

A Comparative Analysis of Student Performance in Paper Pencil Test (PPT) and Computer Based Test (CBT) Examination System

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Accepted 15 April, 2015

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ABSTRACT

Assessment is a means by which the knowledge of students on lessons taught are measured. Computer Based Test (CBT) is assessments that are administered by computer in either stand-alone or dedicated network or by other technology devices linked to the internet or World Wide Web (WWW) most of them using multiple choice questions. The Paper Pencil Test (PPT) is the conventional method of writing exams. This paper focuses on the comparative analysis of student performance in CBT and PPT. A correlational analysis of CBT and PPT assessment method was used. This involves the use of questionnaire to collect data on the scores of students who wrote both CBT and PPT UTME exams in 2013 and 2014. Pearson Correlation was used for the analysis. Result showed a positive correlation in the scores of student, it is therefore concluded that, if students are well prepared for the CBT exams, their performance will be enhanced. It is recommended that government improve the technological awareness and utilization of computer based test at the primary and secondary school level for both the teachers and the students.

Key words: Assessment, Computer Based Test, Paper Pencil Test, Performance, Comparative Analysis.

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INTRODUCTION

Information technology has significantly transformed the method of assessment. In many academic domains, educational measurement has been moving from Pencil paper test (PPT) to the use of computer-based testing (CBT), defined as tests or assessments that are administered by computer in either stand-alone or dedicated network or by other technology devices linked to the internet or World Wide Web most of them using multiple choice questions (MCQs), (Sorana-Daniela and Lorentz, 2007).

Computer based tests have been used since 1960s to test knowledge and problem solving skills, (Peter et al., 2004). Computer based assessment systems have enabled educators and trainers to author, schedule, deliver and report on surveys, quizzes, tests and exams. There are two main types of computer based testing. The

most familiar type is where candidates fill in their responses on a paper form, which is fed into a computer optical mark reader. This reads the form, scores the paper and may even report on the test reliability. The second type of computer based testing is where computers provide an assessment interface for students; they input their answers and receive feedback via a computer, (Peter et al., 2004).

An effective method of student assessment technique is necessary in assessing student knowledge. Due to an increase in student numbers, ever-escalating work commitments for academic staff, and the advancement of internet technology, the use of computer assisted assessment has been an attractive proposition for many higher education institutions (Darrell, 2003).

Currently in most Nigerian institution, the traditional

method (a combination of essay examination and practical examination) is most used as evaluation of students' knowledge. In the past few years, the number of students increased drastically and the conventional examination method became time consuming in terms of the examination time for evaluation and assessment.

A solution of examination in large classes of students is an automated testing system which has not yet been fully introduced by institutions in the country, primarily to address this concern and others.

Generally, advantages of CBT systems over traditional paper-and-pencil testing (PPT) have been demonstrated in several comparative works and as mentioned by (Peter et al., 2004) CBT is not just an alternative method for delivering examinations, it represents an important qualitative shift away from traditional methods such as paper based tests. Despite, these advantages available in computerized test administration as it was shown that, it does not mean that CBTs are intrinsically better than paper-and-pencil tests (John et al., 2002).

Furthermore, whilst recognizing the system level advantages associated with CBT it is important to explore the relationship between assessment mode and the behavior of the students being assessed. If the term "affordances" is used to describe what is made possible and facilitated, and what is made difficult and inhibited by a medium of assessment (Johnson and Green, 2004). It is possible that the affordances offered by computer mediated assessment may affect the perceptions of students involved in computer-based assessment differently than if they were engaged in paper-based assessment (Johnson and Green, 2004). In general, several areas appear worthy of investigation, including issues related to quality factors that may influence performance and student perceptions regarding computer-based tests.

STATEMENT OF THE PROBLEM

Institutions across the globe are migrating toward the use of Computer Based Test (CBT) to test students' knowledge. The advantages of using computer technology for educational assessment in a global sense have been recognized and these include lower administrative cost, time saving and less demand upon teachers among others.

Johnson and Green (2004) reviewed the assessment mode, the behavior as well as perception of the students being assessed because the assumption of comparability between CBT and PPT without proper investigation within that particular testing context is inappropriate. Some test takers reported that, it is more difficult to navigate back to about grades, attitudes about convenience, control and validity. Some examinees have a general anxiety about the computer itself, while others are more concerned about their level of computer experience (John et al., 2002). Some other technical issues in CBT that affect students' response to the designed questions are: Use of

the mouse, font size, screen clarity, screen size, screen resolution, display rate and scrolling.

Furthermore, they have to be designed to minimize examinees' frustration and to limit the sources of examinee anxiety. These additional test design steps are well worth taking because of the effective and measurement improvements they offer. CBT implementation should also be constructed to meet the standard requirements such as that of International Test Commission (ITC) and has been summarized under four issues. These are: the Technology, Quality, Control, and Security.

