Analysis of the Effect of Computer Based Examination Introduced by Jamb

Peter Buoye & Oluwafunke Bada

Department of Computer Science, Federal Polytechnic, Ilaro, Ogun State, Nigeria
adewuyi.buoye@federalpolyilaro.edu.ng; oluwafunke.bada@federalpolyilaro.edu.ng

Abstract

Joint Admission Matriculation Board (JAMB) introduced partial Computer Based Examination (CBE) to conduct its exams in 2013 and 2014, in 2015, there was a complete transition from Paper Based Examination (PBE) to Computer Based Examination. The reason for the introduction of Computer Based Examination was to eliminate examination malpractices among others. This paper statistically studied the performances of students before CBE was introduced and during the use of CBE. This paper put forward three research questions which are: compare the academic performance before and during the introduction of CBE, investigate whether examination malpractice has been eliminated and investigate the influence of examination malpractices on the performance of the pr-CBE era. Using JASP statistical tools, the Mann-Whitney U test gives the p-value to be equal to 0.007) which is more than 0.05 significant test that shows that candidates performed better during the pre-CBE era than during the CBE-era. Pearson's r correlations (r = 0.566, p = 0.069) shows that there is no correlation between the performance of students in the pre-CBE era and the examination malpractices observed during the pre-CBE era.

Keywords: computer-based test, paper-based test, unified tertiary matriculation examination

1. Introduction

JAMB was given birth to in 1977 as a result of varying concessional entrance examinations with no particular structure that were conducted by each of the 13 Tertiary Institutions in Nigeria then (Mayowa, 2015). This uncoordinated system of entrance examinations prompted the committee of vice-chancellors to clamour for a unified body to conduct a pre-varsity examination. For 32 years, the body supervised and conducted two sets of examinations; one for university entrance called University Matriculation Examination (UME) and the second examination for Polytechnics/Colleges of Education (PCE).

In 2010, the two entrance examinations were combined to give birth to a new nomenclature (Wikipedia) called Unified Tertiary Matriculation Examinations (UTME). Since the commencement of the examination, the board has been conducting the exams, using the paper and pencil method. Professor Dibu Ojerinde, the JAMB registrar, 2013 introduced a computer-based test which implies that candidates will be writing the unified tertiary examination on a computer system. However, Computer Base Examination was only partially introduced. Only a few candidates and a few centres made use of the new technology. This new technology was introduced to serve as a solution to the rampaging examination malpractices that characterized the unified tertiary matriculation

examination. In 2015, Unified Tertiary Matriculation Examinations (UTME) was written using computer-based technology which mark the beginning of a new era.

Dayo (2012) in his article said that formal education minister Professor Ruqayyatu Rufa'í and formal JAMB registrar, professor Dibu Ojerinde while addressing the press stated that one of the objectives of the e-testing was to ensure 100 per cent elimination of all forms of examination malpractices. Another justification highlighted for the introduction of electronic test is to encourage computer literacy. It was as a result of this that this study was conducted to determine the performance of students when it was Paper Pencil Examination (PPE) and the performance of students using Computer Based Examination (CBE).

Ojuawo & Oduntan (2015), defined computer-based tests as "assessments that are administered by computer in either using stand-alone devices linked to the internet or World Wide Web (www) most of them using multiple-choice questions." Abubakar and Adebayo (2014) opined that some major reasons for introducing Computer Base Examination for Unified Tertiary Matriculation Examination were to inhibit the rate of examination misconduct and also to speed up the release of results. Mayowa (2015), in his article, stated the following as examination misconduct: evolution of special centres; some candidates getting questions before the exam; writing examination under little or no supervision; coming into the exam hall with chips; some candidate paying their way through.

Professor Adeyemi Isaac said that irregular power supply, computer literacy gap between students in the city and the village and capital are major factors that may discourage the idea of using Computer assessment for JAMB. (Dayo, 2012). The then Vice-Chancellor of the Bell University, Ota, however, debunked the claim of total freedom from examination malpractice (Dayo, 2012). Talking of elimination of all forms of examination malpractices, nigeriascholar.com and daily school news, said over 116 Computer Base centres and JAMB centres were delisted between 2017 and 2019.

Oladimeji and Mwuese (2018) in their paper concluded that Computer Based Examination (CBE) is a good method of assessment, because It enhances students' performance and gives credibility of scores, is consistent, and do not suffer from human error. The duo nevertheless gave some setbacks of the examination mode such as power failure, network failure, good infrastructural facility and questions leakage.

