E-Learning Implementation in Higher Education: Aspects of Infrastructure Development Challenges and Students Learning Approaches

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Abstract

Successful implementation of e-learning in any field of study depends largely on the development and deployment of learning materials using the right infrastructure. In education, there is the need to grant and have access to resources for enhanced learning that would lead to acquisition of the right type of knowledge for gainful employment in industries. E-Learning promotes individual and flexible approach to learning through the use of the right type of infrastructure to facilitate teaching, learning, research and the right type of pedagogy. The infrastructure for e-learning deployment in higher education in advanced countries seemed to be well established compared to those available in developing nations. This paper examines some of the challenges faced by education providers in developing countries in infrastructure development and deployment. These are compared to some of the instances in advanced countries. We investigate the different approaches adopted by students for learning from the perspectives of fully online and blended modes. This paper presents some of the reasons given by learners for engaging in online studies, and also report on suggested ways of addressing the challenges faced by both the teachers and learners in relation to infrastructure development and improvement of education utilizing e-learning.

1.0 Introduction

E-learning (otherwise known online learning or digital learning involving rich student-focused pedagogy) is the use of electronic technology to deliver, support and enhance teaching and learning. It is the use of ICT (Information and Communication Technology) infrastructures such as computers, networks, internet, smart phones and ipads to facilitate access to resources and services as well as remote exchanges and collaborations [1]. This practice has resulted in ILT (Information and Learning Technologies) for modern day educators to support the core business of higher education such as colleges and Universities. Severally, this approach to learning has been utilized to overcome time and distance barriers, provide learning aid for individuals with physical disabilities and also for tailoring learning to meet individual needs.

Migration from the traditional method of teaching to e-learning requires good planning and adequate resource investment. Insensitivities of many governmental and private proprietors of higher educational institutions have resulted in the failure of the use of this approach. The bulk of the failure emanates from inadequate infrastructural deployment. A comprehensive e-learning solution depends on the synergy between the content delivered, technologies used and services provided [2] to produce a quality learning platform adhering to recognized standards that can be delivered to the student in a timely way. This paper comparatively explores infrastructural deployment in relation to students disposition to adopt e-learning methods in higher institutions of learning in developed (case study: United Kingdom) and developing (case study: Nigeria) countries. In the cases of the former and latter, the paper reports on higher education practices in the UK and Nigeria respectively. We recommend relevant solutions to overcome the identified challenges.

2.0 E-Learning Infrastructural Deployment in Developed and Developing Countries

E-learning as a tool and modern technology has revolutionized the educational sector. According to the e-learning statistics for 2014 [3], it is estimated that about 46% of college students are taking at least one course online. In the same vein, by 2019, roughly half of all college classes will be e-learning-based. In higher education, more than 3 million enrolments in online courses in the USA have been reported by American sources [4]. As shown in Table 1, the majority of those online degrees are in higher education institutions, which puts the associate degree level at 50 %, followed by master's degrees at 21%, doctoral degrees:16%, bachelor's degrees: 8% and specialized degrees: 4%.

A recent search on the internet (Google, on December 15, 2014) for 'Online Education in Europe' and 'Online Education in Africa' resulted in 530,000,000 links and 394,000,000 links respectively. To be more precise, a repeat of the search was conducted for 'Online Education in UK', 'Online Education in USA'

and 'Online Education in Nigeria'. Amazing results of 1,010,000,000 links, 626,000,000 links and 83,200,000 links respectively were reported. Although many references occur more than once and a large part of the results were due to the improved algorithms of the search engine, nevertheless the disparity in the statistics reported between the developed and developing countries had been on the rise with the advanced countries constantly taking the lead.

