Journal of Engineering, Science and Technology
ISSN: 2714-2396, Volume 8 Issue 1

Appraisal of Education Technology as a Teaching and Learning Aid in University of Ibadan, Nigeria

Bolarinwa, Mojisola Aderenike and Adeosun, Paul Omoniyi

Department of Industrial and Production Engineering, University of Ibadan, Nigeria

*Corresponding Author: E-mail: mojimolati@gmail.com

Received Date: 29 March 2025 Accepted Date: 30 April 2025 Published Date: 4 June 2025

Abstract. The conventional approach to teaching has been inhibiting teaching and learning processes in many tertiary institutions in Nigeria, especially where class size seems large (ranging between 100–300, or even more). On the other hand, the adoption of Information and Communication Technology (ICT) in the educational sector of many developed countries has a positive impact on teaching and learning progressions despite its social influences. This study investigated the impact of ICT in a public tertiary institution in South-Western Nigeria as a tool for teaching final year students in an engineering management course. 183 final-year students in the Faculty of Technology from 6 departments took part in the data collection process using a questionnaire. The students were exposed to ICT-facilitated learning using the university Learning Management System (LMS) for a semester before administering the questionnaire. The data were analysed using the quantitative technique. Results suggest that using ICT improved the quality of teaching when used in addition to traditional classroom lectures. The findings provided strong evidence of positive impacts of ICT on students' attitudes towards learning in engineering. ICT platforms in addition to classroom learning aid effective teaching and learning processes in the university. This teaching approach can be applied to several other courses being taught across tertiary institutions in Nigeria.

Keywords: Educational Technology, learning and teaching method, tertiary institutions, system, final year students.

1. Introduction

The sudden technological drive comes with new learning opportunities in enhancing students' learning abilities across boundaries. There are no comprehensive organizational strategies for technology-enhanced learning, particularly in Africa [1]. Recently, there has been a transformation from the chalk and board approach to classroom-based teaching and learning using recent information and communication technology-based (ICT) tools. Nowadays, technology has continued to improve daily lives: advancing the way we interact, study and reason. Likewise, the advent of internet connectivity, mobile learning platforms, digital game technologies and social networks continues to affect people's manner of operating, collaborating, interacting, and forming social constructs, thereby remarkably impacting ways of life [2]. In the last few decades, technology has been integrated into classroom activities, augmenting teacher–to–student interactions [3]. The turn of academic events during the COVID-19 era showed that learning at different levels does not necessarily require a physical learning setting.

Engineering students need to have basic knowledge of engineering management as an important component of their engineering training requirement to equip them properly for future managerial positions and challenges. The various engineering specializations require management practices for better decision-making, and young engineers are introduced to this skill in addition to their knowledge of engineering functions [4]. Current workplace expectations demand increasing integration of engineering management skills, which is not restricted to undergraduate and graduate education, but necessitates continuous education through seminars, workshops and training. It thus becomes imperative to start introducing changes to teaching approaches by implementing Information Technology, IT [5]. Research findings have

shown that education technology aids teaching engineering, collaborative engineering and other disciplines, creating a linked-class problem-based learning method [6].

The learning cycle is composed of three generations of people: Generations X, Y, and Z [7]. Generation X are those born between 1964 and 1976, characterized as having less digital experience. Generation Y (born between 1977 and 1995) are more adept at using digital knowledge and collaboration. Generation Z (1995 to present) is the most vast with the knowledge of digital technology and applications to their daily lives. Older generation (experts) tend to struggle adapting to technology while interacting with the younger generation (mentees or students), negatively impacting the learning process. The focus of this study is to investigate the effectiveness of adopting education technology in a learning process to enhance knowledge sharing between a lecturer (experienced manager) and the students (trainees). The case study is an engineering management class drawn from different engineering disciplines, examining how educational technology can aid the acquisition and application of theoretical concepts to practical challenges trainees are likely to encounter when occupying management positions in the future.

1.1 The Concept of Education Technology

Education technology entails a systematic approach to teaching and learning by using modern technologies to enhance knowledge sharing, aiding educator-learner relationships both in and out of the classroom [1]; [8]. Integrating technology in education exists across three domains: teaching instrument, instructor, and learning device [8]. Adopting technology in education creates two categories of instructors: (1) those who are well-versed in the proper knowledge and understanding of using ICT facilities; and (2) those who need assistance (additional knowledge/training) to use these facilities. This categorization distinctly separates the younger and older generations of educators, the latter of whom were less exposed to this system of learning or these facilities than the former. Studies show a connection between tutor self-efficacy and online learning [9]. Established studies include teachers' views on using the internet in education to aid literacy learning [10], and teachers' understanding of using web-based technology and ICT facilities in education [11]. Existing technologies for educational purposes, in addition to ICT facilities, include Computer Technology (CT), Computer-Assisted Instruction (CAI), and Computer-Based Instruction (CBI). Several authors have reported that educational technology can positively influence students' behaviour and attitudes towards learning, including math and science subjects, reading and spelling abilities, writing skills, retention ability, and students' performance [12]; [13]; [14]; [15]; [16]; [17]. For instance, an appraisal of the effectiveness of educational technology shows that the use of online learning experiences, Computer Technology (CT), and Computer- Assisted Instruction (CAI) have positive impacts on students' performances compared to traditional learning approaches [18]; [19]; [20]; [21] in achieving academic success [20]; [22]; [24]. Similarly, students with prior knowledge of computer applications for learning obtained better scores on examinations [21]; [22]. Additionally, students who used computer technology for learning performed better than conventional students [25]. On the other hand, students' performances depreciated when traditional instruction was completely replaced with CAI [26]. Therefore, it is more beneficial to use computers as a supplementary mode of instruction during teaching and learning processes [26]; [27].

1.2 Use of Education Technology in Learning Processes

An evaluation of technology applications, including writing-based reading programs, reading management programs, and integrated learning systems as a reading instructor shows little effectiveness in: beginning readers [12], kindergarten [28] and middle school readers [29]. However, findings suggest that students show positive attitudes towards learning using computers; notably, using computer-simulated experiments and computer-based instruction as learning platforms [30]; [31]. In advanced countries, using computer systems as instruction devices to teach algebra processes in pre-college and post-secondary education shows that students performed better when technologies are adopted to teach [32]. Findings support that using CAI systems as an instructional tool improved students' learning ability studying mathematics, having a positive effect on students' performance in the subject [17]; [27]; [33]. Besides, a technology-intensive learning environment was reported to be more effective in teaching and learning mathematics [16]. However, findings on using CAI by students with learning disabilities to study mathematics at the entry level and middle school were inconclusive [34]. In contrast to the impact of CAI on teaching and learning

mathematics, the use of computer software to teach spelling in schools has no significant effect on learning outcomes [13]. Inconsequential evidence supports the widespread usage of ICT in learning the English language [35].

