

**INVESTIGATING THE IMPACTS OF ICT-BASED EXAMINATIONS ON THE
DEVELOPMENT OF CRITICAL THINKING AND PROBLEM-SOLVING SKILLS
AMONG NIGERIAN HIGHER EDUCATION STUDENTS**

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Abstract

The positive and negative impacts of information and communication technology (ICT) have been felt in all sectors. As regards the education sector, ICT is not only being used to source for educational materials by both students and lecturers, it has also be used to conduct examinations. Thus, the concern of this study is to investigate the impacts of ICT-based examinations on the development of critical thinking and problem-solving skills among Nigerian higher education students. The study adopts the quantitative survey research method to collect data from a sample of 350 through purposive technique. Population of the study comprises of undergraduate students of Plateau State University, Bokokos. Results show that while ICT-based examinations limit the capacity of the students to critically think and express themselves on questions asked, data equally indicates that ICT-based examinations do not enable the students to think and write exams that are capable of solving problems. The study concludes that ICT-based examinations are not a good means of measuring the understanding of students. The study, therefore recommends a rethink on the conduct of ICT-based examinations in Nigeria's higher institutions.

Keywords: ICT-Based, Examinations, Critical Thinking, Problem-Solving, Skills.

Introduction

Online communication technologies since their innovations have served as important and valuable tools in the field of education. The integration and adoption of these technologies to assess examinations in schools, according to Skinner (1958) started in the 1920s', marked by Sidney L. Press's development of machines for automated testing. In the same vein, institutions of learning at the same time began to make use of automatic testing and scoring technologies with a view to handle large students because of their cost-effectiveness (Audette, 2005). Llams-Nistal et al (2013) argue that the introduction of the Internet technology (WWW) in the 1990s brought about significant transformations in different fields, with the education sector inclusive. As a result of this, many industries from that time started to integrate E-evaluation that best handled their peculiar situations. In the United Kingdom, Joint Information System Committee set up its own rules and regulations for E-examinations (Alruwais, Wills and Wald, 2018). In addition, in 2009, IMS Global Learning Consortium produced IMS Question and Test interoperability Specification (Consortium, 2008). That same year, Cisco, Intel and Microsoft collaborated to produce the document entitled "Transforming Education: Assessing and Teaching 21st Century Skills" (Kozma, 2009).

Online-based conduct of examinations, sometimes called computerised examinations or computer-based examinations is a way in which electronic machines are used to test the understanding of students of what their instructors have given them in the class and the questions and answers are presented and recorded electronically (Khohsima & Toroujemi, 2017). Hashemi and Toroujeni (2016) concurs that the interest of using computers in educational assessment called computer-based examinations is growing daily. Computers have brought enormous innovations and changes in evaluating students' performance as these computer technologies provide new assessment tasks as well as potentially powerful scoring, reporting and real-time feedback mechanisms (Scalise & Gifford, 2006). Further, Alruwais, Willis and Wald (2018, p. 34) opine that "E-learning and E-assessment have been introduced, to offer online courses and electronic assessment. E-assessment enables the students live in remote areas to have the test in their homes, and helps the teacher to correct the exam and release the marks in short time". Certainly, while conducting computerised examinations have some advantages, using computers to assess students cannot be said to be intrinsically better than paper-based examinations. In fact, some challenges such as the issues of reliability, validity, and limitations in terms of allowing the students to express themselves on

questions asked always accompany computerised assessment that makes it questionable. Plateau State University, Boko for some years now have been conducting some sections of its examinations for undergraduate students online. The efficacy and efficiency of this method of assessment needs to be studied. Therefore, the thrust of this study is to investigate the impacts of ICT-based examinations on the development of critical thinking and problem-solving skills among Nigerian higher education students.

Statement of the Problem

The world is currently referred to as the digital age, which places demands not only on the ability to work with online-based information technologies but also on being able to understand them as well as evaluate their importance. Information and communication technology allows the implementation of communication and education strategies and introduce new ways of teaching and conducting examinations.

Examination is an essential approach to measure the level of acquisition of knowledge and intellectual competence of a student for a particular course or programme. Of recent, many higher institutions of learning across the world have been conducting examinations online for their students. However, questions around the credibility of using ICT-based technologies to examine students' understanding of what they have been taught in classes are frequently being asked. Studies on the impacts of conducting examinations through the information and communication technology platforms have been conducted by researchers and scholars both in Nigeria and outside the country (Křeménková et al, 2021; Fu, 2013; Pant & Muddgal, 2018; Negoro, Rusilowati & Aji, 2023; Bankole & Nasir, 2020; Odunola & Tella, 2020). However, none of these studies focused on impacts of ICT-based examinations on the development of critical thinking and problem-solving skills among undergraduate students of Plateau State University, Boko, Nigeria.