Table 1: Origin of Distance Learners based on level of study. Source: [4]

Degree Type	Percentage
Associate degree	50%
Masters degree	21%
Doctoral degree	16%
Bachelor's degree	8%
Specialized degree	4%

However, a key factor responsible for the huge success recorded by the advanced societies in e-learning implementation is high infrastructural investments and various initiatives taken; both by the governmental and private sectors. According to the American Society for Training and Development, organizations spent over $134 billion on employee learning and development, while expenditure on e-learning rose to $17.5 billion from $10.0 billion between 2006 and 2007 in the United States [5]. As illustrated by the chart in Figure 1, investment in learning technology by private sectors in the USA had seen a progressive growth between years 2008 to 2012 [6]. This is because e-learning technology has gained much popularity over this period, hence the investors' confidence for improved performance.
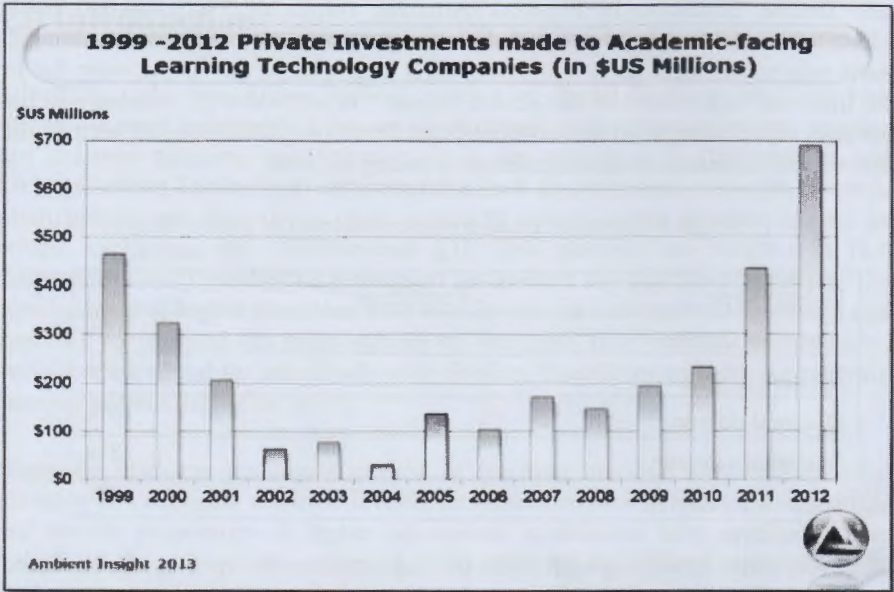
Figure 1: A Chart Representing Investments by Private Sectors in E-learning
Technology in USA.   Source: [6]

Since the 1960s, the Open University in the United Kingdom has been offering undergraduate and postgraduate distance e-learning degrees. Presently, it has begun to extend and expand provision into the next generation of e-learning through its "iTunes U" program that allows students to download course material directly onto their portable computers or listening devices [7]. Over the years, the European Commission had also initiated many projects that focused on supporting higher educational institutions in introducing e-learning. Some of these are the HUMANITIES project, which span through the year 1994 to 1999 [8].   The project's objective was to develop and consolidate a structure for virtual mobility through European universities. The HECTIC (Higher Education Consultation in Technologies of Information and Communication) project was formulated and presented to the European Commission as a mean to bridge the gap between European Union policies and university strategies. A project termed 'SPOT-PLUS' (Students' Perspective on Technology in Teaching and Learning) was commissioned between the years 2001 to 2003. The activities resulted in the assessment of the added value brought about by the use of ICT for didactical purposes in terms of collaborative learning methodologies, access for less favoured categories, effective development of students' transversal skills, and enhancement of the outcomes stemming from physical mobility experiences [8].

In addition to the many initiatives put in place by the government and private agencies in Europe, many organizations were also employed to create guidelines for quality assurance in e-learning in higher education [8]. Examples are the British

Quality Assurance Agency (QAA), Norwegian Association for Distance Education and Flexible Education (NADE), Council for Higher Education Accreditation (CHEA), European Association of Distance Learning (EADL), International Network for Quality Assurance Agencies in Higher Education (INQAAHE) and European Foundation for Quality in E-learning (EFQUEL). Some of the objectives of these organizations are to engage in system design, approval and review, management of program delivery, student development and support, student communication, representation and assessment. Other agencies serve to broaden the discussion and discourse on e-learning quality and to provide a sustainable infrastructure as a single entry point for e-learning quality.