LITERATURE REVIEW

There is a great transformation from the traditional mode of assessment to the modern method of the use of Computer-based test (CBT). Computer-based testing (CBT) is gaining popularity over the traditional paper-and-pencil test (PPT) due to many advantages that computer-based assessment provides. Meanwhile, more educators and researchers have shown interest in investigating the factors that influence students' CBT performance. There are many factors related to student characteristics, which includes student demographic attributes, learning style, computer familiarity and test anxiety.

According to Fyfe et al. (2005), it has been found that testing format does not affect test scores therefore CBT can be considered a valid and acceptable testing mode. As CBT began to be used for summative assessment, it is therefore important to establish whether computer based testing is comparable to that of paper based test. Researchers have performed large scale reviews of studies examining differences in performance of CBT and paper-based version of tests and have generally found that when CBT is similar in format to pencil and paper tests, it has little if any effect on test performance (Darrell, 2003). From students' perspective of the CBT there have been a number of mixed reactions.

Previous research showed that more people anticipated problems with the computer assisted assessment than actually had them (Erle et al., 2006). Their research also showed that despite fewer students being confident about CBT before completing the assessment more students stated a preference for CBT afterwards. Previous study conducted indicated a preference for CBT over PPT (Fyfe et al., 2005). Some studies reported the main disadvantage as being increased anxiety amongst those unfamiliar with use of computer (Erle et al., 2006) and as such students agreed that they are "technophobic". The challenge to test examinees by means of microcomputers demands appropriate software design.

The results of the effect of demographic attributes on students' CBT performance are not always consistent. For example, some studies indicate that gender was not related to performance differences between CBT and PPT (Clariana and Wallance, 2002; Alexander et al., 2001), while other studies suggest that gender is

associated with the test mode (Leeson, 2006; Gallagher et al., 2000), with male examinees benefiting from the CBT format more than female examinees who showed slightly poorer performance on CBTs. Though age was found to be associated with the test mode effect (Parshall and Kromrey, 1993). The study by Alexander et al. (2001) suggests no difference in the administration mode for age and class level. Consistent results were found in examinees' race associated with the test mode (Gallagher et al., 2000; Parshall and Kromrey, 1993). It was found that although the differences were quite small, some patterns were consistently found for some racial/ethnic groups, with African American examinees and Hispanic examinees benefiting from the CBT format (Gallagher et al., 2000). To explore whether family income was related to test mode effect, Pomplun and Custer (2005) examined the differences between format score means at grade level from K-3 for students eligible for free/reduced lunch and students not eligible for free/reduced lunch. Results showed that at every grade, the free/reduced lunch eligible students had larger score differences in favor of the PPT than for students not eligible for free/reduced lunch. In addition, these differences generally decreased as grade level increased, suggesting that family income and possibly computer familiarity may be related to PPT/CBT score differences and that the longer students are in school and exposed to computers, the smaller the score differences become.

Researchers also examined the relationship between student learning styles, online learning and testing. It should be mentioned that scholars define learning styles differently, and there is currently no widely accepted definition of what a learning style is. In a study by Johnson (2007) about learning style under two web-based study conditions, four learning styles (active-reflective, visual-verbal, sequential-global and sensing-intuitive) were considered and it was found that students who were more active than reflective expressed a preference for face-to-face study groups rather than online study groups and for online quizzes. Ames's study (2003) used Gregorc's definition of four distinct learning styles (Abstract Sequential (AS), Abstract Random (AR), Concrete Sequential (CS) and Concrete Random (CR)). The findings indicate that computer-based or computer-assisted instruction may not be optimal for all students. In their study to investigate the effects of formative assessment and learning style on student achievement in a Web-based learning environment. Wang and Huang (2006) used another four learning modes (concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE)). Results showed that both learning style and formative assessment strategy are significant factors affecting student achievement in a Web-based learning environment.

Computer familiarity was examined as another important factor that may have an impact on students CBT performance, but the results were not consistent. Some

studies suggested that computer familiarity was not related to performance difference between CBT and PPT groups (Clariana and Wallance, 2002; Bennett et al., 2008). Little or no performance difference was shown associated with students' computer familiarity, suggesting that computer experience does not affect students' CBT scores (Leeson, 2006; Edit, 2005; Taylor et al., 1999). On the other hand, other studies reported the opposite findings. For example, Goldberg and Pedulla (2002) found that students' computer familiarity was significantly associated with test performance in CBTs. Students with lower computer familiarity scored lower on CBTs than students with moderate and higher computer familiarity.

A few studies have examined the relationship between CBTs and student test anxiety. Results from these studies seem consistent, providing no support that CBTs will induce additional anxiety or impact performance levels (Cassady and Cridley, 2005; Stowell and Bennett, 2010). Shermis and Lombard (1998) also found for a written English exam, computer anxiety was not statistically significant for performance on the written English essay.

RESEARCH METHODOLOGY

A number of previous related works reviewed employed a quantitative approach using survey questionnaire as appropriate method of investigating students' performance in both computer based test and pencil-paper test. In this study, a statistical approach which involves a comparative analysis of data on students score from the PPT and the CBT exam will be performed using the Pearson Coefficient Correlation.

