Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.5, No.11, 2014

Optimizing e-Learning Opportunities for Effective Assessment in Science Education in Nigerian State Universities

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Abstract
This study ascertained the optimization of e-learning opportunities for effective assessment in Nigerian state Universities. The study was a descriptive survey carried out in South-South and South-East states of Nigeria. 80 lecturers from South-South and 80 lecturers from South-East states formed the sample. Simple random sampling without replacement was used to select the sample. Three research questions and three null hypotheses guided the study. The instrument for data collection was a 24-item questionnaire structured by the researchers. The questionnaire was validated and trial tested. A reliability of 0.81 was established using Cronbach Alpha Technique. Analyses were made using mean and standard deviation for research questions while z-test statistics was used to test the null hypotheses at 0.05 alpha level. The result showed that e-assessment would yield objective results with great reliability. Recommendations were made which include that government should fund state universities adequately by providing e-learning tools to be used for effective e-assessment in science education.
Keywords: Assessment, Constraints, e-Learning, Opportunity, Optimizing, Science Education, State University.

Introduction

Science education is the bedrock of technological development of any nation. The aim of education amongst others is to contribute to the development of the mind and self; to provide pupils/students with essential knowledge required to survive in the natural world; to secure a happy life to serve the individual human being; to guide him into an awareness of his condition and promote his successful commitment to a significant and meaningful existence. Furthermore education which is regarded as a great investment, is a long term investment by the state/nation to make itself a better place to live and a better place to make a living.

Hence science education could be seen as the training and acquisition of scientific knowledge through observation and analysis of events or natural phenomena that helps an individual to integrate himself/herself effectively into the society. It can also be seen as knowledge got from empirical reasoning that produces initiative for man's development through which his life is modified and simplified (Ifeakor, 2004).

A man can only create something of which he has a vision; for everything that is now proved was once only imagined. To actually acquire this scientific knowledge, skills and attitude, one has to think about what the educational outcome (product) would look like. To this end, the system of education needs to be revolutionized in terms of the methods and instruments with which to carry out such tasks in order to bring about individuals that would effectively fit into the work force in this 21st century.

It therefore followed that the conventional classroom teaching, learning and assessment in Nigeria institutions of higher learning are grossly inadequate and ineffective and therefore calls for a change in the methods of teaching and assessment in particular. The objectives of an educational programme should invariable determine the curricular contents, the methods and materials needed for curriculum implementation as well as the strategies and instruments needed for measuring learning outcomes. It has been indicated that educational assessment strategies, as well as the use to which the results of evaluation are put, have tremendous influences on teachers' curriculum implementation strategies and students learning styles. Just as learning and teaching are undergoing transformation, so too is assessment which seems to be on a faster track. This would be accomplished by the introduction of e-learning as well as e-assessment in education.

The recent trends in the assessment of students' academic performance at the university level demand a new approach to assessment using e-learning in which assessment plays an integral part of instructional activities. E-learning has become one of the most important and potentially significant and efficient instructional methods to improve teaching, learning and assessment. It is facilitated and supported through the use of Information and Communication Technology (ICT) (Asogwa, 2007). The development of e-learning products and the provision of e-learning opportunities is one of the most rapidly expanding areas of education, training and assessment.

E-learning is essentially the network-enabled transfer of skills and knowledge, and refers to the usage of electronic applications and processes to learn. Its applications and processes include web-based learning, computer-based learning, virtual classroom and digital collaboration. It is education delivered via the internet, intranet/extranet, audio or video tape, satellite television and CD-ROM. It can also be used for the assessment of

learning outcomes.

E-learning is preferred for a variety of reasons: it provides consistent and worldwide training, reduces delivery cycle time, increases learner's convenience, reduces information overload, improves tracking and lowers expenses (Welsh, Wanberg, Brown, Simmering, 2003). It provides visual classroom that allow the tutor to present materials to any number of people at the same time and also chat rooms to enable a learner to invite another learner logged into they system to engage in synchronous discussion. It has back-end database to handle all the learning materials and assessment instruments. As aforementioned, e-learning which is computer-based could be used for assessment of different learning abilities.

