-enhanced competitive learning environment.

Hypotheses

The study was guided by the following hypotheses:

1. There is no significant difference between mean achievement scores of students in traditional learning environment and technology-enhanced competitive learning environment.
2. There is no significant difference between students' mean interest scores in traditional learning environment and technology-enhanced competitive learning environment.
3. There is no significant difference between the mean achievement scores of male and female students exposed to technology-enhanced competitive learning environment.
4. There is no significant difference between the mean interest scores of male and female students exposed to technology-enhanced competitive learning environment.

Methodology

The study employed quasi-experimental design since intact classes were used for the study. Quasi-experimental design is a useful research design when random assignment of participants to different groups is not possible. In the context of studying the effects of technology-enhanced competitive learning environments (TECLE) on students' achievement and interest, a quasi-experimental design was employed. This design typically employed two groups: one group receives the intervention (TECLE), while the other group acted as a control with no access to the intervention. The target population was 174,570 JSII Information Technology students in mixed public secondary schools in Delta State. 382 JSII students in six intact classes made up the study's sample. The sample size was acquired using the stratified random sampling technique. The rationale behind using this sampling approach was to ensure that each school in Delta State had an equitable opportunity to be included in the study. For this reason, the schools were divided into strata based on senatorial districts. Thereafter, two schools each were randomly selected from each stratum which amounted to six schools. The study had a cohort of 246 students from intact classes in the six selected schools. The data collection process utilised two instruments: Information Technology Achievement Test (ITAT) and Information Technology Interest Scale (ITIS). The instruments were subjected to face validation by three specialists. The reliability of ITAT was evaluated using the Kuder-Richardson 21, resulting in a reliability coefficient of 0.73. The reliability of ITIS was evaluated using Cronbach's alpha, resulting in a reliability coefficient of 0.79. The ITAT and ITIS were administered as a pretest and posttest, respectively, both before and after the treatment.

The first stage of the treatment was the assignment of selected schools into experimental and control groups. Thereafter, the researcher trained three Information Technology teachers out of the nine teachers as research assistants on the practical

application of technology-enhanced competitive learning environment. The teachers in the control group were not trained since they are conversant with the traditional learning environment.Before the actual treatment, both groups were assessed using ITAT and ITIS to determine their pre-existing achievement levels and interest in the subject matter.The experimental group received the technology-enhanced competitive learning environment (TECLE), which involved the use of devices such as computers and tablets. The teachers assigned this group clearly defined the learning objectives and identified technology tools that support collaboration, competition and interactive learning. Some examples include gamification platforms, learning management systems, online quiz platforms among others. Explained to students the purpose of implementing a competitive learning environment and the benefits it brings. Emphasized that competition is meant to foster growth, encourage teamwork and enhance learning outcomes. The teachers divided their classes into teams, assigning them both individual and team-related goals. They encouraged diversity in team composition to leverage the strengths and abilities of all students. They ensured that each team has access to the necessary technology tools. The teachers offered training sessions or tutorials on how to use the selected technology tools effectively. They ensured that students understand how to navigate the platforms, collaborate and compete with their peers. They created a variety of competitive activities that align with the learning goals. These included online quizzes, group projects, discussion forums and virtual simulations. They set clear rules, deadlines and criteria for evaluation. They provided regular opportunities for students to reflect on their progress and provided feedback to their peers. This was be done through class discussions and online forums. They continuously monitored the progress of students and assessed the effectiveness of the implemented competitive learning environment. They solicited feedback from both students and colleagues to make necessary adjustments or improvements.

The control group continued with their regular traditional learning environment with no access to the intervention (TECLE). Posttest was administered at the end of the six weeks treatment. The scores obtained were collated and analyzed using ANCOVA.

Results

HO_1: There is no significant difference between the mean achievement scores of students in traditional learning environment and technology-enhanced competitive learning environment.

Table 1
ANCOVA Comparison of Achievement Scores of Students in Traditional and Technology-Enhanced Learning EnvironmentClassrooms

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11024.808[a]	2	5512.404	59.362	.000
Intercept	115967.583	1	115967.583	1248.835	.000
Pretest	1023.208	1	1023.208	11.019	.001
Environment	10064.885	1	10064.885	108.387	.000
Error	22565.127	243	92.861		
Total	929540.000	246			
Corrected Total	33589.935	245			

Table 1 presents a notable difference in the mean achievement scores between students in conventional learning setting and those in technology-enhanced competitive learning setting. The observed distinction is substantiated by a significant F-value of 108.287 and a P-value below 0.05. Therefore, the null hypothesis is rejected. Hence, there exists a significant difference in the mean achievement scores between students in conventional learning setting and those in technologically enhanced competitive learning environment, with the latter demonstrating greater advantages.

HO_2: There is no significant difference between the mean interest scores of students in traditional learning environment and technology-enhanced competitive learning environment.

Table 2
ANCOVA Comparison of Interest Scores of Students in Traditional and Technology-Enhanced Learning Environment Classrooms

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1139.032[a]	2	569.516	6.015	.003
Intercept	44787.585	1	44787.585	473.055	.000
Pretest	229.305	1	229.305	2.422	.121
Environment	912.116	1	912.116	9.634	.002
Error	23006.598	243	94.677		
Total	1010499.000	246			
Corrected Total	24145.630	245			

Table 2 exhibits a notable difference in the mean interest scores among students in conventional learning setting and those in technologically-enhanced competitive learning setting. The observed difference is statistically significant, as evidenced by the F(1,243) statistic of 9.634 and a p-value of 0.002, which falls below the critical threshold of 0.05. Therefore, the null hypothesis is refuted. Therefore, there is a significant difference in the mean interest scores between students in traditional learning environment and those in technology-enhanced competitive learning environment, with the latter being more advantageous.

