

## IMPACT OF COMPUTER-BASED TESTING MODES ON ACADEMIC ACHIEVEMENT AMONG SENIOR SECONDARY SCHOOL STUDENTS IN ABUJA, NIGERIA

OKOLI, Canice E.; UBANGHA, Monday B. & EGBERONGBE, Olasunbo Aminat

Department of Educational Foundations,  
University of Lagos, Nigeria

### Abstract

*Innovation in education has led to several changes and method of testing is no exception. Paper-Pencil examination is less used as a method of determining students' achievement nowadays owing to several limitations. Computer-based testing has been adopted by some testing organisations, however, some elements of cheating are still perceived. Thus, the study investigated the effects of Computer-Multimedia Test (CMT) and Randomized Computer-Based Test (RCBT) on academic achievement of senior secondary students. The study adopted a quasi-experimental research design. The population comprised all the Senior Secondary School three (SSS 3) students who took the 2017 West African Senior Secondary Certificate Examination (WASSCE) and the 2017 Unified Tertiary Matriculation Examinations (UTME) in the Federal Capital Territory, Abuja. Multi-stage process sampling procedure was used to select three Local Education Authorities, nine secondary schools and three hundred and thirty-five (335) students who participated in the study. The nine selected schools were randomly assigned 3 each to CMT, RCBT and Randomized Paper-Pencil Test (RPPT) examination mode groups. Five research instruments were used for data collection and analysed using descriptive and inferential statistics. Two research hypotheses were tested at 0.05 level of significance. The findings indicate that the participants in the RCBT group performed significantly better in English Language and Mathematics Achievement Tests than the participants in other groups. However, majority while answering the Scale of Attitude to Computer-based Testing attested to the fact that CMT is better at curbing cheating. Based on these findings, recommendations are made that RCBT should be initially adopted to acclimatise students to computer-based examinations while CMT should be gradually embraced for all examinations in Nigerian secondary schools not to only to effect a change of attitude towards cheating in examination but also to curb it and promote true learning.*

**Keywords:** *Computer-Based Testing modes, Academic Achievement, Innovative items.*

### Introduction

The sensitivity of conducting examinations warrants that errors and other lapses are avoided in order not to mar the process. Failure to check these could be detrimental in terms of financial, human, time and material resources involved in the administration of examinations. Thus, no matter the test delivery mode used, these standards must be maintained. Predominantly, the traditional paper-pencil mode has been since the inception of examination in Nigeria and has been fraught with issues of examination malpractice as far back as 1914 when the Cambridge examination leaked (Adekale, 1993).

Since then, the scourge of examination malpractice has been on the increase in spite of laudable and concerted efforts by all and sundry at various levels to stop the menace. The governments at all levels, examination bodies, school authorities and concerned individuals in the Nigerian society have consistently condemned the prevalence of examination malpractices in our assessment practice. Examination bodies such as the West African Examinations Council (WAEC), the Joint Admissions and Matriculation Board (JAMB), National Examination Council (NECO) National Business and Technical Examinations Board (NABTEB) have also adopted several punitive measures against candidates who engage in examination malpractices in their examinations. These measures include: cancellation of results, blacklisting of schools and candidates, etc.

However, these punitive measures seem to have had little impact in deterring candidates from engaging in examination malpractices (Wilayat, 2009; Adeyemi, 2010).

Several factors have been adduced as reasons why this problem continues to permeate our assessment practices, rendering results almost worthless as it poses a great threat to the validity and reliability of any examination; thus, defeating the whole essence of examinations. These factors as identified by Onakwakpor (2005) are:- laziness to study, demand for higher grades, undue emphasis on certificate possession (OND, NCE, Degree, etc); greed, poverty and unpaid salaries, undue competition, lack of self-confidence in writing examination, poor teaching methods, inadequate facilities, disregard for spiritual values, decline in the teaching of morals in school to instil sound values, etc. In addition, the World Bank Group (2001) gave the following as other reasons for examination malpractice. These are:- high stakes of the examination, teacher and school status, personal factors, admission quota factors, inadequate number of teachers required for effective teaching and learning, inadequacies in the conduct of public examinations; inadequate government policies, location of some examination centres, low salary level of teachers, and so on.