As part of government's efforts to facilitate e-learning in Nigerian universities, ICT resource centres were built in some federal universities which include Michael Okpara University of Agriculture Umudike, University of Port Harcourt, University of Benin, University of Abuja, Federal University of Technology, Minna, Federal University of Technology Owerri and University of Calabar [9]. The Federal Government, through the National Universities Commission (NUC) is also implementing the Virtual Library Project, while conducting capacity-building activities, as well as providing technical and logistics support to enable the universities to build their ICT capacities. The NUC has so far, trained more than 2,000 lecturers in ICT uses and applications in its drive to revamp the country's university system. The commission has spent more than N180 million on the Virtual Library Project, as part of its e-learning and ICT development programmes [10].

Nigerian Communications Satellite (NIGCOMSAT) Limited, a subsidiary of the Federal Ministry of Communication Technology that operates and manages geostationary communications satellite (NigComSat-1R), sees distance education enhancement as one of their services. A project called "Easy Learning" was developed by NIGCOMSAT and NITDA (Nigerian Information Technology Development Agency). Easy Learning is an e-learning program that delivers more than 1500 affordable, certification-level IT, desktop and professional development courses through the Web, allowing student to learn anytime, anywhere for a fraction of the cost of class-based training. NIGCOMSAT also facilitates access to education through the National e-Library project by making materials to education available to 78 universities in Nigeria [11]. The Nigerian Universities Electronic Teaching and Learning Platform was one of the schemes introduced by the Federal Government with the support of the Tertiary Education Trust Fund (TETFund) to support the universities in producing more quality graduates and research output. The project was an ICT-enabled interactive teaching and learning concept, of which the focus was to develop "smart classrooms" that use technology to overcome the challenges of large classes, aid modern methods of teaching and learning as well as content development using interactive tools [9].

In a more recent development, part of the ongoing project for e-learning infrastructural facilitation is the University Inter-Campus Connectivity (UnICC) project spearheaded by the Universal Service Provision Fund (USPF). The fund

was established by the Federal Government of Nigeria to facilitate the achievement of national policy goals for universal access and universal service to information and communication technologies (ICTs) in rural, un-served and under-served areas in Nigeria. The UnICC is a support project to the NUCs' Nigerian Research and Education Network (NgREN) project, the primary purpose is to deliver broadband infrastructure and access to facilitate research and learning using state of the art technology [12].

However, to ascertain students' e-learning level of satisfaction in developed and developing countries, a survey was conducted with a questionnaire using the students of Ulster University, United Kingdom and Salem University, Nigeria as case studies. The result of the survey is as shown and analyzed in the following section.

3.0 Assessments of Students' Satisfaction with E-Learning from Diverse Backgrounds

Students' evaluation was done for some of the modules delivered with e-learning and the responses of students were compared to responses received for similar modules conducted using other modes such as face-to-face and blended. Collaboration was viewed by the students to be one of the features well supported for enhanced learning, which proved useful in preparing them for their assessment.

Result of our study of students learning approaches in a UK institution shows that when dealing with a new topic they work out ideas for themselves in their own way and when conditions are not right to study, they always manage to do something to change them. Thus displaying consistency, application to study and reflective practice featured by e-learning, this survey sampled 72% on the average, (see Table 2). The response from a Nigerian institution gave an average of 58% when samples were taken for students who "agree" with these conditions (see Table 3).

The e-learners must be interested, willing to engage and actively participate in the programmes and activities planned and prepared by the tutors. When the enthusiasm is lacking, the major factor responsible is infrastructural challenges typical of developing nations. This is evidenced by the disparity shown by the result of our survey taken for a UK and a Nigerian institution in the analysis of the result of our study. The resources exist in advanced countries, such as infrastructure and skilled tutors and right strategies and policies for implementation.

Table 2: UK Students' Learning and Studying Approaches Showing Learners' Consistency, Application to Study and Reflection

Conditions	Agree	Unsure or does not apply	Disagree	Definitely disagree
Good at getting down to work at any time	68%	10%	25%	10%
Work out ideas when dealing with a new topic	84%	15%	5%	0%
Manages always to change condition when not right for study	64%	34%	10%	0%

Table 3: Nigerian Students' Learning and Studying Approaches Showing Learners' Consistency, Application to Study and Reflection.

