ORGANIZATIONAL FACTORS AFFECTING EFFECTIVE UTILIZATION OF VIRTUAL LABORATORY PACKAGE ON SELECTED NIGERIAN SECONDARY SCHOOL PHYSICS CONCEPTS

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Abstract

The study examined the requirements needed for utilization of Virtual Laboratory Package (VLP) on selected Nigerian secondary school physics concepts. It also investigated some barriers that affect theeffective utilization of VLP in schools. Twenty four physics teachers were purposively selected to evaluate a virtual physics laboratory package using a 10-item questionnaire that was validated and found reliable for data collection. Two research questions were raised and answered. Data gathered from the administration of the questionnaire were analyzed using Mean and Standard deviation. Findings revealed that physics teachers agreed that effective use of virtual physics laboratory package in schools require adequate number of physics teachers, ICT staff, technicians who need regular in-service training for implementing technological innovations meant for teaching and learning(average mean response= 2.83 out of 5). It is also found that poor electricity supply, insufficient fund, low awareness and insufficient time allocated to physics practical in Nigerian secondary schools are parts of barriers to effective use of VLP in Nigerian secondary schools(average mean response = 2.56 out of 5). Based on the findings, it was recommended that government and relevant administrators should assist schools by providing needed manpower, training, fund and computer facilities in schools since the benefits of VLP in teaching and learning process are enormous.

Keywords: Barrier, Evaluation, Laboratory, Requirements, Technology, Virtual

Introduction

Information and Communication Technology (ICT) can be regarded as a strong weapon for sustainable development, empowering people for global competitiveness and tools that have contributed to the growth of all areas of human activity (Brakel & Chisenga, 2003). Virtual laboratory is one of the innovations in teaching and learning process that depend on the application and utilization of ICT tools. It is an interactive environment without real laboratory tools meant for creating and conducting simulated experiments (Babateen, 2011; Harry & Edward, 2005). It provides students with tools and materials set on computer in order to perform experiments saved on CDs or on web site (Babateen, 2011; Nunn, 2009).

The roles of virtual laboratory in teaching and learning process cannot be over-emphasized, it makes students become active in their learning and provide opportunities for students to construct and understand difficult concepts more easily (Gambari, *et al.*, 2012).Studies on effects of virtual laboratory on students' academic performance especially in practical based science subjects revealed the effectiveness of laboratory globally and thereforerecommended its utilization in teaching and learning process(Efe & Efe, 2011;Gambari, *et al.*, 2012; Mahmoud & Zoltan, 2009; Maldarelli, *et al.*, 2009; Tuysuz, 2010).

However, several computer learning packages have been developed, validated and found to be effective in teaching and learning of science-based subjects through various researches conducted in Nigeria are not being utilized in Nigerian schools owing to series of school factors which Bates (1995) referred to as organizational factors (requirements, barriers and technical capabilities).

Effective teaching with technology requires a higher skill level and this requires support, encouragement and investment for teachers by school administrators (Bates, 2000). The level of organizational support given to a technology is critical to its long-term success. Bates (2000) listed various organizational barriers to implementing technology, the greatest of which is lack of interest in using the technology for teaching by teachers. In addition, Irani and Telg (2002) stated that skills alone are not enough and that in many instances, instructors must change their teaching style as they learn how to operate or at least understand the operations of the technology they are using. Changes in administrative structures, policies and procedures, improved technical support for staff and students, and in-service training for staff will certainly be necessary to ensure effective adoption of technologies (Bates, 1995; Bates, 2000; Lambert & Williams, 1999; Irani & Telg, 2002).

Bates concluded that existing educational institutions were created to meet the needs of a society that is fast developing and that there is need for educational organizations that can exploit the new technologies to meet the needs of the twenty-first century. Adomi and Kpangban (2010) observed that adoption of learning technologies in Nigerian secondary schools is affected by limited school budget, inadequate manpower and limited ICT skills among teachers. Carnevale (2010) was of the opinion that for effective use of virtual laboratory, there is need for computers with special standard, need for specialized working staff, instructors and curriculum experts for designing and production. In terms of organizational issues, this present study will identify the barriers that are likely to hinder effective adoption of virtual physics laboratory package in Nigerian secondary schools as well as determine the essential requirements needed for the package to be selected for use in teaching and learning of physics experiments.

This study was therefore carried out to determine organizational factors (requirements, barriers and technical capacities within the school that affect effective utilization of an adapted virtual laboratory package on selected Nigerian secondary school physics practical concepts in schools.

Research Questions

The study provided answers to the following research questions:

(i) What requirements within the school do physics teachers consider essential to provide stability and support for the utilization ofvirtual laboratory package on selected physics concepts in Nigerian secondary schools?

(ii) What barriers within the school do physics teachers consider necessary to be addressed to ensure effective utilization of virtual laboratory package on selected physics concepts in Nigerian secondary schools?

Methodology

The study is a descriptive survey research. It involved the use of researcher's adapted questionnaire to elicit needed information from physics teachers and computer experts.