Information and communication technology has shown immense potentials for enhancing effectiveness and efficiency in various fields of human endeavours. Turning specifically to the field of testing, technology has already played significant roles in the form of scoring technology, analytical practices, and development strategies. The computer plays a central role in the new web-based technologies that have transformed the process of educational testing as it is known today. The use of computer-based technology has greatly facilitated test administration, scoring, data analysis, data management and score reporting. It has been applied to streamline the educational testing process in the following areas: registration data capture, item analysis and banking, online payment, computer-based testing (CBT), electronic marking, results checking/verification, issuance of Result Slips and Letters of Admissions etc.

Advanced security measure is a primary advantage of computerized examinations. Examination questions are viewed via the computer screen, therefore eliminating the need for the movement of examination writing materials to various locations across the country. Also, the extensive encryption mode prevents hackers from breaking into the system. The test centre controls the security of the environment and detects unauthorized examination materials. Furthermore, test items generation, development and banking are also automated. Thus, Computer Based Tests can be used to prevent examination fraud by reducing to minimal extent areas requiring human intervention which have hitherto created opportunity for a lot of malpractices. As a result of these enhanced security features, examinations delivered via computer have become more and more prevalent. One of the frequently used computer-based test formats is the Randomized Computer-based Testing (RCBT).

Randomized Computer-based Testing (RCBT) has grown in popularity and is increasingly becoming the primary mode for delivering tests in Nigeria. RCBT offers many advantages over the traditional paper-pencil testing (Measurement Research Associates, 2010). This test involves administering a fixed set of items but the order of the items is randomized to provide a modest test security benefit (Prometric, 2005). In writing the test, all the multiple-choice items are done using computer and students are timed so that they can submit as soon as they finish and results are given immediately.

One of the major reasons why JAMB adopted the CBT mode of examination was to curb the incidences of examination security breaches. Considering the fact that the UTME is not a one day affair, but rather spread across several days and at different times, the Linear-on-the-fly (LOFT) method (a form of Randomized

computer based testing) was deemed necessary. Another computer-based test mode is the Computer-Adaptive Testing (CAT). This mode involves construction of individualized examinations for each candidate based on their demonstrated level of knowledge and skill (Prometric, 2005). The advantages are that, all candidates take examinations within their ability level thus improving the overall reliability of the examinations.

However, the current mode of CBT in the international scene is the Computer Multimedia Testing (CMT) which confers on itself all of the benefits of the former and much more. Advances in cognitive and measurement science are transforming assessment in fundamental ways in such areas as test design, item generation, task presentation, scoring as well as testing purpose and location (Bennett, 2014). Technology today offers many new opportunities in terms of novel assessment tasks and more accurate scoring, reporting and real-time feedback mechanisms (Scalise and Gifford, 2006). With the advent of new technology comes the opportunity to create items that are accurate, stimulating and a true measurement of the skills or knowledge of the candidate (Parshall, Harmes, Davey and Pashley, 2010). With Multimedia item types, computers has made possible the inclusion of any media that can be displayed, making tests more fun, accurate and available to groups (such as the visually impaired) who ordinarily cannot be tested by conventional means. The goal of this continued development of testing technology is to improve measurement, either by measuring the same knowledge or understanding better than before, or by measuring something more than or different from before (Parshall, Harmes, Davey and Pashley, 2010).

Computer multimedia tests offer the addition of stimuli such as sound, 3D simulations, voiceovers and others, which can be incorporated into item stems (questions), scenarios and/or response options. This means that computer-based tests can measure a wide range of cognitive processes (Jodoin, 2003). With this process, cheating behaviour may reduce while students' achievement may improve in their subjects.