Conditions	Agree	Somewhat Agree	Disagree	Definitely disagree
Good at getting down to work at any time	50%	40%	10%	0%
Work out ideas when dealing with a new topic	60%	40%	0%	0%
Manages always to change condition when not right for study	70%	20%	10%	0%

4.0 Infrastructural Challenges of E-Learning Practice in Higher Education in Nigeria

In spite of the measures put in place to support and encourage e-learning in higher education in Nigeria, our survey reveals lapses in e-learning application in developing countries when compared with the practice in developed countries. Assessment of the students studying approaches revealed that the difference between the approaches adopted by students from developing countries (Nigeria) and those from advanced countries (UK) could be attributed to many reasons such as lack of resources (energy/power/electricity), infrastructure, strategy and policies, which are important for laying a foundation for development and growth. This is due to financial incapacity to implement the resources.

Table 4 shows the financial requirements of the various continents of the world for infrastructural development as produced by the World Economic Forum. Over US$2 trillion dollars are needed every year for the next decade for global infrastructure, including investment in e-learning infrastructures such as electricity [13]. This works out annually to over $400 billion for Africa, $500 billion for Asia, $500 billion for Europe, $300 billion for South/Central America, and $300 billion for North America. Many countries in the advanced continents have well established policies for raising funds to meet these demands by engaging in different strategic plans. For instance, UK institutions of higher learning operate under the 2009 revision of the Higher Education Funding Council for England (HEFCE). The legislation recommends e-learning as part of the technological toolkit for teaching and learning.

Table 4: Yearly Funds Needed for Global Infrastructure
Development (billions), Source:[13]

Africa	$400
Asia	$500
Europe	$500
LAC	$300
North America	$300

This way, E-learning as a technology used in higher education in the United Kingdom is publicly funded under the management of the Joint Information Systems Committee (JISC) [14]. An instance of the e-learning projects funded by the JISC is the alliance of JISC Distributed e-Learning and Higher Education Academy Subject Centre Projects. The project was contracted to the academy over a two-year period; ending 21st March 2006 and was funded with a sum of £1.3million by JISC with an objective to enable Subject Centres to engage with HEFCE's political and strategic agendas. And also to work with their subject communities to use technologies to support learning and teaching [15].

The Malaysia's Vision 2020 Development Plan proposed in 1991 heralded an aggressive approach to technology in general and e-learning in particular. The governmental goal was geared towards establishing a scientific and progressive society that is not only a consumer of technology but also a contributor to the scientific and technological civilization of the future. The plan proliferated e-learning at all educational levels, spurred on by a series of legislation, including the Smart School Roadmap launched in 2005 and the National Broadband Initiatives (NBI) launched in 2010. The Singapore government took a proactive approach to promote e-learning by designing a master plan for ICT in Education. The plan promotes collaboration among teachers, promises trials of new assessment approaches, and anticipates improved connectivity and universal technology access for all students in public schools. The plan also calls upon businesses and institutions of higher learning to collaborate with government for

innovation in technology-based educational efforts [14]. In Canada, according to a News Release 07 August 2014 from the Office of the Premier, Post-Secondary Education, Training and Labour, Economic Development, New Brunswick. The provincial government proposed to invest $800,000 over two years in SkillsNB (i.e Skills in New Brunswick), a new e-learning platform offering training and up-skilling online courses [16].

However, in developing countries, there are challenges which need to be addressed, such as the investment in the right type of infrastructure for e-learning and implementation of policies to support development of individuals and society.

5.0 Strategies for Improving E-Learning Practice in Higher Education in Nigeria

The benefits of e-learning are many and varies. Some of these have been identified to include increased flexibility, improved and revitalized teaching, enhanced learning experience, improved access to resources, and increased rate of success and graduation [17]. However there are important issues that must be considered if these and other benefits are to be reaped. The available staff numbers for development and delivery of e-learning must be of the right size and be skilled adequately. The availability, selection and organization of these services must be properly planned and executed. It is true that, to date, efforts in Nigeria are in the right direction, it is important that all stakeholders play an active role in the realization of the lofty goals that have been set. In the face of challenges such as finance, culture, data and record keeping, development and implementation of different business models to meet the needs of education and the sectors are required. Standard practices in traditional education systems must be well recognized. Some of these would need to be revised to take account of changes associated with e-learning, albeit, they are not too challenging to be put into consideration and cater for. Issues relating to accreditation and standards for quality and learning outcomes would need to be maintained irrespective of the variations in the delivery methods. E-learning helps to streamline the curriculum and enhances the reputation of institutions. It is important that the right level of investment is made at the right level and the chosen time in order to realize the true potential. Some of the tendencies and future directions of e-learning developments in higher education have been reported [18, 19, 20].