Nkwocha, Akanwa and Nkwocha (2015) in their paper concluded that challenges experienced by 2015 Computer Based UTME candidates in Owerri zone (Nigeria) were; power failure, an insufficient supply of computers, candidates' incompetence in the use of computers, non-provision of adequate assistance for candidates who had technical hitches, use of faulty computers and fluctuation in-network service, inconveniences caused by posting candidates far from their homes by JAMB and provision of unfavourable timing of exam sessions for some candidates.

However, the authors of the paper on Computer Based Examination have greatly researched the advantages of using Computer Assessment and the factors litigating against the Computer Assessment method of examination. Has the Computer Assessment method, as it stands today, improved the performance of the students better than the previous Paper Base method? What effect does it have on the general performance of the students? This is the focus of this paper to compare the general performance of students before the introduction of the Computer Assessment method with the performances of students while using the Computer Assessment method.

2.   Research Methodology

Research Design

The total number of students who wrote the JAMB examination during the 11 years under the research period (2010-2020) was 17, 170,272. This was the population for the study. Table 1 below shows the population distribution of the students.

The period 2010 -2020 was chosen because of two reasons which are;

i.   Unified tertiary matriculation examination, which is the combination of UME and PCE, started in the year 2010 which enabled us to have the performance of all the candidates sitting for the examination conducted.

ii.   During this period, this Unified tertiary matriculation examination was conducted by JAMB using two different methods which are Paper & Pencil Test (PPT) and Computer-Based Examination (CBE) approaches.

Sources of Data

This study made use of secondary data collected from different websites on the internet. Secondary data analysis though saves time that would otherwise be spent on collecting data, it can also be a source of problems because the data obtained may be out of date or inaccurate.

Table 1: Statistics of Students Performance in Unified Tertiary Matriculation Examination

Year	Total Students	Total Withheld Result	% of Withheld Result	Total Invalid Result	% of Invalid Result	Score ≥200 Population	% of Score≥200 Population
2010	1,276,795	20,780	1.63	96451	2.22	501,463	41
2011	1,493,604	15,160	1.01	28,069	1.88	597,494	40
2012	1,503,931	27,266	1.81	5,161	0.34	673,394	45
2013	1,644,110	12,110	0.74	47974	2.92	733,315	44.6
2014	1,015,564	2,494	0.25	36164	3.56	109,844	10.82
2015	1,475,600	2581	0.17	NA	NA	154,348	10.46
2016	1,592,905	3462	0.22	NA	NA	569,623	35.76
2017	1,772,236	2508	0.14	NA	NA	465,025	27
2018	1,652,825	280	0.02	NA	NA	414,696	25.09
2019	1,792,719	16586	0.93	NA	NA	427,156	24
2020	1949983	195	0.01	NA	NA	404542	20.75

Table 1 above, 2013 recorded the highest number of students who scored above 200 marks as compared to the other years of understudy while 2014 recorded the least. The number of students who sat for the exam in the respective years is as indicated in table 1. There was no figure recorded for invalid registration since 2015 when the Computer Based exams started till date. This is because the registration is online and the students did not need to shade using pencil since most of the invalid registration is from improper shading Likewise 2015 and 2016, only the total number of students who sat for the exam and the total number of students who scored above 200 mark were able to obtain. Educeleb.com stated that the leadership of JAMB did not take other analyses into cognizance.

H₀: The performances of students in JAMB examinations during the pre-computer Based era are better than their performances during the Computer Based era.

H₁: The performances of students in JAMB during the pre-computer Based era are not better than their performances during the Computer Based era.

3.   Data Processing and Analysis

The analysis of the data that was obtained from website pages provided means to answer the research questions. This data from the internet were tabulated and entered into software, JASP data analysis software, to process the data. A combination of descriptive and inferential statistics was used to analyse the data to provide results. The data on the demographic characteristics of the respondents were analyzed with the use of graphs and percentages

Students' performances over eleven (11) years were studied, and the percentage performances were statistically analyzed. Data collected were analyzed under the following.

  i.   total number of students who sat for the exam,
  ii.   the total number of students who scored above 200,
  iii.   the total number of students whom their results were withheld due to examination malpractices
  iv.   and the total number of students whose registrations were not valid due to improper shading.
        The collected data is represented shown in Table 1.

Research Question One: What are the academic performances of the pre-computer Based era and the Computer Based era

The research question was to determine the academic performance of students during the pre-computer Based era and the Computer Based era during the eleven years under study. The collected data of students' scores in JAMB for the eleven years were analyzed with the use of means and standard deviations.