English Language and Mathematics are two important subjects taught in schools which have great implication on students' daily life and continued academic pursuits. They are also compulsory requirements for any admission into tertiary institutions in Nigeria. English Language is a lingua franca in Nigeria. It is a language of nationalism, medium of communication for socio-political activities, the language of instruction and assessment of academic achievements even in other school subjects (Popoola, Akintunde and Jimoh, 2014).

On the other hand, in almost every country, Mathematics occupies a central place in the school curriculum. This is because Mathematics is needed for almost every single profession in the world; be it in real estate, Biology, or even rocket science, it is without a doubt that numbers will be utilized (Brown and Porter, 1996). The techniques learned help to gain some insight into the ways in which Mathematics extends our ability to understand, control and enrich the world we live in. Kuku (2016) also reported that Mathematics was incorporated into school curricula as a result of its importance and usefulness in personal fulfilment, active citizenship, social inclusion and employability in modern society as well as its influence on everyday life, including positive contribution to the wealth of the nation. The importance of these subjects put pressure on students on examination day such that they devise several methods of cheating. As a result, achievement in Mathematics and English Language will be used to examine the effectiveness of Computer Multimedia Test (CMT), Randomised Computer-Based Test (RCBT) and Randomised Paper-Pencil Test (RPPT) modes of test administration the academic achievements of senior secondary schools students in Abuja.

### **Statement of the Problem**

The Nigerian government, parents, guardians, other stakeholders in education and the society at large are concerned about examination malpractice at various levels of education. Cheating in examination tend to have become so 'internalized and legitimized' that some people now regard it as a normal process of passing examination. One of the measures introduced to curb examination security breach is computer-based testing (CBT) which has metamorphosed from the fixed CBT to randomised CBT to further limit cheating. However, it has been observed that in spite of the introduction of randomised computer-based testing by some testing organizations in Nigeria, reports show that some elements of cheating still persist. The use of Computer Multimedia Testing is an innovative examination mode designed to address the anomalies in Computer Based Test (CBT). The use of multimedia items may ensure better motivation to learn and thus reduce the tendency to cheat on the part of students as well as ensuring wider coverage of the domains by the teachers, thereby increasing the content validity and the inferences that can be made from the test scores. This study, therefore, will investigate the effects of computer-based testing modes on the academic achievement of *OKOR* secondary school students in Abuja, Nigeria

### **Research Hypotheses**

The following research hypotheses were tested at 0.05 level of significant.

1. Performance in English Language Achievement Test does not significantly differ among participants in the three experimental groups.
2. Performance in Mathematics Achievement Test does not significantly differ among participants in the three experimental groups.

### **Methodology**

The study adopted a quasi-experimental research design. The target population for this study comprised all the Senior Secondary School Three students (SSS 3) that were duly registered for the 2017 West African Senior Secondary Certificate Examination (WASSCE) as well as the Unified Tertiary Matriculation Examination (UTME) in the Federal Capital City, Abuja. The SSS 3 students were chosen to ensure that the students would have substantially covered the Senior School Certificate Examination syllabus and were adequately prepared for the Unified Tertiary Matriculation Examinations (UTME). There were 62 schools with 16,658 senior secondary three (SSS3) students.

The sample comprised of three hundred and thirty five (335) senior secondary three students. This is made up of 133 males and 202 females. Multi-stage sampling process was used to select Local Educational Authorities (LEAs), secondary schools and participants. Initially, simple random sampling was used to select three out of the five (5) remaining LEAs in FCT using hat and draw method. Afterwards, with the list of the 62 senior secondary schools in FCT with 16,658 SS3 students provided by the Secondary Education Board (SEB), three senior secondary schools were randomly selected in each of the three selected LEAs using simple random sampling, hat and draw method. This resulted in selecting nine (9) secondary schools with a total of 3,526 senior secondary three (SSS3) students. Based on their career leanings 90 students in each of the nine schools were selected for the baseline assessment. The 90 students selected were based on three strata, namely, 30 Arts, 30 Commercial and 30 Science students to ensure full coverage of the range of career leaning available in the schools. A total of 810 students were selected for the baseline assessment using Peer Intelligence and Aptitude Test (PIAT). A total of 369 students who scored at least nine (9) and a maximum of 20 which was the highest score out of forty (40) in the baseline test qualified for the study. The three schools in each of the LEAs were randomly assigned to three groups (that is, RPPT, RCBT and CMT) respectively. However, only 335 participants eventually made the sample for the study due to experimental

mortality. Altogether, the RPPT group had 111 participants; the RCBT had 110 participants while the CMT had 114 participants. The 335 participants consisted of 133 male and 202 female.