Adopting educational technology in Nigeria in addition to the traditional classroom teaching and learning system, particularly in public schools has been slow, partly due to reluctance of educational stakeholders and the lack of willpower of government to adopt this system. Moreover, other challenges include inadequate funding, a large percentage of unskilled technology-oriented personnel, and high capital intensity of technological facilities. These factors motivate this research to provide valuable insights and enlighten educationists and stakeholders on the use of educational technology devices in Nigeria. Hence, this research was centered on analyzing the perception of students on the use of ICT-facilitated learning and its impacts on their performances at the University of Ibadan, Nigeria. The study procedure involves introducing students to the Learning Management System (LMS) platform by registering and granting access to the learning modules and uploaded course contents during one semester. Through the ICT-facilitated features, such as the classroom on the LMS platform, the students were engaged with the uploaded course content. (3) Data captured from students through a questionnaire were collated, analysed, and interpreted to measure the effect of the newly introduced education technology initiative on their performance.

2. Methodology

2.1. Preliminary

The final year class comprise a large population of students in the faculty lecture theatre studying an engineering management course. The observed class was unconducive for teaching and learning, defeating the notion of personalised learning. Consequently, an online educational platform was introduced for students to learn, conduct group discussions, and share materials. Features of this platform enable students to submit their assignments as well as ask questions and be graded.

2.2. Participants

The study population 183 students in their final year from six (6) different departments in the Faculty of Technology, University of Ibadan, Nigeria. Final-year students of the Faculty of Technology are required to take an engineering management course in the first semester of their final engineering year. This course brings together all the final-year students of the faculty in a classroom. The students were given online access to the Learning Management System (LMS) platform (Moodle) designed for the class and loaded with the courseware in engineering management for thirteen (13) weeks (equivalent to a semester) to facilitate their learning processes of the course. On this platform, students read coursework materials, turn in assignments, ask questions, and take online assessments.

2.3. Data Collection and Collation

Data was collected using a questionnaire designed and administered to the students after thirteen (13) weeks of lectures at the end of the semester. The questionnaire was contained closed-ended questions with fixed responses (on the five Likert Scale) for the students to choose. Filled questionnaires were collected, sorted and analyzed quantitatively. Particularly, items of the questionnaire were selected to provide insights into the following research questions:

1. What measure is the students' previous experience using ICT systems in learning?
2. What impact does ICT have on students' cognitive and learning capacity?
3. What level of improvement does ICT have on the students' quality of learning experience?
4. What is the effect of ICT on improving instruction methods?
5. What level of exposure do the students have using other ICT-facilitated learning experiences?
6. What impact does ICT usage have on students' attitudes towards using ICT-facilitated learning systems?

2.4. Data Analysis

Collected data was analysed based on the participating departments and the number of students: Civil, Electrical/Electronics, Food Technology, Industrial and Production engineering, Mechanical and Petroleum with 29, 28, 21, 38, 29, 38 students respectively. The collected data were analysed statistically using

quantitative techniques, including frequency and percentages, to determine the students' responses in each category: none, little, good, very good, and excellent. Thematic areas in the study include previous knowledge of ICT, impact of ICT on their learning abilities, ICT and quality of learning experience, impact of ICT on quality of teaching method, use of other ICT facilities, and attitude of students to ICT usage for continuous learning. Summaries of the responses are presented in Tables 1 – 6 containing the percentage of their responses.

Table 1: Students' Previous Knowledge of ICT Learning

		Civil (29)	Elect/Elect (28)	Food tech (21)	Industrial (38)	Petroleum (38)	Mechanical (29)
Valid	None	7%	29%	19%	16%	16%	30%
	Little	21%	21%	24%	50%	50%	21%
	Good	24%	18%	24%	26%	26%	14%
	V.good	34%	21%	23%	8%	8%	21%
	excellent	14%	11%	10%			14%
	Total	100%	100%	100%	100%	100%	100%

From Table 1, a greater population of students from Electrical/Electronic and Mechanical engineering have no previous knowledge of the use of ICT, representing 29 and 31 per cent of the class, while 50 per cent of the students from Petroleum and Industrial and Production Engineering have little experience with using ICT. It is obvious that, on average, a majority of the students have no or little knowledge of the use of ICT before their exposure to the use of ETI. A possible advantage of this is that it is an opportunity for those students without any knowledge of the use of ICT facilities to learn to use them.

Table 2: Impact of ICT on Students' Learning Ability

		Civil (29)	Elect/Elect (28)	Food tech (21)	Industrial (38)	Petroleum (38)	Mechanical (29)
Valid	None	10%	11%	5%	13%	13%	28%
	Little	10%	25%	29%	16%	16%	7%
	Good	31%	18%	33%	47%	47%	16%
	V.good	21%	32%	33%	21%	21%	28%
	excellent	28%	14%		3%	3%	21%
	Total	100%	100%	100%	100%	100%	100%

Table 2 is a summary of the students' responses to the impact of ICT on cognitive and learning ability. 32 and 33 per cent of Electrical/Electronic engineering and Food Technology respondents responded that ICT has a very good impact on their cognitive and learning abilities. Other departments responded that ICT has a good impact on their cognitive and learning ability compared to the traditional method of classroom teaching, while fewer students observed no impact on their learning ability.

Table 3: Impact of ICT on Students' Quality of Learning Process

		Civil (29)	Elect/Elect (28)	Food tech (21)	Industrial (38)	Petroleum (38)	Mechanical (29)
Valid	none	6%	7%	5%	8%	8%	24%
	little	14%	18%	14%	21%	21%	10%
	good	28%	39%	43%	58%	58%	24%
	V.good	28%	29%	33%	13%	13%	18%
	excellent	24%	7%	5%			24%
	Total	100%	100%	100%	100%	100%	100%

Table 3 presents the students' responses to using ICT to improve the quality of learning procedures. From these responses, there tends to be a good impact of the use of ICT as a teaching tool across all the departments. There is an improvement in the quality of learning procedures as students have the opportunity of gaining access to lots of information as well and learning can be done at any time of the day.

Table 4: Accessibility to ICT-facilitated Learning Opportunities

		Civil (29)	Elect/Elect (28)	Food tech (21)	Industrial (38)	Petroleum (38)	Mechanical (29)
Valid	none	8%	14%	10%	18%	18%	31%
	little	17%	39%	33%	42%	42%	7%
	good	17%	43%	33%	22%	22%	3%
	V.good	34%	4%	24%	18%	18%	31%
	excellent	24%					28%
	Total	100%	100%	100%	100%	100%	100%

Table 4 presents the students' perception of how ICT-facilitated learning impacts their accessibility to other learning opportunities. 42, 33, and 42 per cent of the students in the departments of petroleum, food technology and industrial and production engineering have little accessibility to other ICT learning opportunities, respectively, while electrical/electronics, mechanical and civil engineering departments have more students who have access to other ICT learning facilities.