Meanwhile, let us take a look at what assessment is and how ICT Technologies could be used to bring about quality educational outcome in this information age through the optimization of e-learning opportunities for effective assessment in science education. Assessment is the process of gathering information/data and fashioning them into an interpretable form for decision-making. Haken 92006) defined assessment as an integral piece of assuring that an educational institution achieves its learning goals, as well as a crucial means of providing the essential evidence necessary for seeking and maintaining accreditation. In the same vein, Hersh (2004) advocated the position that assessment of students' learning should be considered an integral part of the teaching and learning processes as well as part of the feedback loop that serves to enhance institutional effectiveness.

Good assessment serves multiple objectives and benefits a number of stakeholders. According to Dietal, Herman and Hnuth (1991), assessment provides an accurate measure of students' performance to enable teachers, administrators and other key decision makers to make effective decisions. As a result, Kellough and Kellough (999) identified eight (8) purposes of assessment:

1. Improve student's learning;
2. Identify students' strengths and weaknesses;
3. Review, assess and improve the effectiveness of different teaching strategies;
4. Review, assess and improve the effectiveness of curricula programmes;
5. Improve teaching effectiveness;
6. Provide useful administrative data that will expedite decision making;
7. Produce quality educational products; and
8. To communicate with stakeholders.

This lends to the fact that e-assessment, which is part of e-learning technologies, would be employed in the assessment process. E-assessment can be seen as the use of electronic technologies to drive students' assessment. E-assessment supports the assessment of higher order thinking, social skills and group work. It may include pre and post testing, diagnostic analysis, student tracking, the support and delivery of authentic assessment through project-based learning, artifact collection, e-portfolios and data aggregation and analysis (Buzzetto-More, 2006). Buzzetto-More explained that digital assessment measures can score themselves with great reliability and no subjectivity while making data available with immediacy. He further reinterated that web-based testing has significant advantages in the areas of cots, ease of use, reliability, replicability, scoring, aggregating results and data management.

Educational assessment in Nigerian universities is an indispensable tool for determining educational outcomes for the purpose of immanence of standard, promotion, certification, placement, improvement, increased productivity, accountability among others. Corroborating on the importance of e-assessment, Ifeakor and Anekwe (2009) asserted that various assessment tools and techniques (essay, short answer, multiple choice, project, and work portfolios) could be utilized and the computer would be used to score the tests. The scores could be arranged/organized in different ways to suit where the information could be utilized. Electronic scoring would go a long way to help the lecturers from the time consuming task of scoring test responses.

E-assessment could be in form of (i) a turns (ii) a neutral and (iii) a cognitive tool. By implication, the use of the computer through any of the aforementioned for teaching, learning and assessment tutor the learners into:

a. A self-reliant person who is capable of creating information;
b. A problem solver who could store his breakthrough for future use;
c. Somebody who has people and resources from all over the world at his finger tips (Adeyegbe, Modupe and Ayo, 2003). The teaching and learning of science and its assessment could be through teacher observation with appropriate teacher interventions and by peer assessment. All these are computer-based. Such tests have been identified to be of three generations namely:

- Candidate can registers by phone or e-mail while the computer selects questions and tailors them to the individuals' skill levels.
- Computer-based test centres (e.g AFRIHUB) that have high quality multimedia where tests can be administered to the students;
- The "Generation R" which allows the individual to respond while using simulations that model real environments.

1. These three generations of technology-based assessment have the potential of making assessment accessible, affordable and put both the assessee and assessor at ease (Adeyegbe, Modupe and Ayo, 2003).

The use of computer-based assessment is gradually gaining ground in secondary education summative assessment like WAEC, JAMB and NECO. Efforts should be made to introduce and utilize computer-based assessment in Nigeria's higher institutions for quality educational outcomes. Therefore, to optimize e-learning opportunities for effective assessment in Nigerian universities, and to maintain quality in the assessment of students' academic performance, the following should be adopted:

Lecturers should construct high quality test items; Variety of test items should be utilized; the examination should be conducted according to the rules and regulations of the university; With the use of computers, the examination question bank should be kept in hard disc or other well secured and coded computer wares; Examinations involving multiple choice questions should be marked with computers that have optical mark readers; Computerized cameras and transmitters should be used in filming and transmitting of examination procedures in order to detect examination malpractices; Photographs and thumbprints can be cross-matched with the computer to detect impersonation;

Despite, the numerous advantages of optimizing e-learning opportunities for assessment in science education, there are yet some constraints to the use of computers for assessment of students' academic performance in the universities as outline by Asogwa (2007): This includes among others inadequate supply of electricity.

