COMPARATIVE ANALYSIS OF THE EFFECTS OF ICT-BASED AND CONVENTIONAL TEACHING METHODS ON STUDENT-CENTERED LEARNING AMONG UNDERGRADUATE STUDENTS AFFILIATED WITH FCE, ZARIA, KADUNA STATE – NIGERIA

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The study compares the effects of Information and Communication Technology (ICT) and conventional teaching methods on student-centered learning approaches among undergraduate students at FCE Zaria in Kaduna State, Nigeria. The study used a pre-test post-test experiment and control group design, with 60 400-level B.Sc. Economics students from FCE Zaria. The students were divided into two groups, the experimental group (EG) and the control group (CG). The Econometric Achievement Test (EAT) was used to measure academic performance. The results showed a significant difference in academic performance between the two groups. However, there was no discernible difference in retention rates between the two groups. The study recommends using ICT as an instructional strategy in econometrics teaching to limit instructor-based domination and encourage group work.

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Introduction

The use of information and communication technology (ICT) has increased significantly in recent decades, and student-centred learning (SCL) has become more of a focus in higher education globally. To better educate students for the workplace of the twenty-first century, techniques based on SCL and ICT are being introduced. Teachers continued to use traditional teaching methods despite the early 2000s curriculum overhaul that included the introduction of ICT and SCL, with ICT playing a secondary role in teaching and learning.

It is common practice to employ information and communication technology (ICT) as a tool to assist contemporary pedagogies, particularly student-centred learning (SCL) pedagogy. In the modern workforce, where job-related competencies and more general skills are valued, this modern pedagogical method is a successful teaching tool. Higher education institutions (HEIs) must thus embrace SCL to lay the groundwork for graduates' continuous development of competence, skills, and knowledge (Janor et al., 2013; Muganga, 2015).

A new stage in the adoption of ICT was thought to have begun with the emergence of the Internet and the provision of courses on fundamental computer skills for educators,

learners, and civil personnel in general. Additionally, during this time, the higher education institution started providing email access to academic personnel and non-academic workers as well as acting as an Internet provider for public institutions. Along with curriculum reform in the 2000s, the university installed computer rooms in certain faculties and encouraged teaching and learning with them. The transition from an industrial society to an information and knowledge society was seen as a global development, and many countries in the world were preparing their economies and societies for this new era (Hadad, 2017).

The curriculum reform process introduced SCL and ICT as tools for teaching and learning, and there was also a need to provide teachers with the skills and abilities necessary to introduce the changes and pedagogical practices necessary for this new reality. This study investigates the comparative analysis of the impact of ICT and conventional teaching methods on Students' student-centred learning approach among undergraduate studies affiliated with FCE Zaria in Kaduna State – Nigeria. This shift in focus in higher education was brought about by the recognition of the value of ICTs and the role that student-centred education played in implementing these changes (MINED, 2011).

Statement of the Problem

In the classroom teaching and learning process, the use of ICT is imperative as it gives chance to the instructors and learners to operate, store, control and retrieve data other than to promote self-regulated and active learning. ICT-based learning includes an expanded propensity towards collaborative learning among learners and instructors, not just in a specific classroom. This kind of collaboration is in contrast to the conventional learning environment.

Understanding how to use ICT is essential when considering the future of education. Instructors who do not use new technology for teaching create opportunities for these tools to behave in ways that are not optimal. ICT will inevitably be used in education, thus it's critical to recognize trends that could lead to improved teaching and learning environments down the road. There was little discernible change in the use of ICT for teaching and learning, and instructors persisted in employing antiquated and traditional pedagogical techniques in their instruction despite efforts to switch to SCL. This study is distinctive in that it investigates the effects of ICT-based and conventional teaching methods on student-centred learning of undergraduate students of the Department of Economics, Federal College of Education Zaria affiliated with Usmanu Danfodiyo University, Sokoto.

Objective of the Study

The study aimed at achieving the following objective:

- To determine the mean difference in academic achievement of control and experimental groups on pretest.
- To examine the mean difference in the academic performance of students who were taught while using ICT and the academic performance of students who were taught through conventional teaching methods on post-test.
- To identify the mean difference in retention of students who were taught using ICT and the retention of students taught using conventional teaching methods.