Table 5: Impact of ICT on the Quality of Teaching Method

		Civil (29)	Elect/Elect (28)	Food tech (21)	Industrial (38)	Petroleum (38)	Mechanical (29)
Valid	none	8%	14%	10%	18%	18%	24%
	little	3%	11%	13%	5%	5%	3%
	good	24%	29%	24%	29%	29%	17%
	V.good	48%	46%	48%	48%	48%	41%
	excellent	17%	0%	5%		0%	15%
	Total	100%	100%	100%	100%	100%	100%

Generally, the responses of the students indicate that the use of ICT as a supplement of the traditional classroom lectures improves the quality of teaching method. Responses from a majority (over 40 per cent in each department) of the students in all the departments believe that ICT-facilitated platforms improve the teaching method (Table 5).

Table 6: Impact of ICT on Students' Attitude Towards the Use of ICT

		Civil (29)	Elect/Elect (28)	Food tech (21)	Industrial (38)	Petroleum (38)	Mechanical (29)
Valid	None	17%	29%	24%	21%	21%	41%
	Little	14%	4%	10%	11%	11%	7%
	Good	24%	4%	10%	3%	3%	10%
	V.good	28%	61%	57%	66%	66%	41%
	Excellent	17%	4%				
	Total	100%	100%	100%	100%	100%	100%

From Table 6, a summary of the impact of ICT tools on the attitudes of students towards using ICT for learning. There is a very good impact of ICT on the attitudes of a majority of the students (as shown by the percentages in each department). Few students believe that ICT has no impact on their attitude.

3. Results and Discussion

Following the described procedures in Sections 2.2 - 2.4 above, the results obtained are as presented in Figs. 1 – 30. Results from each of the response categories were analyzed and compared to analyse trends among the students' perceptions of the impact of ICT.

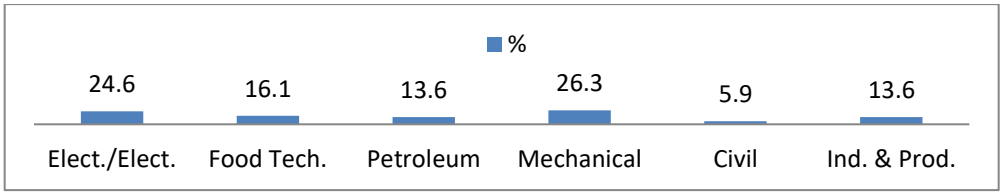

Fig. 1: Non-Previous Knowledge of ICT Learning

Fig. 1 shows the percentage of students with 'non-previous knowledge in ICT-based learning'. Civil engineering department shows the least percentage (5.9%) of non–previous knowledge in the use of ICT, while Mechanical engineering has the highest percentage (26.3%).

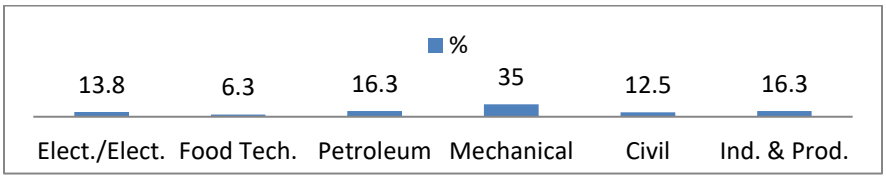

Fig. 2: Non-Impact of ICT on Students' Learning Ability

Fig. 2 presents the percentage of students who perceived ICT as having 'non-impact on students' learning ability'. Food Technology department has the least (6.25%) response to non–impact on students' learning ability, while Mechanical Engineering department reported the highest (35%).

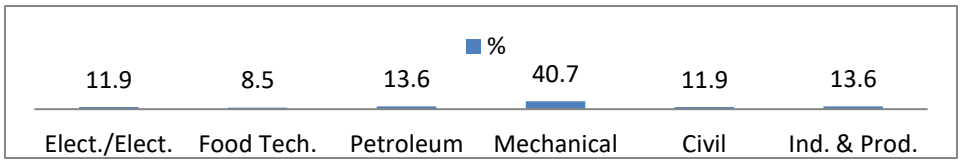

Fig. 3: Non - Impact of ICT on Quality of the Learning Experience

In Fig 3, Food Technology department reported the lowest percentage (8.5%) on the 'non – impact of ICT on students' quality of the learning experience', while Mechanical Engineering department has the highest percentage (40.7%).

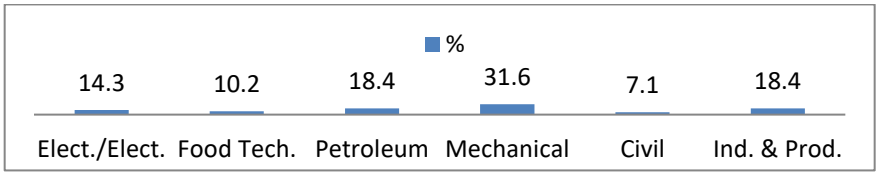

Fig. 4: Non - Accessibility to other ICT-Facilitated Learning Opportunities

From Fig. 4, only 7.1% of students from Civil engineering department reported having 'non – accessibility to other ICT-based means of learning', while Mechanical Engineering department (31.6%) has the largest quota of students within this category.

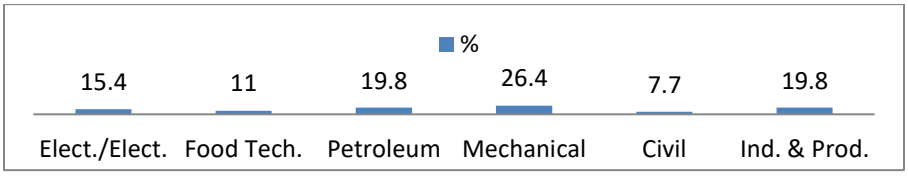

Fig. 5: Non–Impact of ICT on the Quality of Teaching Method

While Mechanical engineering department (26.4%) responded to the 'non–impact of ICT on the quality of teaching method' (Fig. 5), Civil engineering department (7.7%) responded the least in this category.

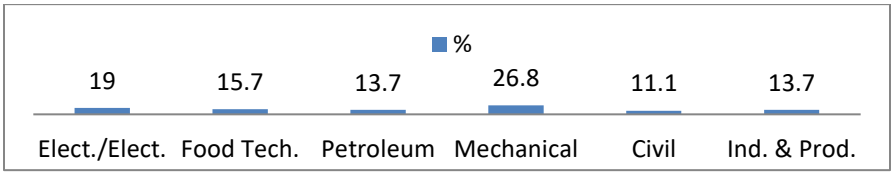

Fig. 6: Non – Impact of ICT on Students' Attitude

Mechanical engineering department (26.8%) responded to 'non-impact of ICT on students' attitude towards its usage in the future for learning' having the largest percentage in this category, Civil engineering department as the lowest (11.1%) response.