Objectives of the Study

- i. To examine the level of comfortability with ICT-based examinations
- ii. To investigate whether ICT-based examinations negatively affect the development of critical thinking and problem-solving among the respondents.
- iii. To find out the areas to which ICT-based examinations negatively affect the development of critical thinking and problem-solving among the respondents.
- iv. To assess the extent to which ict-based examinations affect critical thnikning and problem solving skills.

Review of Literature

Positive Impacts of Computer-Based Examinations

Positive impacts of using computers to conduct examinations are confirmed by many studies. Conventional group-administered assessments will no longer be necessary in the future due to the possibility of implementing computerised examinations. Zare and Toroujeni (2017) contend that since computer-based assessment of students (CBT) offers several advantages over its conventional Paper-and-Pencil-Based Testing (PBT) delivery counterpart, it is consistently becoming popular in the conduct of examinations. Mohamadian and Toroujeni (2017) concur that it is the most important and powerful language of technology and science) as well as testing domain. Computerised test can be manipulated in such a way that allows test takers to choose when they take a test. It also provides the conditions for cooperative learning which is one of the most significant practices in education (Khoshsima & Saed, 2014).

Some troublesome burdens such as providing test takers with allotted time and place of test, going a long distance to present at the place of test at the specified time, sending test materials to various locations and places in which the test is supposed to be administered, sending back the answer sheets to the centres in which the tests are supposed to be scored and analysed, sending the results back to test takers and etc. that are arisen from implementing conventional version of a test need much more energy, time and money than implementing the computerised versions. Computerised versions of examinations are also capable of collecting metrics such as test and item latency rates that paper-pencil based tests cannot. The popularity of CBT can be due to the existence of some unpleasant traditional assessment tasks such as test items creation and presentation, answer collection and scoring, statistical analysis, and storage, transmission, and retrieval of information in PBT. Of course, these difficulties are eased up by some efficient practical and operational functions of computers that are applied in designing, scoring and analysing computerised tests (Jamieson, 2005).

Among the advantages offered by onscreen way of test delivery, presenting uniform and consistent information to all examinees upon how to take the most appropriate measures in taking a complete test (Bodmann & Robinson, 2004); to obtain more effective information about individual test takers (Wise & Plake, 1989); to increase test security (Grist, Rudner, & Wise, 1989); to provide instant scoring by providing new scoring procedures (Goldberg & Toroujeni, 2016); and to be implemented easily than PBT.

Therefore, it is thought that computerised assessments can provide a very good learning and assessing environment, as good learning environment and effective instruments can enhance students learning (Khoshsima & Tiyar, 2014). In the last decades, computer technology and related technological tools have been extensively utilised in testing language discipline to analyse obtained scores and results quickly (McNamara, 1991). Peat and Franklin (2002) believe that the use of formative and summative computerised assessment leads to important advantages for both staff and students. Staffs are engaged more in interacting and communicating with students and consequently students enjoy opportunities to gain extensive and immediate feedback at the time that test is terminated. Since the most effective way to teach a language is providing the environment in which the learners can employ the real language use (Khoshsima & Tasuj, 2014), the computer can be used in educational contexts to provide such effective environment for learning so that the students become more competent to be able to talk into the foreign or second language (Khoshsima & Sayadi, 2016).

Negative Impacts of ICT-Based Examinations

Among the negative aspects of computerised tests, the risk of plagiarism in online tests (test takers are not easily authenticated), lack of IT skills and experience of the requirements of CBT, and the need of high level of organisation across all parties such as academic, support staff. Others are computer services and administrators involved in assessment, the need of training in assessment design, IT skills and examination management for assessors and investigators, computer anxiety and technical malfunctions, and absence of instructor when test takers have questions about an issue or when they are confused by the language of the problems, can be mentioned. Limited access to computers is a challenge to administer the CBT. Internet connection and technological equipment to administer online tests may not be available in all settings (Bugbee & Bernt, 1990). Some other challenges that may pose problems for test takers of CBT are screen sizes of computers and the quality of computer graphics and screen resolution. Actually, different hardware and software requirements that are used in various testing environments and settings may even vary from one computer to the next in the same testing environment (Bennet, 2003).