Research Question

The study intends to provide the answer to the following question:

- Is there a significant difference in the mean academic achievement scores of the control and experimental groups on the pretest?

- How does the mean academic achievement performance of students taught using ICT-based teaching methods compare with those taught using conventional methods on the post-test?
- Is there a significant difference in the mean retention scores of students taught using ICT-based teaching methods and the retention of students taught using conventional teaching methods?

Research Hypotheses

The following hypotheses were formulated and tested at 95% confidence level ($p \leq 0.05$).

- $H0_1$ = There is no significant difference in the mean academic achievement scores of the control group and experimental group on the pretest.
- $H0_2$ = There is no significant difference in the mean academic performance scores of students taught Using ICT-based teaching methods and those taught using conventional teaching methods on the post-test
- $H0_3$ = There is no significant difference in the mean retention scores of students taught using ICT-based teaching methods and those taught using conventional teaching methods.

The flexibility-activity framework

The flexibility-activity framework outlined by Collis and Moonen (2001) serves as the initial frame of reference for this investigation. This is a broad product that can be written, graphic, or both that describes the important ideas, variables, and presumptive relationships between them in the context of ICT use in higher education. Concerning the important aspects that are predetermined by the instructor or the organization for a particular teaching and learning scenario involving cutting-edge pedagogy and cutting-edge learning technology, this framework provides the student with a variety of possibilities. This framework is characterized by four key components of flexibility in the implementation of ICT-supported learning in higher education: these are technology, pedagogy, implementation strategy, and institution,

In Humbhi, Tareen, and Raheem's (2022) study, the effects of ICT resource availability on students' academic performance are examined, along with the usefulness of the technology and its influence on students' academic performance in higher education institutions located throughout Pakistan. 400 students were selected using an appropriate sample technique from the top six universities in Balochistan, one of the nation's largest regions. A closed-ended survey questionnaire including thirty-four items was utilized to gather data from the participants. The quantitative responses of the respondents have been gathered and analyzed using a quantitative research approach. Additionally, SPSS software was used to examine the relationships between the theories. The study's findings indicate that ICT significantly affects how well kids perform in the classroom. Students prefer to use ICT resources to do their academic assignments in the current era of technology. The findings also showed that the institutions' financial and material resources for ICT equipment are low. However, students continue to enable access to a variety of ICT apps within their educational institutions. The results of this study also emphasized Pakistan's higher education institutions' weak points in terms of ICT resource accessibility and availability. Who is preventing the students from using ICT tools to finish their coursework more quickly? The results of this study will help the Pakistani government, the Higher Education Commission (HEC), and educators recognize the value of ICT and ensure that students have

access to enough ICT-related resources for improved learning.

The study conducted by Hussain, Suleman, Naseeruddin, and Shafique (2017) looks at how information and communication technology affect students' retention and academic performance in chemistry. A random selection of fifty ninth-grade pupils was made from Kohsar Public School and College Latamber Karak. Based on their results on the pretest, the students were divided into similar groups. Pretest posttest equivalent groups design was utilized to gather data. Using SPSS, the independent samples t-test, mean, and standard deviation were used to analyze the data. Information and communication technology (ICT) was discovered to be more persuasive after statistical analysis revealed that it has a favourable impact on student's academic achievement and retention. Effective and valuable in teaching chemistry when contrasted with conventional techniques of teaching. It is recommended that information and communication technology should be used in teaching chemistry to enhance students' academic achievement at the secondary level.

In Chittagong, Bangladesh, Ullah, Alam, Shan-A-Alahi, Rahman, Masum, and Akter (2019) looked at how ICT affected students' academic performance at many private universities. Using a survey questionnaire, primary data were gathered from those universities' student populations. OLS regression, Confirmatory Factor Analysis, Descriptive Statistics, Dependability Analysis, Structured Equation Modelling (SEM) and data mining algorithms like Association rule mining and éclat have been used to assess how important each component is concerning determining the student's academic achievement. Overall results show a substantial correlation between students' academic achievement and ICT use from a statistical and mining perspective. Additionally, a student's addiction to ICT significantly affects how well they perform academically when measured comparatively. Lastly, the report suggests that classroom CT infrastructure be enhanced. Instructors ought to employ ICT in their lessons; technology ought to be utilized for personal growth and restrained from being too utilized. The majority of the time, students should utilize ICT for academic objectives. Every university should employ technology for educational purposes.