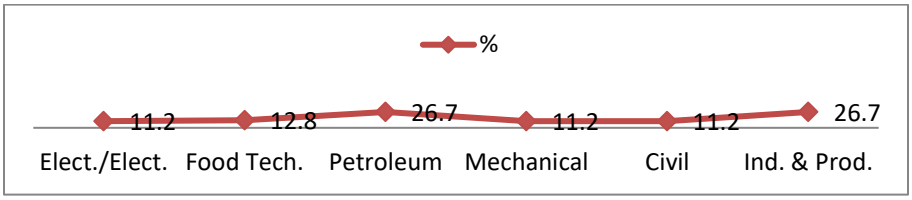

Fig. 7: Little Previous Knowledge of ICT Learning

11.2% each from Mechanical, Electrical/Electronics and Civil engineering departments responded to have 'little previous knowledge on ICT learning' (Fig. 7), constituting the least percentage of the students, while 26.7% each from Industrial and Production and Petroleum engineering departments make up the highest quota in this category.

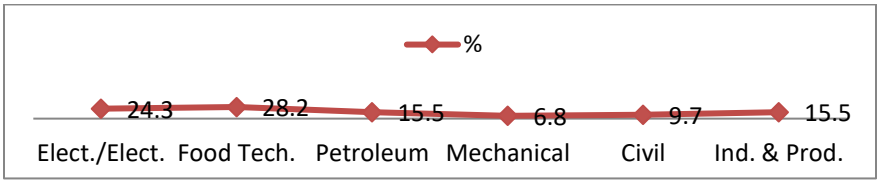

Fig. 8: Little Impact of ICT on Students' Learning Ability

Mechanical engineering department (6.8%) reported 'little impact of ICT on students' learning ability' (Fig. 8) with the least percentage, while Food Technology department (28.2%) reported the highest percentage.

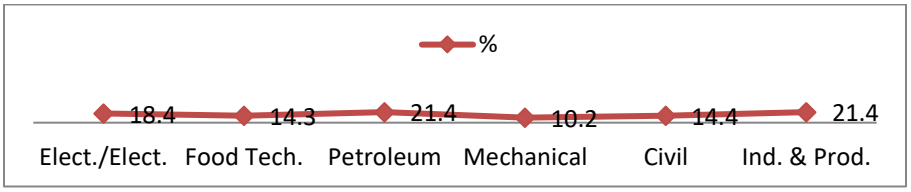

Fig. 9: Little Impact of ICT on Quality of the Learning Experience

From Fig. 9, students from Mechanical Engineering department (10.2%) responded to 'little impact of ICT on their quality of learning experience' having the smallest quota, while Industrial and Production Engineering departments and Petroleum Engineering (21.4% each) have the highest quota in this category.

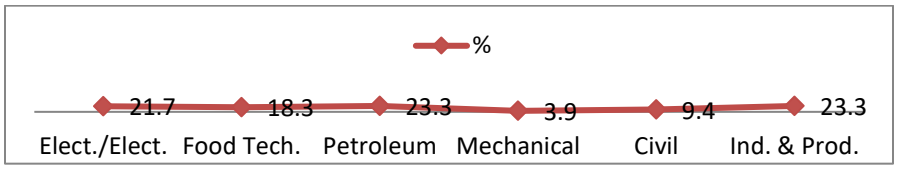

Fig. 10: Little Accessibility to other ICT-Facilitated Learning Opportunities

From Fig. 10, the students' response to 'little accessibility to other ICT-facilitated learning opportunities' shows that the least response was reported by students from Mechanical engineering department (3.9%), while the highest response came from both Industrial and Production and Petroleum Engineering departments each with 23.3%.

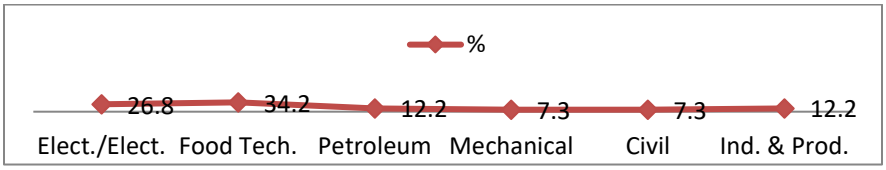

Fig. 11: Little Impact of ICT on the Quality of Teaching Method

Students from Civil and Mechanical Engineering departments (7.3% each) have the lowest response to the 'little impact of ICT on the quality of teaching method' (Fig. 11), while students in Food Technology department recorded the highest quota (34.2%).

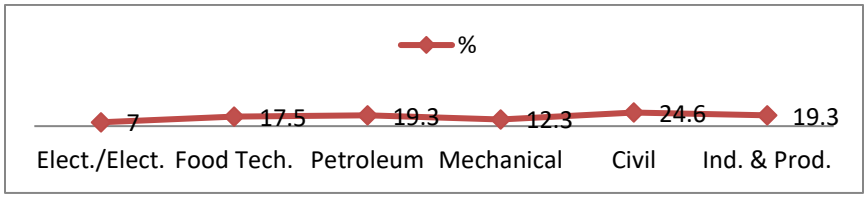

Fig. 12: Little Impact of ICT on Students' Attitude

Students from Electrical/Electronic engineering department (7.0%) have the lowest response to 'little impact of ICT on students' attitude towards using ICT for future learning' (Fig. 12), while Civil Engineering department students recorded the highest quota (24.6%).

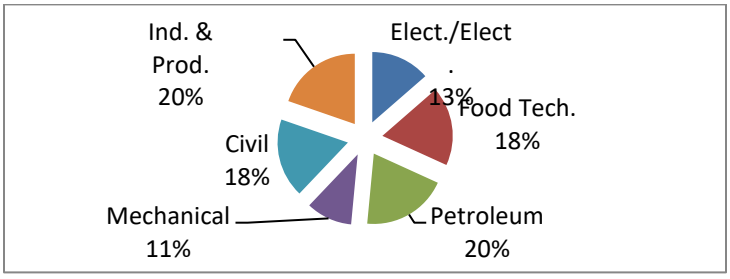

Fig. 13: Good Previous Knowledge of ICT Learning

From Fig. 13, the students' response to 'good previous knowledge on ICT learning' shows that the least response was reported by Mechanical engineering department (10.6), while the highest response came from both Industrial and Production and Petroleum engineering departments each with 19.7%.

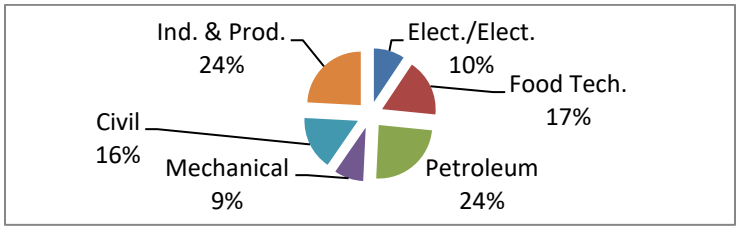

Fig. 14: Good Impact of ICT on Students' Learning Ability

From Fig. 14, Mechanical engineering department students (8.8%) responded to 'good impact of ICT on student's learning ability' having the least quota, while Industrial and Production and Petroleum engineering (24.4% each) have the highest quota in this category.