The English Language Achievement Test (ELAT) and Mathematics Achievement Test (MAT) were used to collect data for the study. The ELAT is a 100 items multiple-choice test in English Language put together by the researchers using past JAMB question papers from 2010 and 2014. The items attracted 100 marks, each with 4 options, A-D. Emphasis was placed on three main topics namely: Comprehension and Summary, Lexis and Structure and Oral forms. A test blueprint was also developed on these topics to enable the researcher assemble test items based on content and behavioural objectives of the topics under study (see Table 2). A total of 120 items were originally selected but for an item to be included in the final instrument after item analysis using Xcalibre 4.2.2.0: an IRT Item Parameter Estimation Software, two criteria must be met (a) discrimination index range from 0.2 to 0.5 and (b) difficulty index range from 0.30 to 0.70.

**Table: 1 Test Blueprint for the English Language Achievement Test**

CONTENTS	Weight	Behavioural Objectives			Total (100%)
		Understanding (30%)	Applying (40%)	Evaluating (30%)	
Comprehension & Summary	35%	10	20	5	35
Lexis and Structure	50%	15	25	10	50
Oral Forms	15%	5	5	5	15
<b>Total</b>	<b>100%</b>	<b>30</b>	<b>50</b>	<b>20</b>	<b>100</b>

Fifty multiple-choice test items were selected by the researcher using JAMB past question papers from 2010 to 2014. The items used were based on the table of specification (TOS) constructed for this instrument (see Table 3). The MAT consisted of 50 objective items which attracted 50 marks, each with 4 options. Emphasis was laid on five topics namely: Number and Numeration, Algebra, Geometry and Trigonometry, Calculus and Statistics. 80 items were originally selected but for an item to be included in the final instrument after item analysis using Xcalibre 4.2.2.0: an IRT Item Parameter Estimation Software, two criteria must be met (a) discrimination index range from 0.2 to 0.5 and (b) difficulty index range from 0.3 to 0.7.

**Table: 2 Test Blueprint for the Mathematics Achievement Test**

CONTENTS	Weight	Behavioural Objectives			Total (100%)
		Understanding (30%)	Applying (40%)	Evaluating (30%)	
Number and Numeration	20%	2	5	3	10
Algebra	30%	5	6	4	15
Geometry and Trigonometry	20%	3	4	3	10
Calculus	10%	3	1	1	5
Statistics	20%	2	4	4	10
<b>Total</b>	<b>100%</b>	<b>15</b>	<b>20</b>	<b>15</b>	<b>50</b>

The ELAT and MAT were pilot tested in a Local Education Authority that was not selected for the main study. The pilot study was designed to try-out the examination modes on a mini scale and to determine the psychometric properties of the instruments. The pilot study started with a total of 135 students. The students

were reduced to 51 students after exposing them to the PIAT. The internal consistency of the instrument was determined using Cronbach alpha reliability. The process yielded a reliability of 0.74 and 0.81 for ELAT and MAT respectively.

The data collected from the various instruments were analysed using both descriptive and inferential statistics appropriate for each hypothesis. The means and standard deviations were computed for all the groups where applicable. The hypotheses were analysed using analysis of variance (ANOVA). Both hypotheses were tested at 0.05 level of significance.

## Results

Hypothesis 1: Performance in English Language Achievement Test does not significantly differ among participants in the experimental groups.