The study conducted by Ishaq, Afzal Ahah, Muqaddar, and Tufail (2021) examined the impact of information and communication technology (ICT) on university students' academic achievement and motivation. The study's goals were to learn about university-level students' perceptions of knowledge, skills, and ICT usage; to learn about students' motivation and academic success; and to ascertain whether male and female students' perceptions of these same topics differ. Additionally, to ascertain the impact of ICT on university-level student academic attainment and motivation. The study design employed was the descriptive survey. All undergraduate students enrolled in Hazara Division public universities make up the study's population. As a sample for the study, 300 students total—100 from each university—were included. The method of stratified simple random sampling was applied. There were two self-made surveys used. The tool's reliability was confirmed and enhanced using Cronbach Alpha on SPSS, indicating a 0.92 reliability value obtained through pilot testing with 50 students. Students enrolled in undergraduate programs provided the data. Subsequently, the information was input into Excel and analyzed using SPSS. The main findings showed that while ICT has a considerable impact on students' motivation, it

has little bearing on their academic performance. It is recommended that educational institutions should introduce ICT in such a way that promotes students.

Methodology

Research Design

The most suitable research design for this study is Quasi-experimental design, specifically a non-equivalent control group pretest-posttest design reason is that there is no random assignment of the participant to the control and experimental group.

Population of the Study

The population of this research study constitutes the entire ninety-five (95) 400-level B.Sc. (Ed.) Economics students of Federal College of Education, Zaria, affiliated with Usmanu Danfodiyo University, Sokoto. The population comprised sixty-three (63) males and thirty-two (32) females respectively.

Sample and Sampling Technique

The study employed a systematic sampling technique. The technique was used to prevent bias and to ensure that each student had an equal chance of being selected. To determine the sample interval the following formula was used:

$K = N/n$

Where:

K = Sample interval

N = Total population size of 400 level B.sc (Ed) Economics Student

n = Desired sample size

$K = 95/60$

$K = 1.58$

$K \approx 2$

The sample interval was rounded up to the nearest whole number $K \approx 2$.

So, a systematic sample with a random start of every 2nd number of students on the register was selected in the study. The calculated sample size for the research study is sixty (60) 400-level B.Sc. (Ed.) Economics students of the Federal College of Education, Zaria, affiliated with Usmanu Danfodiyo University, Sokoto.

Since the study was limited to the use of ICT in the laboratory teaching. The sample students were further divided into two equal and proportionate groups, the experimental group and the control group, each with thirty (30) students.

Instrument

The instrument used for this study is the Econometrics Achievement Test (EAT). The Econometrics Achievement Test (EAT) was self-generated and designed by the researchers to assess students' knowledge both before and after the test. Statistical Package for Social Science (SPSS) version 19 was used to analyze the data at $p \leq 0.05$ level of significance.

Validity of the Econometrics Achievement Test (EAT)

With the assistance of two Econometricians in the Department of Economics, Federal College of Education Zaria, the test's validity was verified and the content validity of the Econometrics Achievement Test (EAT) was assessed, critiqued and examined concerning the following:

i. Whether the test items conform to the objectives of the content and specifications it is to test.
ii. Whether the items are clear, precise and free from ambiguity.

Reliability of the Econometrics Achievement Test (EAT)

The Spearman-Brown Prophecy was used to calculate the research tool's reliability. The result was 0.82, which showed that the instrument was both dependable and within statistical bounds.

Pilot Test

One week pilot test was conducted on ten (10) members of the experimental groups on computer software, generating data from statistical bulletins, and saving data in Excel.

Use basic descriptive statistics, ordinary least square regression, and other statistical tools for economic analysis to analyze the data after importing it from Excel. Seven days later, both groups of respondents took a post-test.

Procedure

Two econometrics instructors with the same training and experience were chosen with the official approval of the department head to eliminate unneeded variables. The researchers scheduled three meetings with the instructors before the experiment was conducted to go over the goals and methodology of the investigation. The study was conducted for a period of six (6) weeks during which instructors in the experimental group were instructed to use computers, the internet, econometrics tools for economic analysis, and other software packages for teaching, whereas instructors in the control group were instructed to stick to conventional teaching methods. Similarly, students in the experimental groups received six (6) week-long training in computer software, assignment writing, internet browsing, generating data from statistical bulletins, and saving data in Excel. Use basic descriptive statistics, ordinary least square regression, and other statistical tools for economic analysis to analyze the data after importing it from Excel. Seven days later, both groups of respondents took a post-test.