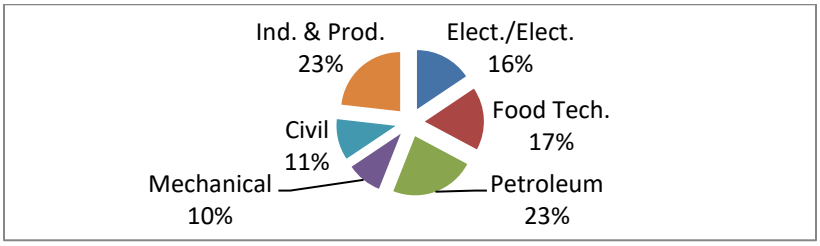

Fig. 15: Good Impact of ICT on Quality of the Learning Experience

From Fig. 15, students from Mechanical engineering department had the least quota (9.6%) for 'good impact of ICT on students' quality of learning experience', while the highest quota each with 23.2% response came from Industrial and Production and Petroleum engineering.

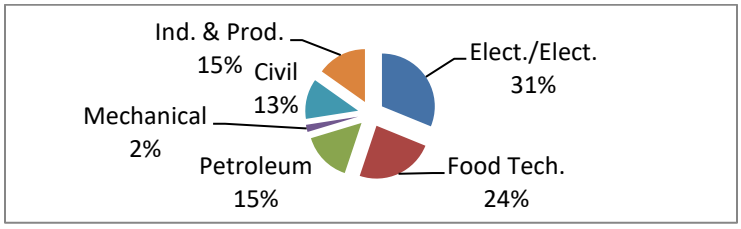

Fig. 16: Good Accessibility to other ICT-Facilitated Learning Opportunities

From Fig. 16, students from Mechanical Engineering department responded the least (2.2%) for 'good accessibility to other ICT-facilitated learning opportunities', while the highest quota of response came from students in Electrical/Electronic Engineering department (31.2%).

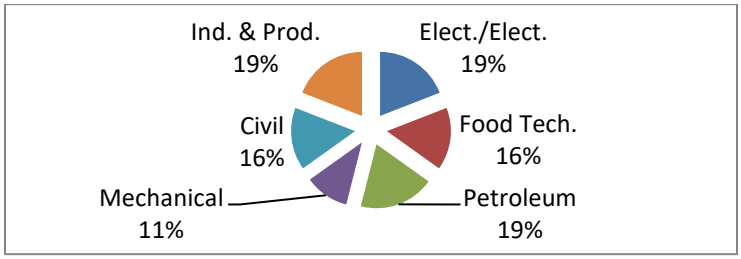

Fig. 17: Good Impact of ICT on the Quality of Teaching Method

From Fig. 17, students from Mechanical Engineering department had the least quota (11.2%) for 'good impact of ICT on students' quality of learning experience', while the highest quota of 19.1% response came from students in Industrial and Production, Electrical/Electronics and Petroleum engineering departments.

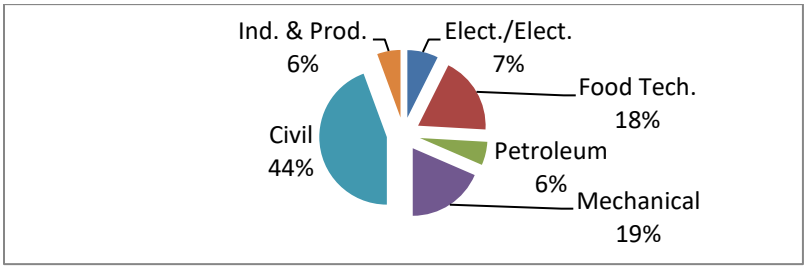

Fig. 18: Good Impact of ICT on Students' Attitude

Students from Petroleum and Industrial and Production engineering departments (5.6%) have the least response to the 'good impact of ICT on students' attitude towards its usage for learning in the future', while students from Civil engineering department recorded the highest response of 44.4%.

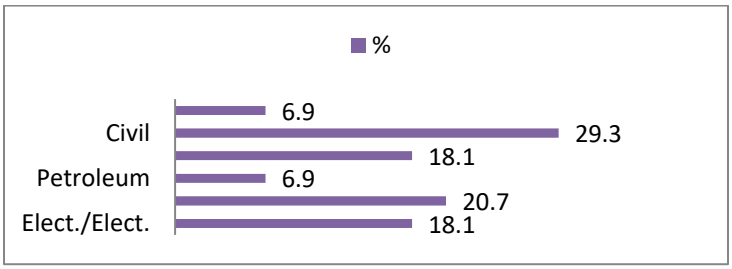

Fig. 19: Very Good Previous Knowledge of ICT Learning

In Fig. 19, students from both Petroleum and Industrial and Production engineering departments (6.9% each) responded to have 'very good previous knowledge on ICT learning' with the least quota in this category, while students from Civil engineering department responded with the highest quota (29.3%).

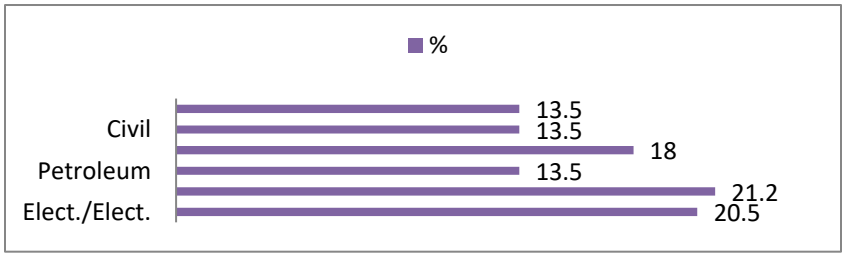

Fig. 20: Very Good Impact of ICT on Students' Learning Ability

Fig. 20 shows that students from Petroleum engineering, Civil engineering, and Industrial and Production engineering departments (13.5%) each reported as the least in this category of 'very good impact of ICT on students' learning ability', while the highest quota of 21.2% response came from students in the Food technology department.

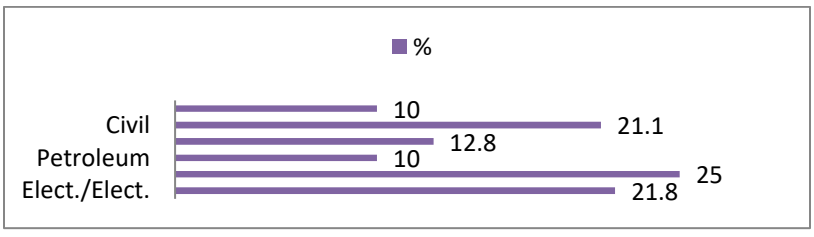

Fig. 21: Very Good Impact of ICT on Quality of the Learning Experience

From Fig. 21, students from Petroleum and Industrial and Production engineering departments (9.8% each) responded to have the least quota in terms of 'very good impact of ICT on students' quality of learning experience', while the highest quota (25%) was obtained from students in Food Technology department.