E-learning opportunities with reference to assessment have proved to be of more advantages than paper and pencil assessment in universities especially in National Open University. To this end, this study is focused on the optimization of e-learning opportunities in the assessment of students' academic performance in universities in south-east and south-south zones of Nigeria. The problem of this study posed as question is: what are the benefits of using e- assessment to assess students' academic performances and what are the constraints to this?

Purposes of the Study

The general purpose of the study was to ascertain the efficacy of e-learning opportunities for assessment in science education in Nigerian universities. Specifically, the study sought to:

1. determine the benefits of e-assessment in science education.
2. ascertain how e-learning opportunities for effective assessment in science education should be optimized.
3. determine the constraints militating against the use of e-assessment in science education.

Research Questions

The following research questions guided the study.

1. What are the benefits of e- assessment in science education?
2. How would e-learning opportunities for effective assessment in science education be optimized?
3. What are the constraints militating against the use of e-assessment in science education?

Research Hypothesis

The following null hypotheses were tested with z-statistics at 0.05 alpha level.

1. There is no significant difference between the mean responses of state university lecturers from South-South and those from South-East states on the benefits of e- assessment in science education.
2. The mean responses of state university lecturers from south-south and those from south-east states on how to optimize-e-learning opportunities for effective assessment would not differ significantly.
3. There is no significant difference between the mean responses of state university lecturers from south-south and those from south-east states on the constraints militating against the use of e- assessment in science education.

Method

The study was a descriptive survey design which was carried out in state universities in south-east and south-south states of Nigeria. The population comprised all science education lecturers and measurement and evaluation lecturers at Delta State University, Abraka (78); Niger Delta University, Bayelsa State (86) and Imo State University Owerri (105), Ebonyi State, Abakaliki (92). The sample consisted of 40 lecturers each from the four Universities; 80 from south-south and 80 from south-east states. Simple random sampling without replacement was used to select the subjects. Thus 160 lecturers participated in the study. Three research questions and three null hypotheses guided the study. The instrument for data collection was a 24-item questionnaire structured on a- 5-point Likert-type scale developed by the researchers. The questionnaire was validated by two science educators and one expert in measurement and evaluation from Abia State University, Uturu. The comments and suggestions of these experts were incorporated to build up the final draft.

The instrument was trial tested on ten (10) science lecturers drawn from Abia State University, Uturu. The result was used to compute the internal consistency of the instrument using Cronbach Alpha Technique. A reliability coefficient of 0.81 was established. The questionnaire was administered to the respondents by the researchers.

The questionnaires were retrieved on the spot thereby ensuring 100% return. The research questions were

answered using means and standard deviation (SD) while the null hypotheses were tested with z-test statistics at 0.05 alpha level. A mean of 3.00 and above indicated that the respondents agreed with the items while a mean of 2.99 and below indicated disagreement with the items.

Result

The results were presented according to the research questions.

Table 1: Mean and Standard Deviation (SD) of State University Science Lecturers on the benefits of e-assessment in Science Education.