In considering e-learning strategies and models, we examine two separate learning strategies that have been advocated for the implementation of e-learning. They include the instructive and constructive models [21]. In the case of the instructive model, the instructor task is simulated in the classroom and the learner is guided through a step-by-step process towards the targeted course objectives. The individual learners' differences and their prior knowledge or present motivation is not accounted for. This renders this model to be instructor-centered with limited interactive capabilities. On the other hand, the constructive model allows learners

to rather build their own knowledge following possibly different learning paths based on their level and the background disparities.

E-learning involves using ICTs to acquire knowledge and skills. This could be children playing interactive games, a group of school pupils collaborating on a science or art project or medical students watching some animated presentation on dissections or nurses using virtual resources to learn to give injections. There must be an initial investment by both the institutions and tutors in preparing and ensuring all requirements are meant for meaningful and useful learning to take place.

Most people using e-learning in schools, industries, offices and home finds out that e-learning makes a significant difference to how quickly they master a skill, how easy it is to study and also how much they enjoy learning. E-learning is vital as it contributes to education objectives by raising standards, improving quality, promoting access, removing barriers to learning and facilitating participation in learning, preparing citizens for employment and up skilling employees in the workplace.

Some of the ways e-learning provision in developing countries can be improved could be through increasing the number of instructional designers and professional development staff supporting e-learning in the institution. Also, when making a selection of e-learning technologies and services, institutions could focus on ease-of-use criteria, ease of integration, security, contribution to learning objectives, reliability and effectives of systems.

6.0   Conclusion

The mapping of pedagogy and promotion of students' engagement with learning in VLEs (Virtual Learning Environments) requires the learning activity to be outlined with the stages of learning well articulated and the learning outcomes identified. It is important that context in which learning is to take place is clarified, with details of the characteristics, level and motivation of learners, the tutors, constraints and preferred pedagogical approach. All mini-learning activities that need to be completed must be identified and tools and resources identified. It is vital to coordinate all activities to allow for interactions with peers, instructors and materials, ensuring feedback is available regularly.

In order that e-learning is successful in both the advanced and developing countries it is important to make its initiatives part of the institution's strategic plan and budget with specific goals set for e-learning initiatives. Development programmes must be planned and deployed as e-learning technology is adopted across board. It is important that an office or centre is established specifically for the management of e-learning along with developing and implementing a strategy for identifying tutors and students that need training. E-learning remains a solution in search of problems. However, it is vital that the process of implementation is understood and followed in order to reap the benefit.

Institutions in developing countries and smaller institutions in advanced nations tend to be behind in e-learning initiatives. This could be due to the initial cost of development and deployment of e-learning. A possible solution could be outsourcing and/or entering into partnership with companies and other institutions for e-learning provision through a variety of European (Horizon2020) and national (UK Royal Society and DFID) capacity building schemes. E-learning is here to stay because it offers the ability to promote access, widens participation in higher education and leads to improvement in education and life of individuals and society. Institutions would need to develop and implement the right blend of policies and governance for implementation of e-learning, investing in staff and students.