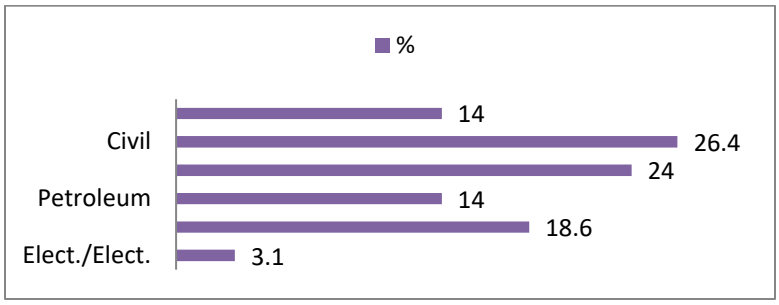

Fig. 22: Very Good Accessibility to other ICT-Facilitated Learning Opportunities

Students from Electrical/Electronic engineering department (3.1%) had the least quota responding to 'very good accessibility to other ICT-facilitated learning opportunities' (Fig. 22), while students from Civil engineering department recorded the highest response of 26.4%.

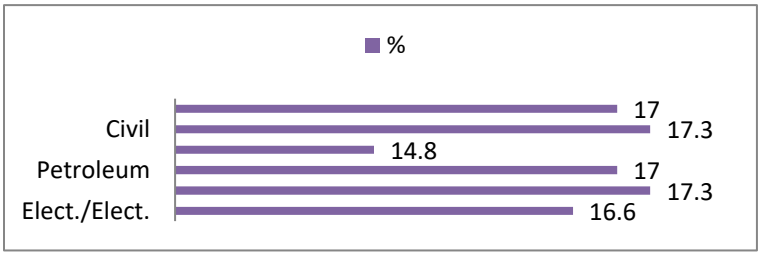

Fig. 23: Very Good Impact of ICT on the Quality of Teaching Method

Fig. 23 shows that students from Mechanical engineering department (14.8%) reported the least with a 'very good impact of ICT on the quality of the teaching method', while the highest quota of 17.3% each was obtained from students' responses in Civil engineering and Food technology departments. This also shows close results from the other departments.

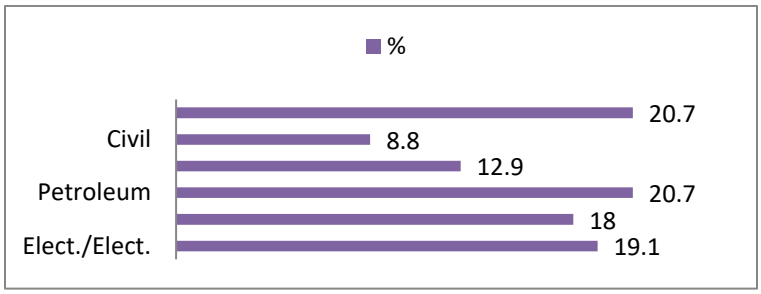

Fig. 24: Very Good Impact of ICT on Students' Attitude

Students from Civil engineering department (8.8%) had the least quota responding to the 'very good impact of ICT on students' attitude towards its usage for learning in the future' (Fig. 24), while students from both Petroleum and Industrial and Production engineering departments recorded the highest response of 20.7% each.

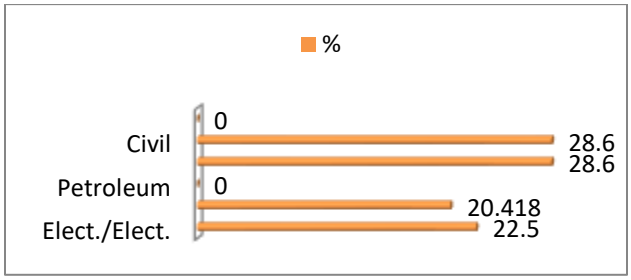

Fig. 25: Excellent Previous Knowledge of ICT Learning

In Fig. 25, no student from the departments of Petroleum engineering and Industrial and Production engineering indicated having 'excellent previous knowledge on ICT learning', while students from both Civil and Mechanical engineering departments (28.6% each) had the highest quota in this category.

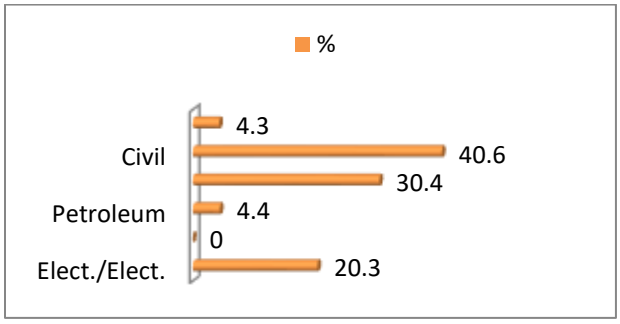

Fig. 26: Excellent Impact of ICT on Students' Learning Ability

Similarly, from Fig. 26, no students from the Food Technology department reported an 'excellent impact of ICT on their learning ability'. Students from the Civil Engineering department (40.6%) indicated the highest percentage of excellent impact of ICT on their learning ability.

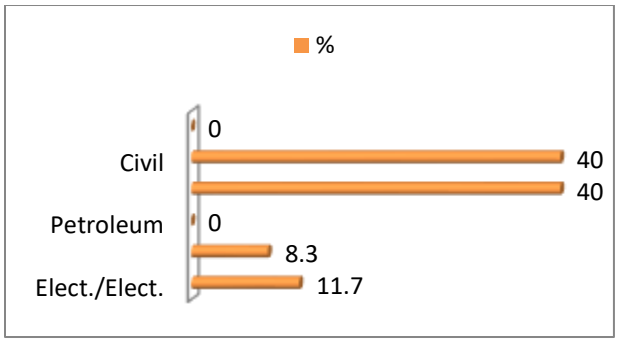

Fig. 27: Excellent Impact of ICT on Quality of the Learning Experience

In Fig. 27, students from both Civil and Mechanical engineering departments (40.0% each) indicated the highest quota of an 'excellent impact of ICT on students' quality of learning experience'. No responses were obtained from Petroleum and Industrial and Production engineering departments.

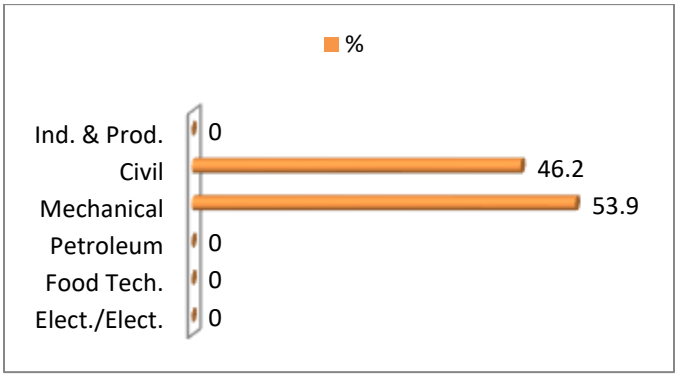

Fig. 28: Excellent Accessibility to other ICT-Facilitated Learning Opportunities

In Fig. 28, only students from Mechanical and Civil engineering departments (53.9% and 46.2% respectively) responded that they had 'excellent accessibility to other ICT-facilitated learning opportunities in this category'. Other departments (Food technology, Electrical/Electronic engineering, Industrial and Production engineering, and Petroleum engineering) showed no indications in this category.