The population for this research consists of all secondary school physics teachersin Nigeria.Twenty- four physics teachers were purposively selected fromsix Federal Government Colleges in southwest Nigeriabecause of their relevance to the evaluation to be carried out.

Physics Teachers' Evaluation Questionnaire (PTEQ) was used for data collection.It was divided into two sections (Sections A & B). Section A were designed to collect demographic data of the respondents while Section B consist of 10 statements designed using 4-point scale (namely, 1 as Strongly Disagree, 2 as Disagree, 3 as Agree and 4 as Strongly Agree).Physics teachers used PTEQ to evaluate the requirements and barriers needed to be addressed within the school to ensure effective utilization of VPLP in schools.

The package was validated by two computer experts, four physics teachers and two educational technology experts. The questionnaire was validated by four secondary school physics teachers and its reliability was determined in a single administration on physics teachers in one of the schools within the research area but that was not considered for the main study and reliability coefficient of 0.90using Cronbach's Alpha formula.

Results

The data gathered was analyzed using Mean and Standard Deviation.A mean response below 2.50 was considered Disagree while a mean response of 2.50 and above was considered Agree. The analyses were used to answer the research questions.

Research Question 1: What requirements within the school do physics teachers consider essential to provide stability and support for the utilization of virtual laboratory package on selected physics concepts in Nigerian secondary schools?

Table 1: Physics teachers' meanresponse on requirement to enhance effective use of virtual physics laboratory package

S/N	Statement	N	SA	A	D	SD	Mean	S.Dev.	Decision
1	Effective use of virtual physics laboratory package in my school requires adequate number of physics teachers	24	7	9	6	2	2.87	0.37	Agree
2	Effective use of virtual physics laboratory package in my school requires adequate number of ICT staff	24	8	6	7	3	2.79	0.29	Agree
3	Effective use of virtual physics laboratory package in my school requires adequate number of technicians	24	9	8	4	3	2.95	0.45	Agree
4	Effective use of virtual physics laboratory	24	7	7	6	4	2.70	0.20	Agree

	package in my school requires adequate funding								
5	Physics teachers and ICT staff in my school need regular in-service training on technological innovations if virtual physics laboratory package will be effectively utilized in teaching and learning of physics	24	8	8	4	4	2.83	0.33	Agree
	Average Mean						2.83		

Table 1 reveals the mean response of physics teachers on the requirements that will enhance effective use of virtual physics laboratory package in secondary schools in Nigeria. The respondents agreed to all the five items with mean responses of 2.87, 2.79, 2.95, 2.70 and 2.83 respectively. The average mean of responses to all the items is 2.83, which is above 2.50. This indicates that physics teachers agreed that effective use of virtual physics laboratory package in schools require adequate number of physics teachers, ICT staff, technicians and regular in-service training of relevant staff in the school on technological innovations meant for teaching and learning.

Research Question 2: What barriers within the school do physics teachers consider necessary to be addressed to ensure effective use of virtual laboratory package on selected physics concepts in Nigerian secondary schools?

Table 2: Mean response of physics teachers on barriers to effective use of virtual physics laboratory package in schools

S/N	Statement	N	SA	A	D	SD	Mean	S. Dev.	Decision
1	Problem of poor electricity supply has to be tackled for virtual physics laboratory package to be effectively utilized in my school	24	8	7	6	3	2.83	0.33	Agree
2	Problem of insufficient time allocated to learning physics practical has to be tackled for students to learn experiments through virtual physics laboratory package	24	7	9	3	5	2.75	0.25	Agree
3	Poor orientation and	24	6	8	6	4	2.66	0.16	Agree

	lack of awareness of school administrators on technological learning packages has to be tackled for them to approve and encourage the use of virtual physics laboratory package in my school								
4	Poor computer skills of students in my school has to be tackled if they will embrace and learn through virtual physics laboratory package	24	3	4	8	9	2.04	0.45	Disagree
5	Insufficient funding of learning programmes and packages are to be tackled for virtual physics laboratory package to be effectively used in my school	24	7	6	4	7	2.54	0.04	Agree
	Average Mean						2.56		

Table 2 reveals the mean response of physics teachers on the barriers to effective use of virtual physics laboratory package in secondary schools in Nigeria. The mean response to each of the five items is above 2.50 except item 4 with a mean response of 2.04 which reveals that respondents disagree that poor computer skill of physics teachers is a barrier. The average mean of responses to all the items is 2.56. This indicates that physics teachers agreed that poor electricity supply, insufficient fund, low awareness and insufficient time allocated for learning physics practical in secondary schools in Nigeria are barriers within the school that will affect effective use of virtual physics laboratory package.

Discussion

The results of the analyses on requirements needed to ensure effective utilization of VLP in Nigerian schools indicated that physics teachers agreed that the effective use of the package requires proper funding, adequate physics teachers, ICT staff, technicians and regular in-service training of staff on latest teaching and learning technological innovations. This is in line with the recommendations of Bates (1995) and Bates (2000) that effective teaching and learning with technology requires a higher skill level and this requires support, encouragement and investment for teachers by school administrators. This finding is also in agreement with the recommendations of Carnevale (2010) that for effective use of virtual laboratory, there is need for computers with special standard, need for specialized working staff, instructors and curriculum experts for design and production. This finding also agrees with Farida and Ezra

(2005) that there is need for creation of awareness and changing of mindset by organizing workshops to promote the use of computer-based instruction.