S/No	Items	State University Lecturers			
		South-South		South-East	
		X	SD	X	SD
1.	Candidates register by phone, e-mail or with password there by securing individual privacy in assessment.	3.50	097	3.65	0.81
2.	Computer selects questions and tailors them to the individual's skills levels.	4.39	1.15	4.13	1.41
3.	Computer-based test centres are used for administration of tests to students e.g AFRIHUB	3.78	0.98	4.10	0.88
4.	Candidates respond to modeled real environments using simulations.	3.86	1.41	3.91	1.32
5.	Computer-based assessment makes a learner a self-reliant person who is capable of creating information.	4.22	1.05	3.94	0.98
6.	Learners become problem-solvers who could store their breakthrough for future use.	3.78	1.25	3.72	1.15
7.	People and resources all over the world are at the learners' finger tips.	3.92	1.55	3.45	0.89
8.	Test items appear on the screen for the candidates to answer using computers.	4.21	1.50	4.11	1.10
9.	E- assessment is beneficial in areas of cost, ease of use, objectivity and immediate feedback.	4.99	0.99	4.81	0.89
	Total	**4.07**	**1.21**	**3.98**	**1.04**

Table 1 indicated that by using e- assessment, results from assessment are available for immediate use. This was as a result of the responses of state university science lecturers that are 3.00 and above.

Table 2: Mean and SD of State University Science Education Lecturers on How to optimize e-learning opportunities for Effective Assessment.

S/No	Items	State University Lecturer			
		South-South		South-East	
		X	SD	X	SD
10.	Lectures should construct high quality test items	3.96	1.10	3.91	1.00
11.	Variety of test items should be utilized	4.00	0.99	3.99	0.89
12.	With the use of computers, examination question bank should be kept in hard disc or coded computer wares.	4.10	1.03	4.15	0.99
13.	Examinations involving multiple choice question should be marked with computers that have optical mark readers.	4.05	0.89	4.00	0.82
14.	Students/examinees should register their names, course ID with password on the computer.	3.77	1.09	3.67	1.00
15.	Test items would appear on the screen and students made to answer through the computer.	3.81	1.11	3.88	1.10
16.	Easy test items would appear first then later more difficult test items would appear.	3.67	1.15	3.61	1.00
17.	If the examinees fail to answer correctly (5) five items consecutively, the test would stop and the score would appear immediately.	3.71	1.06	3.69	1.00
	Total	**3.88**	**1.05**	**3.86**	**0.97**

Table 2 indicated that state university science education lecturers are in agreement with the listed items of how to optimize e-learning opportunities for effective assessment.. Their mean responses ranged from 3.67 to 4.10 and these are above 3.00.

Table 3: Mean and SD of State University Science Education Lecturers on the constraints militating against the use of e-Assessment in Science Education.

S/No	Items	State University Lecturer			
		South-South		South-East	
		X	SD	X	SD
18.	Inadequate supply of electricity.	4.62	1.04	4.51	1.00
19.	Access to unhindered utilization of ICT tools has been very low.	4.52	0.99	4.00	0.89
20.	Skills in designing course wares, assessment techniques/softwares are lacking in the universities.	4.07	1.21	4.10	1.10
21.	Inadequate provision of computers to universities	3.98	1.15	3.89	0.99
22.	Cost of equipment, access to and maintenance are farfetched.	3.87	0.88	3.89	0.88
23.	Computer literacy among lecturers and students is still very low	3.71	1.00	3.75	0.99
24.	Low proficiency in the use of modern electronic learning and assessment devices by science education lecturers.	3.65	1.12	3.60	1.10
	Total	**4.06**	**1.05**	**3.95**	**0.99**

From table 3, it showed that the use of e- assessment in science education is faced with many constraints ranging from inadequate power supply to very low proficiency in the use of modern electronic learning and assessment

devices by science education lecturers. This was revealed from the mean scores of state university science education lecturers which was 3.00 and above.

In order to make decision of how to optimize e-learning opportunities for effective assessment in state universities, the following null hypotheses were tested with Z-test statistics at 0.05 level of significance.

Table 4: Z-test statistics on the Mean responses of State University Science Education lecturers on the Benefits of e- assessment in Science Education.

Source of variation	N	X	SD	df	z-cal	z-crit	p<0.05
South- South Lecturers	80	4.07	1.21	158	0.511	1.96	Ho not rejected
South-East Lecturers	80	3.9	41.04				

Table 4 revealed that z-calculated was 0.511 against z-critical of 1.96. this showed that z-calculated was less than z-critical, there null hypothesis of no significant differences was not rejected.