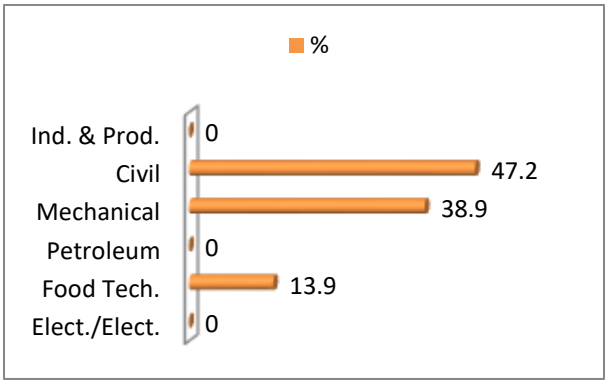

Fig. 29: Excellent Impact of ICT on the Quality of Teaching Method

Fig. 29 shows that students from Civil engineering department (47.2%) obtained the highest reported 'excellent impact of ICT on the quality of teaching method', while students from Industrial and Production engineering, Electrical/Electronic engineering, and Petroleum engineering departments indicated no excellent impact in this category.

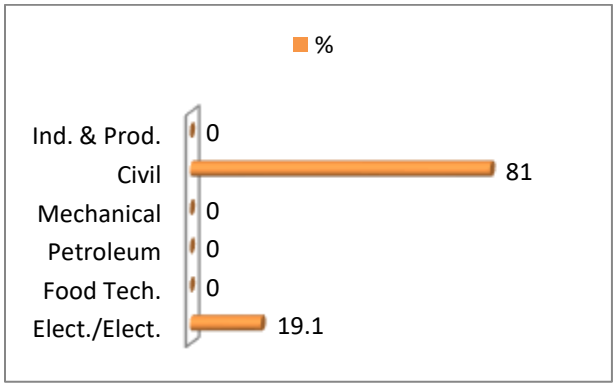

Fig. 30: Excellent Impact of ICT on Students' Attitude

Likewise, in Fig. 30, students from Civil engineering department (81%) reported 'excellent impact of ICT on students' attitude towards its future usage for learning', while students from Mechanical engineering,

Industrial and Production engineering, Food technology, and Petroleum engineering departments indicated no excellent impact in this category

Two stages of ICT adoption were investigated in this study: before and after the introduction of ICT. Findings from the response of the students show that a majority had little or no knowledge of using the ICT-facilitated learning approach. This is a common feature of most public schools in Nigeria, reflecting the current state of education in developing nations, most especially in Africa [36]. On the contrary, education in advanced countries makes good use of ICT-facilitated learning; learners beginning elementary to advanced classes are exposed to the use of ICT facilities to learn with various positive outcomes [17]. The study results suggested that using ICT positively impacts students' cognitive and learning abilities as well as their attitude towards learning. Other research findings suggest similar outcomes on the effects of ICT on students' learning [37]. One of such positive outcomes is the reduction in learning period; students learn at their own pace and space. Studies support this outcome, suggesting that students who use CAI learning platforms tend to learn faster and spend less time learning various concepts than their counterparts who learn using the traditional classroom method of teaching [23]; [30]. In addition, the students observed that using ICT led to an improvement in the quality of teaching methods. Adopting the CAI approach as a supplement to traditional classroom instructions was found to provide better quality instructions to learners [2]; [13]; [18]. ICT-facilitated learning was observed to improve students' attitudes towards learning and the continuous use of ICT facilities. However, the use of ICT facilities was observed to vary across the different departments. Some engineering courses like design, drawing, simulation, testing, etc., require the use of computer software. Students in these departments may be exposed to computer-facilitated learning than others.

4. Conclusion

This study provides evidence on the impact of ICT facilities in a public tertiary education institution to facilitate the teaching and learning process of an engineering management course to engineering/technology students. The following conclusion can be drawn based on the findings across six (6) departments:

- Under the 'excellent' category, students from Civil engineering had the highest claims, and next are the Mechanical engineering students.
- Under the 'very good' category, students from both Civil Engineering and Food Technology had the highest claims.
- Students from both Industrial and Production and Petroleum engineering departments had the highest claims in the 'Good' category, followed by students from the Electrical/Electronic engineering department.
- Similarly, students from both Industrial and Production and Petroleum engineering departments had the highest claims in the 'Little' category; next are students from Food Technology.
- A mixed result was obtained in the 'None' category. Students from Mechanical engineering had the highest claims under this category.

Therefore, both students' responses and findings suggest that using ICT as supplementary to face-to-face classroom for teaching and learning is effective with significant positive outcomes. ICT is observed to positively impact teaching effectiveness, students' learning progression, students' attitude towards the use of ICT and learning, and the quality of instruction. Lastly, integrating technology into the traditional educational system in Nigerian public schools will encounter some challenges, such as financial constraints, skill deficiency, stakeholders' resistance, etc. Changing this long-standing traditional system of education and the instructional approach requires the collective efforts of both the government and the people, especially having the willingness to change and embrace technology. The outbreak of COVID-19 exposed

the weakness in our educational system and the rigidity of the classroom structure, students were out of learning for several months. The eventual adoption of technology was slow and weak, faced with several unprepared circumstances. The educational system must expand its robustness for future eventualities.

Acknowledgement

The authors wish to acknowledge the support of Partnership for Higher Education in Africa (PHEA), and especially, the University of Ibadan team, under the chairmanship of Professor A. E. Oluleye, for sponsoring the technology enhancement aspect of this work and data collection.