Findings from this study also indicated that lack of awareness, poor funding, poor computer skills, insufficient time allocated to physics practical and epileptic power supply are barriers to effective use of VPLP in Nigerian schools. This is in agreement with the earlier finding of Irani and Teig (2002) that inability of teachers to operate or at least understand the operations of modern learning technologies to be used in schools, and finding of Bates (2000) that lack of faculty interest in using technology for teaching by administrators are barriers to effective utilization of learning technologies in schools. This finding also support the findings of Adomi and Kpangban (2010) who found that adoption of learning technologies in Nigerian secondary schools is affected by limited school budget, inadequate manpower and limited ICT skills among teachers.

Conclusions

It has been asserted that the major cause of non-utilization of learning technologies is as a result of lack of requirements and presence of barriers to effective utilization of such in schools. The result obtained from this study indicated that problems of poor funding, inadequate facilities, lack of awareness, incompetent manpower and poor maintenance culture are the major causes of not non-utilization of learning technologies in Nigerian schools which must be addressed.

Recommendations

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

(i) Government should assist schools by providing funds, computer facilities and competent manpower that can handle development, utilization and maintenance of learning packages such as virtual physics laboratory as their benefits in teaching and learning process are enormous.

(ii) Physics teachers should endeavor to develop competence in the use of technological applications meant for learning. This will further increase their knowledge on new innovations in ICT-Based instructional strategies;

(iii) Government and appropriate school authorities should embrace and support the use of virtual physics laboratory package in schools as this will enhance students'performance in physics; and

(iv) ICT staff in schools should be trained and acquainted with technological innovations. This will enable them develop, modify and maintain latest learning applications like, virtual physics laboratory package within the school system.

References

Adomi, E. E. & Kpangban, E. (2010). Application of ICTs in Nigerian secondary schools. *Library Philosophy and Practice (e-journal).* Paper 345. Available online at http://digitalcommons.unl.edu/libphilprac/345

Babateen, H. M. (2011). *The role of virtual laboratories in science education.* Singapore: *IACSIT press.*

Bates, A. W. (1995). *Technology, open learning and distance education*. London: Routledge.

Bates, A. W. (2000). *Managing technological changes: Strategies for college and university leaders.* San Franciso: Jossey-Bass.

Brakel, P. A., & Chisenga, J. (2003). Impact of ICT based distance learning: The african story. *The Electronic Library, 21* (5), 476-486.

Carnevale, D. (2010).The virtual lab experiment some colleges use computer to expand science offerings online. *The Chronicle of Higher Education,* 49, (21), 30-32.

Efe, H. A. & Efe, R. (2011). Evaluating the effect of computer simulations on secondary biology instruction: An application of bloom's taxonomy*. Scientific Research and Essays,* 6 (10), 2137-2146.

Farida, M &Ezra, M. (2005).*Towards enhancing learning with information and communication technology in Universities.* Retrieved December 27, 2014 from *http://cit.mak.ac.ug/iccir/downloads/SREC_05/Farida%20Muzaki%20and%20Ezra%20Mugisa_05.pdf*

Gambari, A. I., Falode, O. C., Fagbemi, P. O. & Idris, B. (2012). *Effect of virtual laboratory strategy on the achievement of secondary school students in Nigeria.* Proceedings of the 33rd Annual Convention and National Conference of Nigeria Association for Educational Media and Technology (NAEMT) held at Emmanuel Alayande College of Education, Oyo, Oyo State. October 8-13.

Harry, E. & Edward, B. (2005). Making real virtual lab. *The Science Education Review*, 4(1), 2005.

Irani, T. & Telg, R. (2002). Building it so they will come: Assessing universities' distance education faculty training and development programmes. *Journal of Distance Education,* 17(1), 36-41.

Lambert, S. & Williams, R., (1999). *A model for selecting educational technologies to improve student learning.* HERDSA Annual InternationalConference, Melbourne, 12-15, July 1999.

Mahmoud, A. & Zoltan, K. (2009). *The impact of the virtual laboratory on the hands-on laboratory learning outcomes, a two years empirical study.* 20th Australasian association for Engineering Education Conference. University of Adelaide, 6-9 December, 2009.

Maldarelli, G. A., Hartmann, E. M., Cummings, P. J., Horner, R. D., Obom, K. M., Shingles, R. & Pearlman, S. (2009). Virtual laboratory demonstrations improve students' mastery of basic biology laboratory techniques. *Journal of Microbiology Education*, 10, 51-56.

Nunn, J. (2009). *The virtual physics laboratory V 7.0.* Retrieved November 13, 2013 from www.vplab.co.uk

Tuysuz, C. (2010). The effect of the virtual laboratory on students' achievement and attitude in chemistry. *International Online Journal of Education Sciences,* 2(1), 37-53.