HO_3: There is no significant difference between the mean achievement scores of male and female students exposed to technology-enhanced competitive learning environment.

Table 3

ANCOVA Comparison of Achievement Scores by Students' Sex in Technology-Enhanced Learning Environment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	35.407[a]	2	17.704	.204	.816
Intercept	72694.963	1	72694.963	836.893	.000
Pretest	21.532	1	21.532	.248	.620
Sex	2.140	1	2.140	.025	.876
Error	10162.959	117	86.863		
Total	547004.000	120			
Corrected Total	10198.367	119			

Table 3 indicates that there is no statistically significant difference in the mean interest scores of students depending on their gender in technology-enhanced competitive learning environment. This is supported by the F(1,117) value of 0.025 and the P-value of 0.876, which exceeds the significance level of 0.05. Thus, the null hypothesis remains unchallenged. Therefore, there is no significant difference in the mean achievement scores between male and female students who experienced technology-enhanced competitive learning environment.

HO_4: There is no significant difference between the mean interest scores of male and female students exposed to technology-enhanced competitive learning environment.

Table 4

ANCOVA Comparison of Interest Scores by Students' Sex in Technology-Enhanced Learning Environment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	39.792[a]	2	19.896	.240	.787
Intercept	26739.257	1	26739.257	322.093	.000
Pretest	3.678	1	3.678	.044	.834
Sex	30.873	1	30.873	.372	.543
Error	9713.000	117	83.017		
Total	543753.000	120			
Corrected Total	9752.792	119			

Table 4 indicates no significant difference in the mean interest scores of students in a technology-enhanced competitive learning environment based on their gender. This is supported by the F(1,117) value of 0.372 and the P-value of 0.543, which exceeds the

significance level of 0.05. Thus, the null hypothesis remains unchallenged. Consequently, there is no significant difference in the mean interest scores between male and female students who experienced technology-enhanced competitive learning environment.

Discussion

The study revealed a significant difference between the mean achievement scores of students in traditional learning environment and technology-enhanced learning environments, in favour of technology-enhanced competitive learning environment.Probable reason why students exposed to a technology-enhanced competitive learning environment scored higher achievement scores than their counterparts exposed to a traditional learning environment may that technology provides interactive and dynamic learning experiences that engage students in a way that traditional environment may struggle to. Students may be more motivated to participate and actively engage in their learning, leading to increased achievement scores. This finding supports that of Schmid et al. (2020) and Iroriteraye-Adjekpovu(2022) who found that found that the use of educational technology resulted in higher student performance across various subjects. This finding further lends credence to that of Tamim et al. (2021) who found that technology-enhanced learning environments significantly improve students' achievement outcomes in science, mathematics, and reading.

The study also found a significant difference in the mean achievement scores of students in traditional learning environment versus technology-enhanced learning environment, with technology-enhanced competitive learning situations being favoured. One potential reason for this discovery is that technology frequently enables students to utilise their learning in real-life scenarios, promoting a more profound comprehension of topics and enhancing their capacity to link theoretical information to practical problems. Relevance has the potential to enhance students' interest in the subject matter. This conclusion corroborates the findings of De Backer et al. (2020) and Hsu et al. (2017). De Backer et al. (2020) found that students had elevated levels of interest and motivation when engaging with educational platforms that utilise technology. In a similar vein, Hsu et al. (2017) discovered that students who underwent technology-enhanced learning exhibited a noteworthy augmentation in their enthusiasm and inclination to pursue jobs in the field of science.

The study reaffirmed that there was no statistically significant difference in the mean achievement and interest scores between male and female students who were exposed to a technology-enhanced competitive learning environment. This discovery is predicated on the assumption that both male and female students had equal opportunity to obtain and possessed equivalent levels of knowledge regarding technology. If all students were provided with the same resources and opportunities to engage with technology, it can level the playing field and allow for similar outcomes. In addition, the learning environment itself, which is technology-enhanced and competitive, could be conducive to the learning and engagement of all students, regardless of gender. Utilising technology can offer interactive and captivating educational experiences that accommodate various learning styles and interests. This discovery supports the findings of Bossu et al. (2019) and Chai et al. (2014). In their study, Bossu et al. (2019) found that the use of technology in cooperation had a positive impact on

students' critical thinking skills, problem-solving ability and communication fluency, regardless of gender. Chai et al. (2014) on the other hand reported that revealed that online collaboration, facilitated through technology, positively influenced students of both gender academic performance and promoted effective teamwork.

Conclusion

In conclusion, the study on the effects of technology-enhanced competitive learning environment on students' achievement and interest has shown promising results. The findings indicate that incorporating technology in a competitive learning environment positively impacts students' academic achievement and fosters their interest in Information Technology irrespective of gender. Firstly, technology integration provides students with interactive and engaging learning experiences. The use of various digital tools and resources keeps students motivated and actively involved in the learning process. As a result, they are more likely to retain information and exhibit higher levels of achievement compared to traditional teaching methods.

Additionally, the competitive aspect of the learning environment enhances students' interest and participation. The element of competition not only encourages students to strive for higher academic performance but also instills a sense of urgency and excitement. Through competition, students are more likely to push themselves and explore new avenues of learning, resulting in improved achievement.

Recommendation

Based on the study's finding, it was recommended that:

1. Teachers should implement a technology-driven competitive learning environment for teaching at the junior secondary school level.
2. Teachers should be provided with sufficient training and assistance to proficiently incorporate technology into their instructional methodologies.
3. Schools must guarantee that pupils have access to dependable technology devices and internet connectivity.

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