References

[1] Haynes, C. A., and Shelton, K. 2018. Beyond the classroom: A framework for growing school capacity in a digital age. *Journal of Research on Technology in Education*.
[2] Adebayo, O. D., Chen, M., Onwuzuruike, O. L., & Joshua, A. (2024). The Impact of ICT Integration on Academic Performance: A Comparative Study of Traditional and Technology-Enhanced Classrooms. *International Journal of Trend in Scientific Research and Development*, 8(6), 1132-1141.
[3] Harper, B. 2018. Technology and teacher–student interactions: A review of empirical research. *Journal of Research on Technology in Education*. https://doi.org/10.1080/15391523.2018.1450690
[4] Kotnour, T., and Farr, J. V. 2005. Engineering management: Past, present, and future. *EMJ - Engineering Management Journal*, *17*(1), 15–26. https://doi.org/10.1080/10429247.2005.11415273
[5] Galloway, P. D. 2007. The 21st-Century Engineer: A Proposal for Engineering Education Reform. *Civil Engineering*, *77*(11), 46–104.
[6] Hunt, E. M., Lockwood-Cooke, P., and Kelley, J. 2010. Linked-Class Problem-Based Learning in Engineering: Method and Evaluation. In *American Journal of Engineering Education* (Vol. 1, Issue 1).
[7] Wong, S. S. K., Cross, J. A., & Burton, C. M. 2021. A Quantitative Analysis of Knowledge Collaboration Enablers for Practicing Engineers. *EMJ - Engineering Management Journal*, *33*(3), 174–186. https://doi.org/10.1080/10429247.2020.1780840
[8] Stošić, L. 2015. The importance of educational technology in teaching. *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, *3*(1), 111–114.
[9] Wu, Y. T., and Wang, L. J. 2015. The exploration of elementary school teachers' Internet self-efficacy and information commitments: a study in Taiwan. *Educational Technology & Society*, *18*(1), 211–222.
[10] Stosic, L., and Stosic, I. 2015. Perception of teachers regarding the implementation of the Internet in education. *Computers in Human Behaviour*, *53*, 462–468.
[11] Belo, N., McKenney, S., Voogt, J., and Bradley, B. 2016. Teacher knowledge for using technology to foster early literacy: a literature review. *Computers in Human Behaviour*, *60*, 372–383.
[12] Blok, H., Oostdam, R., Otter, M. E., and Overmaat, M. 2002. Computer-assisted instruction in support of beginning reading instruction: a review. *Review of Educational Research*, *72*(1), 101–130.
[13] Torgerson, C. J., and Elbourne, D. 2002. A systematic review and meta-analysis of the effectiveness of information and communication technology (ICT) on the teaching of spelling. *Journal of Research in Reading*, *25*, 129–143.
[14] Usman, M. H, Shuaibu, U.; Abdullahi, Z. 2025. Effects of ICT on Students' Academic Performance in Mathematics in Selected Secondary Schools in Kaduna State. *ATBU Journal of Science, Technology and Education*, *11*(4), 464-475
[15] Onuoha, C. O. 2007. *Meta-analysis of the effectiveness of computer-based laboratory versus traditional hands-on laboratory in college and pre-college science instructions. (Doctoral Dissertation Capella University*. Minneapolis, MN.) ProQuest Dissertations and Theses.
[16] Rosen, Y., & Salomon, G. 2007. The differential learning achievements of constructivist technology-intensive learning environments as compared with traditional ones: a meta-analysis. *Journal of Educational Computing Research*, *36*(1), 1–14.
[17] Li, Q., and Ma, X. A. 2010. Meta-analysis of the effects of computer technology on school students' mathematics learning. *Educational Psychology Review*, *22*(3), 215–243.

[18] Fletcher-Flinn, C. M., and Gravatt, B. 1995. The efficacy of computer-assisted instruction (CAI): a meta-analysis. *Journal of Educational Computing Research*, *12*(3), 219–242.
[19] Christmann, E. P., and Badgett, J. L. 2003. A meta-analytic comparison of the effects of computer-assisted instruction on elementary students' academic achievement. *Information Technology in Childhood Education Annual*, 91–104.
[20] Liao, Y. 2005. Effects of computer-assisted instruction on students' achievement in Taiwan: a meta-analysis. *Computers & Education*, *48*, 216–233.
[21] Mensah, R. O., Quansah, C., Oteng, B., & Nii Akai Nettey, J. 2023. Assessing the effect of information and communication technology usage on high school student's academic performance in a developing country. *Cogent Education*, *10*(1). 1-16
[22] Pérez Echeverría, M., Cabellos, B. & Pozo, J. I. 2025. The use of ICT in classrooms: The effect of the pandemic. *Education and Information Technologies*. https://doi.org/10.1007/s10639-024-13124-w
[23] Camnalbur, M., and Erdogan, Y. 2008. A meta-analysis on the effectiveness of computer-assisted instruction: Turkey sample. *Educational Sciences: Theory and Practice*, *8*(2), 497–505.
[24] Khalili, A., and Shashaani, L. 1994. The Effectiveness of Computer Applications: A Meta-Analysis. *Journal of Research on Computing in Education*, *27*(1), 48–62.
[25] Lou, Y., Abrami P. C., and d' Apollonia, S. 2001. Small group and individual learning with technology: a meta-analysis. *Review of Educational Research*, *71*(3), 449–521.
[26] Bayraktar, S. 2000. A meta-analysis on the effectiveness of computer-assisted instruction in science education. *Journal of Research on Technology in Education*, *34*(2), 173–189.
[27] Cheung, A. C., and Slavin, R. E. 2011. *The effectiveness of educational technology applications for enhancing Mathematics achievement in K-12 classrooms: A meta-analysis*.
[28] Kulik, J. A. 2003. Effects of using instructional technology in elementary and secondary schools: what controlled evaluation studies say. Semantic Scholar.
[29] Moran, J., Ferdig, R. E., Pearson, P. D., Wardrop, J., and Blomeyer, R. L. 2008. Technology and reading performance in the middle-school grades: a meta-analysis with recommendations for policy and practice. *Journal of Literacy Research*, *40*(1), 6–58.
[30] Kulik, C. C., and Kulik, J. A. 1991. Effectiveness of computer-based education in elementary schools. *Computers in Human Behaviour*, *7*, 75–94.
[31] LeJeune, J. V. 2002. *A meta-analysis of outcomes from the use of computer-simulated experiments in science education. (Doctoral dissertation*. Texas A&M University) ProQuest Dissertations and Theses.
[32] Tokpah, C. L. 2008. *The effects of computer algebra systems on students' achievement in mathematics (Doctoral dissertation, Kent State University)*. ProQuest Dissertations and Theses.
[33] Kuchler, J. M. 1998. *The effectiveness of using computers to teach secondary school (grades 6-12) mathematics: a meta-analysis (Doctoral dissertation*. University of Massachusetts, Lowell) ProQuest Dissertations and Theses.
[34] Seo, Y. J., and Bryant, D. P. 2009. Analysis of studies of the effects of computer-assisted instruction on the mathematics performance of students with learning disabilities. *Computers & Education*, *53*(3), 913–928.
[35] Torgerson, C., and Zhu, D. 2003. A systematic review and meta-analysis of the effectiveness of ICT on literacy learning in English. *EPPI-Centre, Social Science Research Unit, Institute of Education, University of London*, 5–16.
[36] Karamti, C. (2016). Measuring the impact of ICTs on academic performance: evidence from higher education in Tunisia. *Journal of Research on Technology in Education*, *48*(4), 322–337. https://doi.org/10.1080/15391523.2016.1215176
[37] Kulik, C. C., & Kulik, J. A. (1991). Effectiveness of computer-based education in elementary schools. *Computers in Human Behaviour*, *7*, 75–94.