References

1   Moore J. L, Dickson-Deane C. and Galyen K., E-Learning, Online Learning, and Distance Learning Environments: Are they the same? (2010), Elsevier Journal of Internet and Higher Education 14 (2011) 129–135.
2   Henry P. (2001). E-Learning Technology, Content and Services, Education + Training MCB University Press. Vol. 43 (4), pp. 249-255, ISSN 0040-0912.
3   Christopher Pappas (2014), Top 10 e-learning Statistics for 2014 You Need To Know. Retrieved Dec., 15, 2014 from: http://e-learningindustry.com/top-10-e-learning-statistics-for-2014-you-need-to-know
4   Allen, I.E., Seaman J. (2003), Sizing the Opportunity: The Quality and Extent of Online Education in the United States 2002 and 2003.
5   Kopf D. (2007) , 'E-Learning Market to hit $52.6B'. Retrieved December, 2, 2013, from http://www.TheJournal.com
6   Winkler K. (2013). Investments in Higher Education Show a Self-Paced and Collaborative Future. Retrieved March, 09, 2015 from: http://edcetera.rafter.com/investments-in-higher education-show-a-self-paced-and-collaborative-future/
7   Albidewi I. and Tulb R., (2014), Promise And Challenge Of E-learning – Literature Review, European Scientific Journal , vol.10(1), pp. 210-217, ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431.
8   Dondi C, and Moretti M. (Editors) (2007), E-Learning Quality In European Universities: Different Approaches For Different Purposes, European Universities in E-learning.
9   Vanguard (2012). NUC Commissions e-learning Platform at UniUyo. Retrieved Dec., 23, 2014 from: http://www.vanguardngr.com/2012/09/nuc-commissions-e-learning-platform-at-uniuyo/
10 The Tide (2011). Promoting ICT-Based Education In Nigeria. Retrieved Dec., 22, 2014 from : http://www.thetidenewsonline.com/2011/07/21/promoting-ict-based-education-in-nigeria/
11 Ahmed-Rufai T., Nigcomsat E-Learning Initiatives. Retrieved Dec., 23, 2014 from: http://centralfloridatraining.com/wp-content/uploads/2010/10/e-Learning.jpg

12 UnICC, University Inter-Campus Connectivity, Retrieved Dec., 23, 2014 from: http://www.uspf.gov.ng/index.php/2014-09-20-22-37-38/2014-09-30-16-00-54/10-unicc-university-intercampus-connectivity

13 IP3 (2014). Certified Project Finance Specialists. Retrieved Dec., 18, 2014 from: http://www.ip3.org/ip3_site/certified-project-finance-specialist.html

14 Rowelle L. (2010). How Government Policy Drives e-Learning, eLearn Magazine.   Retrieved   Dec.,   19,   2014   from: http://elearnmag.acm.org/featured.cfm?aid=1872821.

15 The Higher Health Education Sciences Academy and Practice. Retrieved Dec., 22, 2014 from: http://www.health.heacademy.ac.uk/projects/jiscdel.html

16 GNB (2014). Investment made in e-Learning. Retrieved Dec., 22, 2014 from: http://www2.gnb.ca/content/gnb/en/news/news_release.2014.08.1005.html

17 Jacqueline B., The State of E-Learning in Higher Education: An Eye Toward Growth and Increased Access, (Research Report), Loiusville CO.: EDUCAUSE Centre for Analysis and Research, June 2013, available from http://www.educause.edu/ecar

18. Uhomoibhi J., Palma J., Alves P., Elpebion Y., Restivo M., Piteira M., Soares F., Fernandez C. (2010), "E-Learning Development Tendencies in Higher Education and Future Directions", Proceedings of EUNIS 2010 - 16th International Conference of European University Information Systems, 23-25 June 2010, Warsaw Poland.

19. Ferrell G., Alves P., Alves M., Epelboin Y., Farrugia M., Hayes S., Piteira M., Restivo T., Fernandez C., Engert S., Grepilloux J., Madoz E., Soares F., Leao C., Uhomoibhi J. (2010),"The State of the Nations: Current and future developments in Technology-Enhanced-Learning", Proceedings of EUNIS 2010 - 16th International Conference of European University Information Systems, 23-25 June 2010, Warsaw Poland.

20. Uhomoibhi J. and Ross M. (2010), "Trends in the Development of E-Learning in Engineering and Computing Education", Proceedings of the International Conference on Engineering Education (ICEE) 2010: Engineering Education and Research for Society, July 18-22, 2010, Gliwice, Poland.

21 Duffy T.M. and Jonassen D.H., Constructivism: New implications for educational Technology. Educational Technology, Vol. 31, No.5, (1991), pp. 7–12.