According to Chapelle and Douglas (2006), validity of CBT can be challenged in two ways. The first one is that the final performance and measurement of learners' language ability resulted from CBT may not be the same as the resulted performance received from its PBT counterpart. The second one is that the items designed and presented in CBT may be different from the items that are constructed and developed in other formats (Chapelle & Douglas, 2006). Therefore, the common conceptions that are applied to the validity of CBT may not be applied to the validity of tests presented in other formats due to the unique features of computer technology (Chapelle & Douglas, 2006).

Review of Empirical Studies

Alruwais, Wills and Wald (2018) examined the advantages and challenges of using e-assessment. The study adopted the document search research method. Findings revealed the plus of using ICT for assessment of students to include fastness in assessing students, students prefer E-assessment, because they can have more control, friendly interfaces and test as games and simulations, which resemble learning environment and recreational activities. Also, e-evaluation provides immediate feedback comparing with paper test, which helps to improve the learning level, e-examinations can improve the student performance and that helps the students in remote area to learn and assess in their locations and it can take it any time, which provide flexibility for students to have the exams. The study further found the challenges of e-evaluation of students to include inexperienced students find it difficult to cope with such technology during exams, challenges of accessibility of computer and internet, poor technical infrastructure development, especially in poor countries like Nigeria. The study also found the obstacles regarding around assessing group project. It needs a monitor of the communication skills, evaluate the group work, assess each member and the whole group, and provide a feedback. It is hard to use computer in this task. Equally, some teachers' unfamiliarity with online technology or using of such technology for the first time for assessment remains a big challenge. Further

Odunola and Tella (2020) assessed the nexus between undergraduates' perceptions of Online Public Access Catalogues (OPAC's) utility and their employment in South West Nigerian institutions. The study used the survey research design. Findings of the research revealed that university undergraduates' adoption and use of OPAC was influenced by their perception of its value.

Sarkar, Baus and Bhattacharya (2023) conducted a study on ICT based examination reform: an ultimate solution to conduct CBCS pattern of assessment in India. The researchers employed the survey research method. The study found that conducting exams online affects mostly students in rural areas because they are deprived of the new technology. The study concluded that conducting of computer-based assessment of students leaving in remote communities remains a huge challenge. The study recommended that government should focus on developing modern communication infrastructure in rural areas to address the gap between students in urban centres and those in rural communities when conducting online-based examinations.

Similarly, Abdulkareem and Lennon (2023) studied impact of digital divide on students' performance in computerised UTME in Nigeria. Survey research design was used to collect data. The study was guided by the knowledge gap theory, digital divide theory and resources and appropriation theory. The finding showed that a wide gap exist among private school students and public school students taking UTME online. The study also found that the most affected group of students are those schooling in public schools in rural areas. The study recommended that

inexpensive and easy to access information and communication technology facilities and CBT practice centres should be provided to students, especially those in disadvantaged areas, to ensure the fairness of UTME to all candidates.

Okah-Tim (2023) examined the impact of computer-based tests on the quality of education in Nigeria. Data for the study was gathered from secondary sources. The study found that ICT-based examinations in Nigerian higher educational facilities has enhanced teaching and learning and made it easier for teachers to achieve their teaching objectives. Findings also revealed the challenges affecting the use of ICT-based equipment to conduct tests and examinations to include inadequate ICT infrastructure, power supply, inadequate ICT skills of students and candidates, examination manager integrity, acceptability, network and software factors. The study suggested among others that the government should provided ICT-facilities in all tertiary learning institutions in the country.

Usman and Olaleye (2023) investigated the effect of computer based test (CBT) examination on learning outcome of colleges of education students in Nigeria. The study made use of survey to collect data from 2112 NCE students and lecturers in the School of Education, Federal College of Education (Special), Oyo. The study established that the challenges militating against CBT examination on learning outcome of colleges of education students in Nigeria, among are lack of ICT practical knowledge by lecturers assigned to supervise CBT examination, visually impaired students complained of unclear voice, some physically handicapped students could not use mouse, erratic power supply during CBT examination couple with high cost of diesel for alternative source of power and time period fixed affect some students who are not that versatile with the use of mouse and keyboard. The study further found the benefits of conducting exams online to include: instant feedback, helping in covering course contents, immediate scoring of students, assessment is authentic, allowing multiple test administration and large number of students can be attended to. The research advocated among others that lecturers assigned to supervise CBT-based assessment should be adequately trained so that they can effectively perform the tasks.