**Table 3: Descriptive Statistics on English Language Achievement Test**

Groups	N	Mean	SD
RPPT	111	31.31	11.86
RCBT	110	45.65	10.18
CMT	114	44.39	13.93
Total	335	40.47	13.7

Figures from Table 3 shows that the mean score performance of the participant in English Language Achievement Test for RPPT, RCBT and CMT were 31.31, 45.65 and 44.39. The RCBT had the highest mean score of 45.65. To determine whether significant difference exists in the ELAT among the participants in the testing groups, an Analysis of Variance (ANOVA) was done. The result is presented in Table 4.

**Table 4: ANOVA on English Language Achievement Test among Testing Groups**

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	14015.579	2	7007.790	47.790	0.000
Within Groups	48683.776	332	146.638		
Total	62699.355	334			

The ANOVA results presented in Table 4 shows that the F-value of 47.79 was greater than the F-critical value of 3.09, given 2 and 332 degrees of freedom at 0.05 level of significance. Since the calculated F-value was greater than the F-critical value, hypothesis 3 was rejected. This therefore suggests that the performance in ELAT significantly differed among the testing groups. As a result a pair-wise comparison was done to determine which pair of the groups recorded significant difference. The result is presented in Table 5.

**Table 5: Pair-Wise Comparison on English Language Achievement Test among Testing Groups**

(I) Testing Group	(J) Testing Group	Mean Difference (I-J)	Sig.
RPPT	CMT	-13.07966*	0.0000
	RCBT	-14.33915*	0.0000
	CMT	1.25949	0.4370
	RPPT	13.07966*	0.0000

\*. The mean difference is significant at the 0.05 level.

Employing the LSD post-hoc test, Table 5 show that RCBT with mean difference of 14.339 and CMT with a mean difference of 13.079 had significant difference when compared with RPPT. This shows that participants in the groups tested with computer system (that is, RCBT and CMT) had significant difference when compared with participants that used paper and pencil test. However, there exist no significant mean differences among the two types of computer based form of test (that is, Randomized computer-based and multimedia test).

Hypothesis 2: Performance in Mathematics Achievement Test does not significantly differ among participants in the experimental groups.

**Table 6: Descriptive Statistics on MAT**

Testing Groups	N	Mean	SD
RPPT	111	12.16	10.38
RCBT	110	19.2	9.5
CMT	114	15.71	7.15
Total	335	15.68	9.51

The results in Table 6 show the participants in the RCBT group had the highest mean score of 19.12, followed by those in CMT with 15.71 while participants in the RPPT group had the lowest mean score of 12.16. To determine whether significant difference exists in Mathematics Achievement Test across the testing groups, Analysis of Variance (ANOVA) was done. The result is presented in Table 7.

**Table 7: ANOVA on Mathematics Achievement Test and Testing Groups**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2736.836	2	1638.418	16.533	0.000
Within Groups	27480.020	332	82.771		
Total	30216.856	334			

Table 7 shows that the obtained F value of 16.533 was greater than the F-critical value of 3.09, given 2 and 332 degrees of freedom at the 0.05 level of significance. Since the calculated F-value was greater than the F-critical value, hypothesis 4 was rejected. This, therefore, implied that performance in Mathematics Achievement Test significantly differed among participants in the CMT, RCBT and RPPT groups. As a result, a pair-wise comparison was done to determine which pair of the groups differed significantly. The result is presented in Table 8.

**Table 8: Pair-wise Comparison of MAT among the Testing Groups**

(I) Testing Group	(J) Testing Group	Mean Difference (I-J)	Sig.
RPPT	CMT	-3.55*	0.004
	RCBT	-7.04*	0.000
RCBT	CMT	3.49*	0.004
	RPPT	7.04*	0.000
CMT	RCBT	-3.49*	0.004
	RPPT	3.55*	0.004

\*. The mean difference is significant at the 0.05 level.