Result

Version 19 of the Statistical Tools for Social Sciences (SPSS) was used to analyze and interpret the results to address the study topics.

Research Question One

Is there a significant difference in the mean academic achievement scores of the control and experimental groups on the pretest?

Table 1: Analysis Between the Performance of the Experimental and Control group

Groups	N	Mean	Variance	Std. Dev	Mean Score Diff
Experimental	30	26.75	46.84	6.84	
Control	30	23.00	40.50	6.36	3.75
Total	60				

The result in Table 1 above shows that the experimental group has a mean of 26.75, while the control group has a mean of 23.00 and the mean difference was observed to be 3.75. To test whether the variance is significant or not the formulated hypothesis was subjected to statistical t-test analysis.

Research Hypothesis one

$H0_1$ = There is no significant difference in the mean academic achievement scores of the control group and experimental group on the pretest. The result is presented in the table below

Table 2: Independent Sample T-Test Results Comparing Pre-Test Academic Scores of Control and Experimental Groups

Group	N	Mean	Variance	Std.Dev.	Df	t-cal	t-crit	Division
Experimental	30	26.75	46.81	6.84	29			
Control	30	23.00	40.50	6.36	29	2.23	2.00	rejected
Total	60				58			

The result shown in Table 2 revealed that t-calculated has a value of 2.23, while t-critical has a value of 2.00 for df = 58 at 95% confidence level ($p \leq 0.05$). Since t-calculated is greater than t-critical, the null hypothesis is therefore rejected. This signifies that there is a significant statistical difference between the mean difference in academic achievement of control and experimental groups on the pretest.

Research Question Two

How does the mean academic achievement performance of students taught using ICT-based teaching methods compare with those taught using conventional methods on the post-test?

Table 3: Analysis Between the Mean Performance of Students Who Were taught while Using ICT and the Academic Performance of Students Who Were taught through Conventional Teaching Methods on post-test?

Groups	N	Mean	Variance	Std. Dev	Mean Score Diff
ICT	15	27.60	56.69	7.53	
Conventional Teaching	15	27.33	42.69	6.31	0.27
Total	30				

The result in Table 3 shows that ICT has a mean of 27.60, while conventional teaching has a mean of 27.33 and the mean difference was observed to be 0.27. To test whether there is a significant difference between the variance, hypothesis two is subjected to statistical analysis.

Research Hypothesis Two

$H0_2$ = There is no significant difference in the mean academic performance scores of students taught Using ICT-based teaching methods and those taught using conventional teaching methods on the post-test. The result is shown in the table below:

Table 4: Analysis of Variance Results Comparing Post-Test Academic Performance Scores of Students Taught Using ICT-Based and Conventional Teaching Methods.

Group	N	Mean	Variance	Std.Dev.	Df	t-cal	t-crit	Division
ICT	30	27.60	56.69	7.53	14			
Conventional teaching	30	27.33	42.69	6.93	14	1.29	2.05	Accepted
Total	60				28			

The result shown in Table 4 revealed that the t-calculated is 1.29, while the t-critical 2.05 with df = 28 at 95% confidence level. Since t-calculated is less than t-critical, hence null hypothesis two is accepted. This means that there is no significant difference in the mean performance of students taught using ICT and students taught using conventional teaching methods.

Research Question 3

Is there a significant difference in the mean retention scores of students taught using ICT-based teaching methods and the retention of students taught using conventional teaching methods?

Table 5: Analysis Between the Mean Difference in Retention of students who were taught using ICT and the retention of students taught using a conventional teaching method

Groups	N	Mean	Variance	Std. Dev	Mean Score Diff
ICT	15	27.60	56.69	7.53	
Conventional Teaching	15	27.33	42.69	6.31	0.27
Total	30				

Table 5 displays the mean for ICT at 27.60, compared to the mean for conventional instruction at 27.33. The mean difference was found to be 0.27. The third hypothesis is statistically analyzed to see if there is a significant difference in the variance.

