EUROPEAN JOURNAL OF HEALTH AND BIOLOGY EDUCATION

The Challenges of Instructional Design and Development in Biology Education in Nigeria

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•*Received 03 June 2014*

•*Revised 14 August 2014*

•*Accepted 27 August 2014*

The paper focuses on the changes in the instructional design of a science course resulted from the implementation of modern information technologies in science education. This is a descriptive study and has three major research questions. The target population consist of biology teachers in tertiary institutions in Rivers State. Data were collected using a questionnaire of a four point likert scale. The validity and reliability of the instrument were ascertained using experts in the field. Ten science teachers in Imo State were used for the test retest exercise, and a reliability of 0.75 was obtained using Pearson product movement correlation coefficient. Frequencies, percentage and mean were the statistics used to take decision on the research questions. The findings revealed the required competencies and there constraints as well as identify the various strategies for science teachers to adhere to create e-learning.

Keywords: biology, e-learning, science, education, instructional design, teachers, Nigeria

INTRODUCTION

The traditional methods of teaching science are not profitable anymore to prepare the competent individual who is capable to track the scientific and technological challenges of the modern world (Opara, 2014a, Opara and Ejifugha, 2014). The use of modern information and communication technology in teaching and learning science helps not only to produce, access information but also to facilitate the transfer and acquisition of knowledge (Opara, 2014b). Jegede (2005) described e-learning as the presentation and delivery of the materials using the electronic media.

To design and deliver science courses, the science teacher has to develop a course of syllabus goals and objectives, select quality science textbooks or science journal articles to create learning exercise, develop quiz and examinations presented in electronic form. This could be through the commercially available package or teacher-made interactive packages.

To design and deliver on-line science course, the biology teacher require a thorough knowledge of main components of on-line teaching and learning. Khan (1997) identifies content development, multimedia components, internet tools, computers and storage devices service providers, authoring program, servers, browsers and other applications. The instructional designer must have a clear understanding of what learning activities, methods and components are included in the learning. The science teacher should have the knowledge of computer appreciation, presentation, computer programming as well as administration of e-learning packages (Opara, 2014b).

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ISSN: 2165-8722

Table 1. Comparing Traditional Approach and Modern Approach

	Traditional Approach	Modern Approach
Learning method	- Face to face (F2F) meeting in auditory	- F2F meeting in auditory - Pure e-learning (distance learning) - Blended learning
Learning activities	- Lecture (F2F) - Assignments (F2F) - Presentations (F2F) - Testing for grading (F2F)	- Lecture (F2F, or using IT: Video lectures, video conferencing - Assignments (F2F or using IT) - Presentations (F2F or using IT) - Self-control testing (mainly using IT) - Synchronous and asynchronous activities (forums, chats, etc.) - Tools of web 2.0 (blogs, wikis, etc.)
Learning resources	- Different kinds of printed materials mainly: books, handouts, journals etc.	- Different kinds of printed materials mainly: books, handouts, journals etc. - CD and DVD resources - Electronic libraries - Web pages etc.
Work with a target group	There is some lack of individual work with the target group	A learning process is directed to both, a target group and each individual from this group. In e-learning, it is much easier to organize individual consultations with individual members of a target group.

The selection of instructional tools depends on the specific features of a particular science course. In essence, different set of instructional tools and techniques are required to develop instructional design for different science courses (Opara, 2014c).For instance, to compare the tools and techniques used to develop the traditional approach to science education with the modern approach using information and communication technology.

Indeed, the tools and techniques used to develop e-learning course enable learners not to be tied to the particular time and particular space in which it is an important and attractive features of e-learning.

Purpose of the study

The purpose of the study is aimed to:

i. Determine the competency needed by the science teacher in the instructional design for e-learning.

ii. Find out the constraints in acquiring the needed competencies.

iii. To suggest strategies to create modern e-learning for science course.

Research questions

The following research questions guided the study:

i. What are competencies required by the science teacher in instructional design for e-learning?

ii. What are constraints in acquiring the needed competencies?

iii. What strategies could be adhered to by the science teacher to create modern e-learning

Statement of problem

Today teaching is a concept that demands that teachers should not only have the knowledge and skills but also the professional competencies in the use of information and communication technology to not only process and access information but to facilitate the transfer acquisition of knowledge. However, in the tertiary institutions, e-learning appear not to be only inadequate but also of poor designed quality. Thus, the teachers and students do not effectively utilize learning opportunities provided by such e-learning process.