Hypothesis testing.
Table 2 shows the population of students with 200 and above marks and their percentages.

ABOVE 200	% of 200 above	CB USED
501,463	41	no
597,494	40	no
673,394	45	no
733,315	44.6	no
109,844	10.82	no
154,348	10.46	yes
569,623	35.76	yes
465,025	27	yes
414,696	25.09	yes
427,156	24	yes
404542	20.75	yes

Descriptive analysis
By using JASP data analysis software, the mean, standard deviation and standard error of the data in table 2 is given in table 3.

Table 3: descriptive analysis for parametric independent test

	Group	N	Mean	SD	SE
% of 200 and above	no	5	36.284	14.401	6.440
	yes	6	23.843	8.273	3.378

The descriptive table above provides information about the number of years per group, the sample means, the observed standard deviations and, and the standard error. The standard error is the ratio of observed standard deviations to the square root of the sample size.

Table 4: assumption Normality test **(Shapiro-Wilk)**

		W	p
% of 200 and above	no	0.684	0.007
	yes	0.959	0.813

From table 4 (Test of Normality) above, the p-value for pre-Computer Based (no case) is significant (0.007) as it is less than 0.05 while the p-value for Computer Based period is not significant (0.813), therefore the data is not normally distributed. Mann-Whitney U test, which is a non-parametric independent test was then carried out to give table 6 below.

The independent sample test table below shows all the test statistics values; the t-value, the probability value (p-value), degrees of freedom, the mean difference, the standard error of the difference, and Cohen's d, which gives the estimate of the population effect size.

Table 5: independent Sample test

	Test	Statistic	df	p	Mean Difference	SE Difference	Cohen's d
% of 200 above	Student	1.801	9.000	0.105	12.441	6.909	1.090
	Welch	1.711	6.132	0.137	12.441	7.272	1.059

Using Mann-Whitney U Test for Non-Parametric Analysis

Table 6: Independent Samples T-Test using Mann-Whitney U test**.**

	W	df	p	Hodges-Lehmann Estimate	Rank-Biserial Correlation
% of 200 above	25.000		0.082	16.500	0.667

From the Mann-Whitney U test table above, the p-value (=0.082) is more than 0.05 significant test. This made us adopt the null hypothesis which says the performances of students in JAMB examinations during the pre-computer Based era are better than their performances during the Computer Based era and drop the alternative hypothesis which says the performances of students in JAMB during the pre-computer Based era are not better than their performances during the Computer Based era. JAMB examination conducted without the use of a computer shows a better performance with a median =597.494 and U(related to sample size)=25 (table 6 above).

Table 7: Descriptive Statistics for non-parametric independent test

| | ABOVE 200 | |
	no	yes
Valid	5	6
Missing	0	0
Median	597.494	446.091
IQR	171.931	125.662

Research Question Two: what trend exists in the population of students who were engaged in examination malpractices?

Table 8a: Population of withheld result

Table 8b: Population of withheld result (Prune)

YEAR 20xx	WITHELD	YEAR 20xx	WITHELD
2010	20780	2010	20780
2011	15160	2011	15160
2012	27266	2012	27266
2013	12110	2013	12110
2014	2494	2014	2494
2015	2581	2015	2581
2016	3462	2016	3462
2017	2508	2017	2508
2018	280	2018	280
2019	16586	2019	1805
2020	195	2020	195

From table 8a above, examination malpractice was observed to be relatively higher during the time of the Paper and pencil Examination (2010-2014). During the Computer Based Assessment (2015-2020), 2019 has an outrageous value of examination malpractice population. In data science, a figure like this is called an outlier which can either be removed or be replaced with the average of the values in 2015-2020 (table 8b).
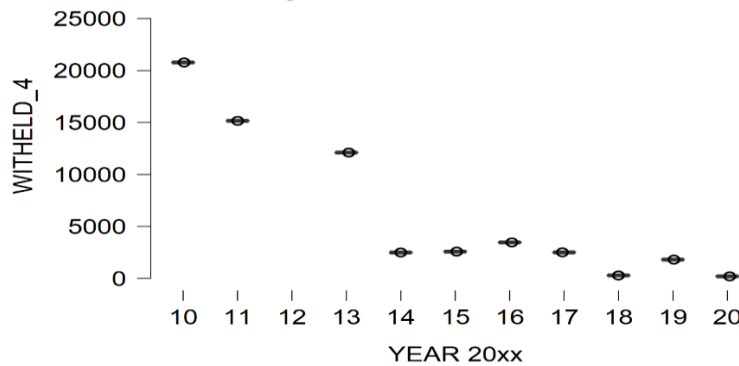
Figure 1: Graph of the withheld results due to exam malpractices vs year.