Hypotheses Three

$H0_3$ = There is no significant difference in the mean retention scores of students taught using ICT-based teaching methods and those taught using conventional teaching methods.

The result is shown in the table below:

Table 6 Independent Sample T-Test Results Comparing Retention Scores of Students Taught Using ICT-Based and Conventional Teaching Methods.

Group	N	Mean	Variance	Std.Dev.	Df	t-cal	t-crit	Division
ICT	30	27.60	56.69	7.53	14			
Conventional teaching	30	27.33	42.69	6.93	14	1.29	2.05	Accepted
Total	60				28			

Table 6 results indicate that, at a 95% confidence level, t-calculated is 1.29 and t-critical is 2.05 with df=28. The null hypothesis three is accepted since the t-calculated is smaller than the t-critical. This indicates that there is no discernible difference between the retention rates of pupils taught using ICT and those taught using traditional teaching methods.

Discussion of Findings

The study was conducted to examine the comparative analysis of the effects of ICT-based and conventional teaching methods on student-centred learning among undergraduate students affiliated with FCE, Zaria, Kaduna State - Nigeria. The results obtained in testing hypothesis 1 revealed that the analysis between the performance of experimental and control groups indicated that the mean difference between the experimental and control groups was observed to be 3.75 and the independent sample t-test results comparing pre-test academic scores of control and experimental groups revealed that t-calculated has a value of 2.23, while t-critical has a value of 2.00 for df=58 at 95% confidence level ($p \leq 0.05$). Since t-calculated is greater than t-critical, the null hypothesis is therefore rejected. This signifies that there is a significant statistical difference between the mean difference in academic achievement of control and experimental groups on the pretest.

The results obtained in testing hypothesis 2 revealed that the analysis between the mean

performance of students who were taught while using ICT and academic performance of students who were taught through conventional teaching method on post-test shows that the mean difference between the academic achievement of experimental and control group was observed to be 0.27 and the analysis of variance results comparing post-test academic performance scores of students taught using ICT-based and conventional teaching methods revealed that t-calculated is 1.29, while t-critical 2.05 with df=28 at 95% confidence level. Since t-calculated is less than t-critical, hence null hypothesis two is accepted. This means that there is no significant difference in the mean performance of students taught using ICT and students taught using conventional teaching method.

The results obtained in testing hypothesis 3 revealed that the analysis between the mean difference in retention of students who were taught using ICT and the retention of students taught using conventional teaching method was found to be 0.27 and the independent sample t-test results comparing retention scores of students taught using ICT-based and conventional teaching methods indicated that, at a 95% confidence level, t-calculated is 1.29 and t-critical is 2.05 with df=28. The null hypothesis three is accepted since the t-calculated is smaller than the t-critical. This indicates that there is no discernible difference between the retention rates of pupils taught using ICT and those taught using conventional teaching methods.

Conclusion

Before testing after the test, since the study was experimental in nature, Equivalent Group Design was used. Based on the pretest findings, respondents were divided into equivalent experimental and control groups. The researcher created the econometric accomplishment test (EAT), which was the instrument employed in the study. Version 19 of the statistical packages for social sciences (SPSS) was used to examine the data at the 0.05 level of significance. At $p \leq 0.05$, the second and third hypotheses were accepted while the first hypothesis was rejected.

According to the study, students who are taught using ICT and those who are taught conventionally both perform better in terms of developing their ability to observe, ask questions, practice manipulative skills, and pique students' interests—but only when the necessary tools are available and enough time is allotted to the teaching method. The study provides more evidence that both traditional classroom instruction and the use of ICT can support meaningful learning and improve students' academic achievement in econometrics.

Recommendations

Based on the findings of the study the following recommendations were made:

- It is recommended that instructors teaching econometrics receive training on utilizing ICT as a learner-centred, activity-based teaching technique and ensure effective and efficient utilization of a variety of instructional approaches/techniques for teaching econometrics since it will minimize the dominance of instructors by focusing on group work, which will enable students to communicate and share experiences.
- To enhance instructors' pedagogical approach to the teaching of econometrics ample time should be allotted when teaching econometrics to guarantee efficient and effective delivery and reception during the teaching and learning process.
- Instructors teaching econometrics should employ the use of ICT and other conventional teaching strategies to enhance meaningful teaching and learning processes.

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