This situation demand appropriate design and use of quality e-learning especially in science courses to enhance quality teaching and learning, and achieve educational objectives of the learners.

METHODOLOGY

The study used a descriptive survey research design to find out the quality of the instructional design for e-learning in science courses and the strategies to be adopted for efficient and effective teaching and learning.

Population of the study

The population of the study comprises of all the science teachers in the public tertiary institutions in Rivers State.

Sample and sampling technique

Sample random sampling technique was used in selecting thirty-five (35) teachers from six public tertiary institutions in Rivers State.

Instruments

The research developed a questionnaire titled "Electronic Learning Design Questionnaire" (ELDQ) was used for data collection. It consists of two sections. Section I provides the personal data of the respondent. Section II has A, B and C in which A provides information for research question I and B for research question 2; C for research question 3. The instrument was face validated by four science teachers from some of these tertiary institutions. The four point likert scale was used as follows: Strongly disagree = 1 point; Disagree = 2 points; Agree = 3 points and Strongly Agree = 4 points.

Method of data analysis

Frequencies, percentages and mean were the statistics used to take decision on the research questions. The 210 copies of questionnaires were duly returned, indicating 100% return rate. A mean of 2.50 is used for the cut off point for acceptance.

RESULTS

The data collected and analyzed are presented in the order of research questions as follows:

Research Question I: What are the needed competency levels of the science teacher in instructional design for e-learning of science courses?

Table 2. Needed competencies for e-learning instructional design

S/N	Needed competencies for e-learning instructional design	SA	A	D	SD	X	Remarks
1.	Internet browsing	197	12	1	-	3.83	Accepted
2.	Sending and receiving email	183	24	2	1	3.85	Accepted
3.	Web based training	181	22	5	2	3.81	Accepted
4.	Using of electronic libraries	187	20	2	1	3.87	Accepted
5.	Using of synchronous and asynchronous communication	162	37	9	2	3.71	Accepted
6.	Preparation of presentation packages (Power Point Presentation)	190	19	1	-	3.92	Accepted
7.	Multimedia presentation	184	22	2	2	3.86	Accepted
8.	Slide presentation	181	17	7	2	3.82	Accepted
9.	Presentation of word processing packages	192	15	3	-	3.90	Accepted
10.	Formatting of presentation packages	187	14	6	3	3.84	Accepted
11.	Preparation of simple instructional packages	182	22	4	2	3.82	Accepted
12.	Programming language	170	29	5	3	3.71	Accepted
13.	Implementation of commercially available packages	169	39	1	1	3.79	Accepted
14.	Validation and evaluation of commercially available packages	160	39	8	3	3.70	Accepted
15.	Production, validation and evaluation of teacher-centred packages	180	25	3	2	3.83	Accepted

Data on Table 1 above, indicate that all the items have their mean score above 2.50. This shows that the science teacher needed these competencies for a quality instructional design

Table 3. Constraints in acquiring needed competencies

S/N	Constraints in acquiring needed competencies	SA	A	D	SD	X	Remarks
1.	High cost of ICT provision	192	17	1	-	3.91	Accepted
2.	Poor computer literacy	187	20	2	1	3.87	Accepted
3.	Poor power supply	201	9	-	-	4.13	Accepted
4.	Awareness problem	12	10	20	168	1.36	Rejected
5.	Inadequate training and retraining of teachers on ICT based on advancement in technology	180	26	2	2	3.85	Accepted
6.	Insufficient provision of the ICT facilities	181	25	3	1	3.84	Accepted
7.	Institutional problems	183	17	7	2	3.82	Accepted
8.	Lack of interest/resistance	19	11	59	119	1.65	Rejected
9.	Technical difficulties	183	23	4	-	3.85	Accepted
10.	Information overload	38	22	49	101	1.99	Rejected
11.	No enough time to use ICT facilities	60	12	70	68	2.30	Rejected
12.	Inadequate funding	203	5	1	1	3.95	Accepted

Table 4. To create modern e-learning

S/N	To create modern e-learning	SA	A	D	SD	X	Remarks
1.	Prepare teaching in small portions	182	24	3	1	3.84	Accepted
2.	Important to have personal communication with learners	181	20	7	2	3.81	Accepted
3.	Inclusion of cognitive, affective and psychomotor domain of learning	186	21	2	1	3.87	Accepted
4.	Well-structured learning content with organized meta-data system	192	17	1	-	3.91	Accepted
5.	Develop instructional design for each learning course according to the specifications.	201	7	1	1	3.94	Accepted
6.	Every learning course should include assessment tool	190	18	2	-	3.78	Accepted
7.	Demonstration of each skill to build competency	180	22	6	2	3.81	Accepted
8.	Both teachers and students should be computer literate, with less formal relationship	187	18	3	2	3.86	Accepted
9.	Create interactive and alive, free from time and space learning course.	180	26	3	1	3.85	Accepted

and utilization of e-learning for effective teaching and learning process.