Table 5: Z-test statistics on the Mean responses of State University Science Education Lecturers on how to optimize of e- LEARNING opportunities for effective assessment

Source of variation	N	X	SD	df	z-cal	z-crit	p<0.05
South- South Lecturers	80	3.88	1.05	158	0.129	1.96	Ho not rejected
South-East Lecturers	80	3.86	0.97				

Table 5 showed that z-calculated (0.129) was less than z-critical (1.96) hence the null hypothesis of no significant differences on how to optimize e-learning opportunities for effective assessment was not rejected.

Table 6: Z-test statistics on the Mean responses of State University Science Education Lecturers on the Constraints militating against the use of e-assessment in science Education

Source of variation	N	X	SD	df	z-cal	z-crit	p<0.05
South- South Lecturers	80	4.06	1.05	158	0.696	1.96	Ho not rejected
South-East Lecturers	80	3.95	099				

Table 6 indicated that the z-calculated (0.696) was less than z-critical (1.96). This showed that south-south state university lecturers were in congruence with south-east state university lecturers on the constraints militating against the use of e-assessment in science education. Therefore the null hypothesis of no significant difference w as accepted.

Discussion

The result revealed that state university science education and measurement and evaluation (m & e) lecturers agreed that all the listed items are the benefits of using e-assessment in science education. There was no significant difference in the mean responses of state univer5sity lecturers. This is a clear indication that as Nigeria is in the information age, which requires quality skilled manpower in our work force, the only way towards such attainment is to produce quality educational products through e- assessment. This finding is in agreement with the ideas of Buzzetto-More (2006) who noted that e- assessment measures can score themselves with great reliability and no subjectivity while making data available with immediacy.

It was revealed that state university science education and m & e lecturers are in consonance with the listed items on optimizing e-learning opportunities for effective assessment in science education. There was no significant difference in the mean responses of the respondents. This showed that with the use of e- assessment in state universities there will be a tremendous improvement in the construction of high quality test items which would be kept in computers as question bank. Examinees would exercise high sense of confidence in the administration of the test, scoring and immediate feedback because everything is computer-based. This finding is in agreement with Buzzetto-More (2006) who reported that digital assessment measures can score themselves with great reliability and no subjectivity while making data available with immediacy. Furthermore, Asogwa (2007) noted that computer-based assessment technique would bring about quality educational products.

The findings showed that state university science education m & e lecturers were of the opinion that e-assessment in science education as in other areas of educational endeavours are faced with many challenges. The same information was revealed where the tested null hypothesis showed no significant difference. The constraints ranged from inadequate power supply, lack of skills in designing assessment techniques/softwares, lack of access to unhindered utilization of ICT tools to very low proficiency in the use of modern electronic learning and assessment devices by science education lecturers. This finding is in agreement with the work of

Asogwa (2007) who reported that the work of Power Holding Company of Nigeria needs great improvement. He further exclaimed that a pool of trained ICT personal, course developers and technicians as well as relevant skills in various aspects of ICT, e.g e- assessment tools, developed in the nation would be of tremendous help.

Conclusion

Science education is the training and acquisition of scientific knowledge through observation and analysis of events or natural phenomena that helps an individual to integrate himself/herself effectively into the society. This can be achieved only when the right products are got through e- assessment. In the findings of this study it has been buttressed that state university science education and m & e lecturers have agreed on the benefits of e-assessment. Ways to optimize e-learning opportunities for effective assessment in science education was also x-rayed. It has been discovered from the present study that e- assessment still has many challenges, the utmost being some science education and m & e lecturers low proficiency in the use of modern electronic learning and assessment devices.

Recommendations

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

1. Efforts should be made by Power Holding Company of Nigeria to upgrade their power supply.
2. Science education and m & e lecturers should avail themselves of the opportunity given by education Trust Fund (ETF) to attend seminars, conference and training in areas of ICT.
3. Computer-based test centres e.g AFRIHUB should be built in all state universities to facilitate the use of e- assessment.
4. Undergraduates should be computer literate so as to benefit from e-learning opportunities used for effective assessment.
5. Government should fund state universities by providing computers, ICT personnel, course ware developers and assessment techniques/software developers.

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