Table 8 indicates that participants in the three testing groups were heterogeneous in the Mathematics performance. The highest performance was achieved by the participants in the RCBT testing mode who differed significantly from those in the RPPT mode (mean diff. = 7.04) and those in the CMT testing mode (mean diff. = 3.55). Also examinees who utilized the CMT mode differed significantly from those in RPPT mode (mean diff. = 3.49).

### **Discussion of Findings**

Hypothesis One states that 'performance in English Language Achievement Test does not significantly differ among participants in the three testing groups'. This hypothesis was rejected. The findings indicated that the participants exposed to Randomised Computer-Based Test (RCBT) performed significantly better in English Language than those in the Computer Multimedia Testing (CMT) and the Randomised Paper-Pencil Test (RPPT). One possible explanation for the effect of using computers is that computers enable each individual to work at his own pace. The user may move freely from one component to another as he wishes and according to his needs. However, the non-familiarity with the Computer Multimedia Testing (CMT) mode might have had impact on the performance of the participants as many were struggling to control the mouse dragging and dropping their answers or matching them to the questions. Pommerich (2004) also compared the performance of students in English Language using computer-based test and paper-pencil test and discovered that averagely, students' performance was higher on computer for English Language tests than paper-pencil test. The findings of this study are also in agreement with Abu-Seileek (2004), who reported that those who took computer-based test performed significantly better than those in the traditional paper-pencil group. The study is also consistent with Bataineh and Bani (2011) who emphasized that the computerized method is more beneficial for students than the traditional paper-pencil.

Hypothesis Two states that 'performance in Mathematics Achievement Test does not significantly differ among the participants exposed to the three testing conditions'. This hypothesis was rejected. The findings showed that the participants in Randomised Computer-based Test (RCBT) performed significantly better again in the Mathematics Achievement Test than the participants in other groups. The differences could be attributed to a number of reasons such as examinees' exposure to computers, software familiarity and administration condition. There is no doubt that the novel application of the Computer multimedia test which most of them had not seen before the study contributed to the low performance of those in that group. The finding is in harmony with the study of Rand, Jame, Andreas, Brent, Bruce and Fred (2008) who reported that candidates' performance in a computer-based Mathematics test was significantly lower statistically than the paper-based test. In addition, computer availability predicted online Mathematics test performance after controlling for performance on a paper-based Mathematics test, suggesting that degree of familiarity with computers may matter when taking a computer-based Mathematics test in NAEP. The above findings also agreed with that of Kapoor and Welch (2011) who carried out a study which compared students' performance on paper-pencil (PPT) and computer-based test (CBT) on a large-scale state-wide Mathematics assessment. They reported that average grade five students found the PPT slightly easier than CBT while grade eight students found the CBT slightly easier than PPT.

### **Conclusion**

There is no doubt to the positive impact of Information and Communication technologies (ICTs); especially, CBT, on student learning and achievement owing to improved student motivation and engagement associated with ICT usage in education. Especially with the opportunities CMT provides for learners to develop different skills thereby promoting learning and empowering teachers and learners in transforming teaching and learning.

## **Recommendations**

Examination bodies that are yet to key into ICT, should adopt the CBT mode and gradually move to the CMT mode in their assessment programmes so as to benefit from the largesse of this type of examination. It is also recommended that, the onus rests on all stakeholders, especially the government to provide appropriate and adequate engaging ICT-based instructional materials to optimize the benefits accruable from the usage of the multimedia mode of test administration.