Research Question 2: What are the constraints in acquiring the needed competencies?

Table 2 shows that four out of the twelve items were rejected by the science teachers as not the constraints in acquiring needed competencies while the remaining 8 items were accepted.

Research Question 3: What strategies could be adhered to by science teachers to create modern e-learning?

Table 3 reveals that all the 9 items were agreed as ways and strategies to create modern e-learning science course.

DISCUSSION

Findings from the study revealed in the table I that the science teachers require all the itemized competencies. This is because e-learning is multifaceted that embrace all forms of electronic devices that are employed in teaching and learning. The finding agree with Wikipedia (2014) which highlighted more on e-learning as all forms of electronically supported learning and teaching using information and communication system, including electronic educational technologies in learning and teaching. That conceptually e-learning is broadly synonymous with instructional technology, Information and Communication Technology (ICT) in Education, Ed Tech, Learning Technology, Multimedia Learning, Technology Enhanced Learning (TEL), Computer Based Instruction (CBI), Computer Managed Instruction, Computer Based Training (CBT), Computer Assisted Instruction or Computer-Aided Instruction (CAI), Internet-Based Training (IBT), Flexible Learning, Web-Based Training (WBT), Online Education, Virtual Education, Virtual Learning Environment (VLE), M-Learning, and Digital Education.

But Gambari and Chike-Okoli (2007) were very sceptical about the needed competencies to be acquired to ensure that advantage of e-learning technology is optimally exploited

considering the obstacles to the adoption and the use of ICT in higher institutions in Nigeria. They stated that Nigeria is not fully part of the Global University System (GUS). The GUS is an initiative to educate students through a satellite or wireless telecommunication infrastructure mostly using internet. This fact was collaborated by Unegbu (1999) about the absence of ICT experts, that high cost of training and retraining staff resulting in low ICT skills on the part of the teacher as a major obstacle. A close look at this propelled that e-learning may not be different from scientific and technological innovative approaches that have been present in science but failed to produce significant impact in teaching and learning.

Table 2: The table revealed that four out of the twelve items of constraints in acquiring needed competencies were rejected by the science teachers as follows: awareness problem, lack of interest/resistance, information overload and no enough time to use ICT facilities. This indicates that they are aware of the roles of e-learning, interested in it and ever ready to make out time for it. This is in support to Abimbade et al (2003) stated that e-learning is an exciting, motivational and innovative front end to the internet, it provides users with a uniform and convenient means of assessing the wide variety of resources. The issue of information overload was rejected based on the fact that e-learning satisfy curricula and lesson objectives in which Lominadze et al (2010) stated that development of instructional design and objective is according to each learning, course specification.

On the contrary, the issue of high cost of ICT provision, poor computer literacy level, inadequate funding, and poor power supply were highly accepted as constraints. This agree with Ogunsola (2005) that stated the diffusion of ICT into Africa is at snail speed. This may be due to the fact that teachers may not have access to a computer either in the school or at home. Even when they have, there is a problem of electricity because electricity service in Nigeria is epileptic. This is to say that the availability, accessibility and the usage of ICT facilities remain considerably very low.

The findings on Research Question 3, itemized different strategies the science teacher should adhere to while creating modern e-learning. A well-structured learning content with organised meta-data system, inclusion of cognitive, affective and psychomotor domains of learning, as well as to develop instructional design for each learning course according to their specifications. The findings are also supportive of Lominadze *et al* (2010) that identified the importance of a well-structured content with inclusion of three domain of learning and the selection of instructional tools which depends on the specific features of a particular learning course.

CONCLUSION

The study reveals the required competencies needed to be improved upon by science teachers in instructional design for effective teaching and learning of science in the tertiary institutions in Rivers State. It identified some constraints that affect the attainment of the required competencies. It also suggested some strategies to be adhered to create modern e-learning. Obviously, e-learning will provide a means of resolving learning difficulties in science, but it should be designed to adapt to learners' need, satisfy curricula and societal aspiration.

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