Theoretical Framework

The study was situated within the framework of the Cognitive Load Theory (CLT). The theory, propounded by John Sweller in 1988 states that human working memory has a very limited capacity. It explains that learning occurs at it best when the technique of teaching does not overload the brain but rather uses clear designs that assist to move information into long-term memory. As it relates to this study, CLT emphasises that ICT-based examinations do not give students the chance to analyse, evaluate and synthesis questions that they are asked during examinations. The outcome of such examination is surfacing learning, poor problem-solving, rushing, and lower quality answers.

Methodology

The study employed the quantitative survey research design. According to Nwodu (2006), the quantitative survey methods collect numerical data from population that are too large. This approach collects information from the representative of the entire population. The population of the study were undergraduate students of Plateau State University, Boko. While the scope of the study was Faculty of Social Sciences, which comprised of Departments of Mass Communication, Political Science, Economics, Sociology and Psychology. The purpose of studying the Faculty of Social Sciences was for easy and effective handling of data. The study adopted the purposive sampling method by focusing on only the 200, 300 and 400 levels students. The sample size for the

study was 350, that was purposively selected, 70 from each Department. The availability administration method of questionnaire was used.

On the validity and reliability of the instrument of data collection, the first draft of the questionnaire was face validated by the researchers who, after personal scrutiny, made comments and observations after which the questionnaire was subjected to two other research experts who equally vetted and modified the instrument before it was administered to the respondents. The reliability of the instrument was established through the test-retest method using sub-scale of 20 of a similar organisation and after an interval of two weeks, it was re-administered to people who have heard of the experience of writing computer-based examinations.

Five-Point Likert Scale of Strongly Agree, Agree, Strongly Disagree, Disagree and Undecided, which the criterion mean was put at 4 point and above is accepted result, while 2 point is rejected result was used. The data was also presented using frequency and percentage charts and tables. The discussion of findings was done in line with the research objectives, linked with the reviewed literature.

Data Presentation and Analysis

A total of 350 copies of questionnaire were administered of which 341 were returned and found valid for analysis. Percentage representation is shown in the Chart below:



Figure 1: Response Rate Analysis

Table 1: Level of Comfortability with ICT-Based Examinations

Options	Frequency	Percentage
Very comfortable	9	2.6
Comfortable	16	4.6
Neutral	13	3.8
Uncomfortable	192	56.3
Very uncomfortable	111	32.5
Total	341	100

Source: Field Survey, 2026

It could be inferred from the data in Table 1 that most of the participants are not comfortable with ICT-based examinations.

Table 2: ICT-Based Examinations enhance your Ability to Handle Complex Questions such as in the ones in the Table Below

Options	SA	A	SD	D	UD	Total	Mean Rating	Decision
Addressing challenges in comprehension and understanding	6	3	26	301	5	341	2.1	Rejected
Solving intricate mathematical problems	8	5	34	291	3	341	2.2	Rejected
Engaging with quizzes or solving puzzles	5	10	75	242	9	341	2.2	Rejected
Writing letters or essays with clarity and structure	11	8	46	269	7	341	2.2	Rejected
Managing laboratory-based tests and conducting experiments	6	9	72	251	3	341	2.3	Rejected
Fostering analytical thinking and problem-solving skills	3	3	94	241	0	341	2.3	Rejected
Providing a realistic assessment of real-world issues	9	6	93	222	11	341	2.3	Rejected

Source: Field Survey, 2026

Most of the respondents strongly agree that ICT-based examinations do not enhance their ability to handle complex questions. It could therefore, be deduced that ICT-based examinations are not very good methods in assessing capability of students on a subject matter.

Table 3: Responses on the Areas in which ICT-Based Examinations Negatively Affect the Development of Critical Thinking and Problem-Solving

Options	SA	A	SD	D	UD	Total	Mean Rating	Decision
ICT-based examinations are far more effective in enhancing critical thinking skills	3	7	1	332	0	341	2.0	Rejected
There is no significant difference between ICT-based and traditional examinations in fostering critical thinking	6	9	19	299	8	341	2.1	Rejected
Traditional examinations are considerably better at developing critical thinking skills	245	72	10	5	9	341	4.5	Accepted
ICT-based examinations limit critical thinking as they focus more on choosing answers rather than deep thinking	287	33	9	5	7	341	4.7	Accepted
ICT-based examinations promote more complex questions and provide immediate feedback to enhance learning	3	3	94	241	0	341	2.3	Rejected

Source: Field Survey, 2026

The result in Table 3 above is an indication that traditional or paper-based examinations remain the best method of evaluating the level of understanding of students concerning a subject.