Pearson moment correlation(r) signifies the degree of relationship that exists between dependent variable and independent variable. In this study, the dependent variable is the Pencil-Paper test (PPT) denoted as X , while the independent variable is the Computer Based Test (CBT) denoted as Y . Equation 1 represents the Pearson correlation coefficient formula, the valid result for r lies between -1 and $+1$. If r lies between 0 and 1 , it shows that there is a positive correlation that is X increases as Y increases. If $r = 1$, it shows that the result is perfect positive. If r is between 0.5 and 1 , it shows a high positive correlation, when r is between 0 and 0.49 , it exhibit a low positive correlation. When $r = -1$, it shows a perfect negative correlation that is the rate at which the dependent variable increases is exactly equal to the rate at which the independent variable decreases. When r is between -0.49 and -1 , it exhibits a strong negative correlation. Below is the Pearson coefficient correlation formula:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}} \quad \text{Equation 1}$$

Where X represent the student's paper-pencil score and Y represent the computer-based test score and N is the

Table 1.Students Scores in PPT and CBT.

Students	CBT(X)	PPT(Y)
1	170	200
2	200	156
3	125	156
4	167	180
5	179	170
6	200	201
7	210	150
8	178	183
9	164	148
10	144	195
11	177	182
12	160	133
13	165	195
14	142	169
15	169	132
16	149	136
17	174	174
18	189	178
19	174	183
20	210	207
21	183	140
22	164	179
23	160	170
24	144	189
25	176	142
26	179	114
27	177	189
28	179	175
29	184	120
30	191	157
31	182	144
32	168	155
33	148	167
34	174	137
35	178	220
36	175	198
37	165	183
38	182	169
39	192	174
40	139	132
41	155	144
42	175	170
43	125	160
44	137	149
45	176	174
46	220	145
47	179	175
48	220	164
49	179	154
50	199	168

number of students analyzed.

DISCUSSION AND RESULT

In this study, data were collected from students who wrote the PPT and CBT exams of UTME in the year 2013 and 2014. Table 1 is a comprehensive table showing the

student's performance in CBT and PPT exams conducted by Joint Admission Matriculation Board. A sample of fifty students' scores were randomly collected from the Yewa South Local Government Area of Ogun State. These sets of students wrote UTME exam using the PPT mode of testing in either of the year 2013 or 2014. Therefore, a particular student represented below has a UTME score for both PPT and CBT exam.

Table 2. Analysis of Students' scores in CBT and PPT.

Score Range	PPT	CBT
>= 200	4	5
150-199	34	33
<150	12	12

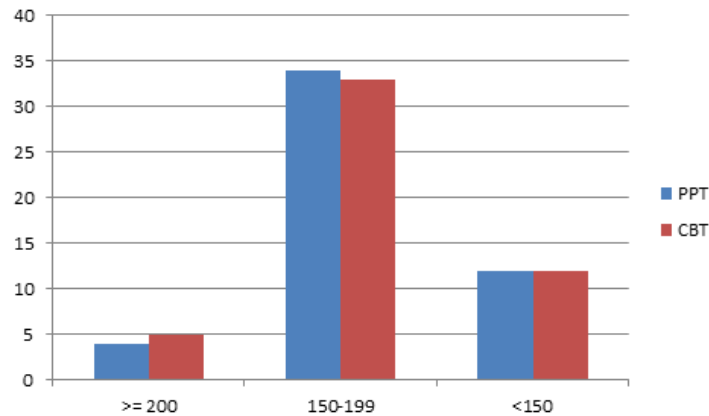


Figure 1. A Chart of comparison between PPT and CBT student Performance.

The correlation coefficient, r of 0.087993 which is approximately 0.1 is derived, this exhibit a low positive correlation between the students' performances in CBT and PPT exams conducted by the Joint Admission Matriculation board (JAMB) for the year 2013 and 2014. Further, analysis was performed on table 1 to examine the number of students who scored 200 and above, those who scored between 150 and 199 and those who scored less than 150, the result is represented in table 2. In table 2, result shows that four (4) students who wrote the PPT exam of UTME scored 200 and above while that of the CBT is five (5) students, thirty four (34) students who wrote the PPT exam of UTME scored between 150-199 while that of the CBT is thirty-four (33) students; and twelve (12) students scored below 150 in both the PPT and the CBT exams of UTME. Table 2 is represented using a bar chart (Figure 1). The bar chart shows the comparative analysis of the students' performance in the PPT and CBT examination.

Conclusion

From this study, it has been observed that students generally are becoming interested in the use of modern method of assessment, which is the computer-based test. During the analysis, it was clear that the performance of the students when they wrote the computer-based test were better than the performance of the same students who wrote the paper-based test. It can therefore be said that computer-based test should be encourage and enhanced at various level of educational assessment.

The result also showed that, the conducive environment provided by the system and receiving results automatically using the CBT system is an advantage of the new system. It is hereby concluded that there is need for basic training on general use of computer before exposure to CBT mode of assessment to aid the effectiveness of the computer-based testing.

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