The graph above shows a pattern of two clusters, a group for the pre-computer Based period (2010-2013) when examination malpractices were high and a second group for the period of Computer-Based Assessment (2014-2020) when examination malpractices were reduced.

Research Question Three: Investigate the influence of examination malpractices on the performance of the pre-computer Based era.

This research question is looking at the influence of examination malpractice on the performance of the pre-computer Based era. It has been statistically proven above that the performance of the pre-computer Based era is better than the performance of the Computer Based era. Could this be a result of high level of examination malpractice during this era? To find out this, a correlation analysis was carried out on the percentage of the population with a 200 and above score (% of 200 and above) and the percentage of the population whose results were withheld due to examination malpractices (%withheld) and the table 9 below was given. But to make sure that assumptions are not violated, a normality test was carried out on (% of 200 and above) and (%withheld).

The assumption check of normality (Shapiro-Wilk) (Table 9 below) is not significant because the value of the probability test, p-value, is more than 0-05. This is suggesting that the pairwise differences are normally distributed, therefore the assumption is not violated.

Table 9: Test of Normality (Shapiro-Wilk)

		W	**p**
% of 200 above	- %withheld	0.895	0.159

Table 10: Pearson's correlation between scores 200 and above and percentage exam. malpractices

		Pearson's r	**p**
ABOVE 200_9	- WITHHELD	0.566	0.069

The Pearson's r correlations (r = 0.566, p = 0.069) shows that there is no correlation between the performance of students in the pre-computer Based era and the examination malpractices observed during the pre-computer Based era. Even the plot (fig 2 below) provides a simple visualization of this no correlation (r = 0.984, p>0.05).
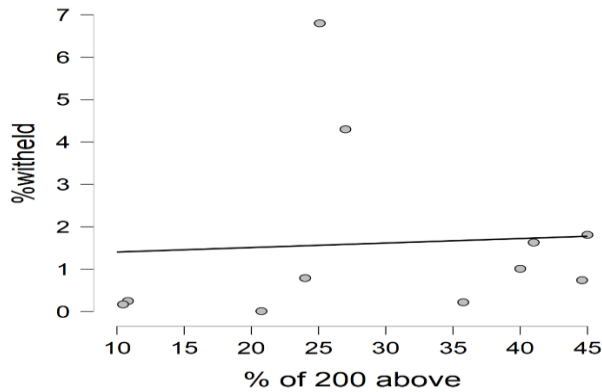

Fig 2: plot of correlation between % of 200 and above score and % withheld results

If correlation coefficient r is squared it will give the coefficient of determination (R^2) which represented the statistical measure of the proportion of variance in % of 200 and above score that is explained by the % withheld.

That is, R^2 = Explained variation / Total variation.

In the table 10 below, r = 0064, so R2 = 0.004. This suggests that examination malpractices account for 0.4% of the variance in the population of students that scored 200 and above in the pre-**era**.

Table 11: descriptive model summary table

Model	R	R^2	Adjusted R^2	RMSE
H_0	0.000	0.000	0.000	12.625
H_1	0.064	0.004	-0.107	13.281

4.   Conclusion

Research question one, which studied the performances during the pre-computer Based era and Computer-Based era concluded that the performance is better with more students scoring 200 and above when it was Paper and Pencil Examination PPE. The Mann-Whitney U test for a non-parametric-variables was conducted showing the p-value (=0.082) which is more than 0.05 significant test. This made us adopt the null hypothesis which says the performances of students in JAMB examinations during the pre-computer Based era are better than their performances during the Computer Based era and drop the alternative hypothesis which says the performances of students in JAMB during the pre-computer Based era are not better than their performances during the Computer Based era.

Research question two concluded that examination malpractices have dropped compared to the pre-Computer Based era. This might be as a result of the measures put together by JAMB to fight malpractices such as the sanction of some registration centres and installation of CCTV in examination halls.

From the research question three, it can be concluded that the performance during the PPE era, which had been statistically shown that be better than the Computer Based era was not associated with the higher level of examination malpractices. The statistical analysis shows a Pearson's r-value of 0.064 and R^2 value of 0.004 and a p-value of 0.853 a statistically non-significant value.

Another critical area that is very obvious is general performance. The population of Students who scored 200 and above marks during the Computer Based era dropped. The reason for this is not the focus of this research but it indicated the level of computer literacy among our teeming youth population in Nigeria is a major factor.

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