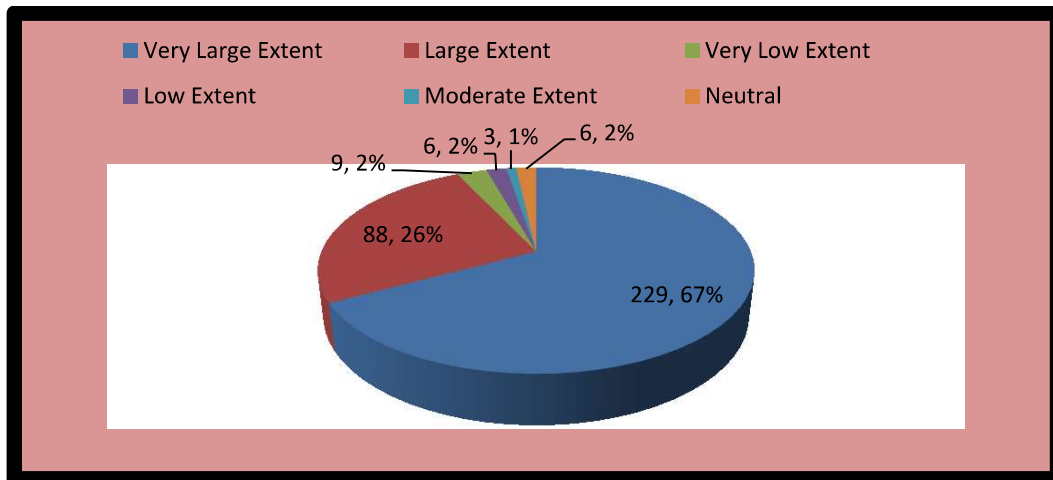


Figure 2: Extent to Which ICT-Based Examinations Affect Critical Thinking and Problem Solving Skills

Data in Figure 2 above points that most of the respondents agreed that ICT-based assessment negatively affect their level of thinking deep and answering examination questions that are capable of finding solutions to problems to a very large extent.

Discussion of Findings

Data from the study indicated that 111 (32.5%) of the respondents felt uncomfortable with ICT-based examinations. 192 accounting for 56.3% of those who took part in the study asserted that they were not comfortable with the conduct of examinations through ICT facilities. 9 representing 2.6% of the participants indicated very comfortable with the ICT-based method of conducting examinations; 16 (4.6%) felt comfortable with it, while 13 (3.8%) remained neutral (see Table 1 above).

Furthermore, analysis of the data revealed that ICT-based examinations not best methods of evaluating the understanding levels of students regarding a subject matter that they are being assessed. For instance, on the question of if ICT-based examinations address challenges of comprehension and understanding. Findings as captured in Table 2 revealed a mean rejection of 2.1. Other findings were that ICT-based examinations are capable of solving intricate mathematical problems, engaging with quizzes or solving puzzles, as well as writing letters or essays with clarity and structure. Mean score rejection of 2.2 was recorded. The results also showed that ICT-based examinations are not good means for managing laboratory-based tests and conducting experiments with a mean score of 2.3. Such method of conducting examinations do not foster critical, analytical thinking and problem-solving skills (2.3 mean score), and do not provide a realistic assessment of real-world issues with a 2.3 mean score.

In addition, the study identified several areas in which –ICT-based examinations negatively affect the development of critical thinking and problem-solving (see Table 3 above). An earlier study by Chapelle and Douglas (2006) corroborate that the validity of CBT can be challenging, emphasising that the final performance and measurement of learners' language ability resulted from CBT may not be the same with the performance from paper-based evaluation. Okah-Tim (2023) findings, however, contradict that ICT-based examinations in Nigerian higher educational facilities have enhanced teaching and learning and made it easier for teachers to achieve their teaching objectives.

Conclusion/Recommendations

The focus of this study has been on investigating the impacts of ICT-based examinations on the development of critical thinking and problem-solving skills among undergraduate students of Plateau State University, Boko. The study concludes that ICT-based examinations are not good means of measuring the understanding of students. This explains the focus of the Cognitive Load Theory in which students have less time to evaluate, analyse and synthesis examination questions, thus affecting critical thinking and better solving of examination problems. The study, therefore suggests a rethink on the conduct of ICT-based examinations in Nigeria's higher institutions.

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