## **References**

- Abu–Seileek, A. (2004). Designing a Computer Assisted Language Learning (CALL) Program and testing its effectiveness on students' writing ability in English. (Unpublished Doctoral Thesis) Amman Arab University for Graduate Studies, Amman – Jordan. Retrieved from <https://www.researchgate.net/publication/220413670>.
- Adekale, C.A. (1993): Incidence and causes of examination malpractices among students of University of Ilorin: *Nigerian Journal of Educational Foundation* 4(1) 18-41.
- Adeyemi, T.O. (2010). Examination malpractice among secondary school students in Ondo State, Nigeria: Perceived causes and possible solutions. *Journal of Educational Administration and Policy Studies*, 2(3), 48-55.
- Bataineh, R., &Bani H., N. (2011). The effect of a CALL program on Jordanian sixth-grade students' achievement. *Teaching English with Technology*, 11(3), 3-24.
- Bennett, R. E. (2014). Consequential decisions from continuously gathered electronic interactions: Could it really work? Paper Delivered at the Annual Meeting of the National Council for Measurement in Education. Retrieved from <https://scholar.google.com/citations?user=XZNTUZIAAAAJ&hl=en>
- Brown, R. & Porter, T. (1996). Why study Mathematics? Retrieved from <http://www.popmath.org.uk/centre/pagescpm/imahob95.html>
- Cizek, G. J. (2001). An overview of issues concerning cheating on large-scale tests. Paper presented at the annual meeting of the National Council on Measurement in Education, April, 2001, Seattle, Washington.
- Jodoin, M.G. (2003). Measurement efficiency of innovative item formats in computer-based testing. *Journal of Educational Measurement*, 40 (1), 1-15.
- Kapoor, S. and Welch, C. (2011). Comparability of paper and computer administrations in terms of Proficiency Interpretations. A paper presented at the annual meeting of the National Council on Measurement in Education New Orleans, LA.
- Kuku, O. O. (2016). Impact of testing on test anxiety, study habits and achievement in mathematics among secondary school students in Ogun State, Nigeria. (Unpublished Doctoral Thesis), University of Lagos, Akoka, Nigeria.
- Lammers, W. J. &Badia, P. (2005). *Fundamental of Behavioral Research*. California: Thomson and Wadsworth.
- Measurement Research Associates, (2010). Computer based testing. Retrieved from <http://www.measurementresearch.com/testing/default.shtml>
- Oduwaiye, R. O. (2014). Students' Perception of Factors and Solution to Examination Malpractices in Nigerian Universities: A case study of the University of Ilorin. [www.academia.edu](http://www.academia.edu)
- Olatunbosun, J. B. (2009). Examination malpractice in secondary schools in Nigeria: What sustains it? *European Journal of Educational Studies* 1 (3), 6-7.
- Onokwakpor, L. O. (2005): Reducing Examination malpractice, Charlton Prints Printing and Publishing Company, Ikot Ekpene, Nigeria, 2005.
- Parshall, C. G., Harnes, J. C., Davey, T., & Pashley, P. J. (2010). Innovative item types for computerized testing. In W. J. van der Linden & C. A. W. Glas (Eds.), *Elements of adaptive testing* (pp.215-230). New York: Springer.
- Pommerich, M. (2004). Developing computerized versions of paper-and-pencil tests: Mode effects for passage-based tests. *The Journal of Technology, Learning, and Assessment*, *International Journal of Educational Research Vol. 5, No 1, 2018*

2 (6), 33-44.

- Popoola, K., Akintunde, A. & Jimoh, I. (2014). Analysing past Unified Tertiary Matriculation Examination (UTME) Use of English for improved teaching and testing. A paper presented at the 32nd AEEA Conference, Livingstone, Zambia, 2014.
- Prometric, (2005). Test delivery options. Retrieved from <https://www.prometric.com/en-us/news-and-resources/reference-materials/pages/Test-Delivery-Options.aspx>
- Randy, E., Jame, B., Andreas, O., Brent, S., Bruce, K., & Fred. Y (2008). Does it matter if i take my mathematics test on computer? A Second empirical study of mode effects in NAEP. *The Journal of Technology, Learning and Assessment*, 6 (9), 56-62.
- Scalise, K., & Gifford, B. (2006). Computer-based assessment in e-learning: A framework for constructing "Intermediate Constraint" questions and tasks for technology platforms. *Journal of Technology, Learning, and Assessment*, 4 (6), 1-45.
- Wilayat, M. (2009). Examination Malpractice: Causes of examination malpractice/unfair Means. Retrieved from <http://research-educationedu.blogspot.com.ng/2009/07/examination-malpractice.htm>