Coping with Emergent Skills: an Appraisal of the Provision and Integration of ICT Infrastructures in Nigerian Universities.

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Abstract- Since the industrial revolution, technology has expanded to influence and impact upon more and more of the world. At work or play, the human being is increasingly faced with technological interfaces. As a result of these changes, many universities have embraced the huge challenge of technology in education based on a transition from process to information-based activities, from an individual approach to a collaborative one, from a knowledge oriented to skill oriented learning. Information and Communications Technologies (ICT) has increasingly dominated universities attention, more so now that the global concern for Higher Education is access for the vast number of people seeking university education. To this end, many universities in developed counties are adapting to the e-learning and virtual university as a panacea to this problem. The purpose of this study is to first and foremost review the state of higher education (University) in Nigeria vis-à-vis factors militating its relevance and efficiency. Secondly, it provides an empirical investigation by examining four key areas of the provision and integration of ICT in Nigerian universities, namely, its impact on the lecturers, the learners, the institutions and our higher education overall policies. Thirdly, technology has provided individuals around the world the convenience of constructing a virtual global learning community. A specific growing technology that compliments the expanding global need is E-learning. When coupling the growth of e-learning with an expanding global marketplace, it becomes imperative to gain an understanding of how Nigerian students are coping with these emergent tools.

Keywords: Emergent skills, ICT infrastructures, Nigerian universities.

1. Introduction

Technology has provided individuals around the world the convenience of constructing a virtual global learning community. Businesses, educational, and training organizations no longer must rely solely on face-to-face, teacher-led or lecture style instruction.
E-Learning and Information Communications Technologies (ICT) cannot be successful without an appropriate and adequate infrastructure. It is worth mentioning here that The ICT revolution started in Nigeria after return to democratic rule in 1999 (Ajayi, 2003). This notwithstanding several government agencies and other and other stakeholders in the private sector have initiated ICT driven projects and programs to impact all levels of the educational sector. When coupling the growth of ICT usage with an expanding global marketplace, it becomes imperative to gain a better understanding of the provision and integration of ICT infrastructures in Nigerian Universities.

Many universities and organizations are building infrastructure systems that support e-learning programs, performance, content, and resource management, but most of them focused on content and delivery. Although content and delivery are important, they alone don't equal ICT success. In fact, focusing only on content and delivery can create an unsuccessful ICT experience. Infrastructure is the permanent foundation on which ICT can function effectively. Supporting the entire infrastructure is a common vision and language for conveying effective ICT implementation across the enterprise.

Infrastructure, according to Blinco, K.,, Mason, J., McLean., N., and Wilson, S., (2004) is highly contextual in its meaning. In e-learning contexts, "e-learning infrastructure", "technical infrastructure", and "ICT infrastructure" all convey a range of meanings. For the technically inclined, "infrastructure" often describes a bottom "layer" of an architectural description or diagram, indicating network hardware components, communications processes, services and protocols. For the purpose of this study 'infrastructure' describes everything that supports both the flow and processing of information, including but not limited to, Internet connectivity, hardware, software, facilities, communication protocols.

In recent times, there has been a few e-Learning educational provisions in Nigeria. There are currently 52 university centers and colleges of education who have their domain names registered while 15 are active email users. Also, there are several initiatives; these initiatives are either being undertaken by government, civil society or the private sectors. Omwenga (2003) listed them as:

Government e-education initiatives and NGO's e-Learning initiatives:

Government e-education initiatives include the following:

1. The Nigerian Universities Network (NUNet) Project
2. The Polytechnics Network (PolyNet) Project
3. The School Net Project
4. The Nigerian Education, Academic and Research Network (NEARNet)
5. The Teachers Network (TeachNet) Project
6. National Open University
7. National Virtual (Digital) Library (Ministry of Education/ NUC)
8. National Virtual Library (Ministry of Science and Technology/NITDA)
9. National Information, communication and education programme of the presidency.
10. The NGO's e-Learning Initiatives

These include examples of tele-centers

1. Community Teaching and Learning Centers
2. Lagos Digital Village by Junior Achievement Nigeria
3. Owerri Digital Village by Youth for Technology Foundation
4. Computer Literacy for Older Persons Programme by Mercy Mission

Even though details of the various initiatives can be found in Omwenga (2003), it is important to elaborate on the objectives of two of the initiatives which are detailed below.

a) National Universities Network (NUNet) Initiatives
National Universities Network (NUNet) was established in 1994 with the following objectives:

1. To end isolation of Nigerian academic staff and students from each other and from the global academic community;
2. To ameliorate staff shortages arising from the brain-drain, by providing the ICT facility required by our academic staff-in-Diaspora to make their contributions regardless of where they live or work;
3. To encourage the sharing of resources, foster academic and research collaborations among Nigerian Universities, and with their counterparts throughout the world;
4. To provide universities with access to electronic databases, journals and books many of which are increasingly available only in digital formats;
5. To serve as vehicle to expand access to education at minimal cost of capital building expenditure; and
6. To place Nigerian universities at the forefront of the information revolution, that they might serve their proper roles as foci for national development.

(b) Virtual Library Initiatives
Virtual library initiatives in Nigeria include:

- The National Virtual (Digital) Library Project of the Ministry of Education,
- The National Virtual Library Project of the Ministry of Science and Technology is supervised by the National IT Development Agency.
- An ongoing effort by UNESCO to develop a virtual Library for all Nigerian Higher Education Institutions in Nigeria.

The objectives of national virtual library initiatives are as follows:

1. Improving the quality of teaching and research institutions through the provision of current books, journal and other library resources;
2. Enhancing access of academic libraries to global library and information resources; enhancing scholarship and lifelong learning through the establishment of permanent access to shared digital archival collections;
3. Providing academic libraries on ways of applying appropriate technologies for production of digital library resources;
4. Advancing the use and usability of globally distributed networks library resources.

To further boost distance and open education in tertiary institutions of learning the National Universities Commission also established the Virtual Institute for Higher Education (VIHEP) in year 2003 as part of the preparation for the eventual take-off of the National Higher Education Pedagogy Centre (NHEPC) in July 2004. The objectives of the institute as elaborated by Okebukola (2003) are as follows:

- To provide academic staff in tertiary institutions in Nigeria especially universities with Internet-based training on modern method of teaching and learning in higher education
- To enhance the knowledge and skills of academic staff on such issues as (a) teaching of large classes; (b) effective utilization of (meager) resource; (c) modern methods of assessment and evaluation of students' performance; (d) basic guidance and counseling techniques; (e) basic skills of curriculum development: and (f) techniques for writing winning grant proposals.
- To share experiences among academic staff in Nigerian universities on best practices in university teaching and how to deal with academic and social vices such as examination malpractice, plagiarism and cultism.
- To try out draft training modules for the National Higher Education Pedagogic Centre.

2. Problem Statement

Nigeria lacks the infrastructures for the full-scale deployment of e-learning facilities. This is besides the high cost of using the technology and maintaining it. Telephone density in the rural areas is still low while Internet access is concentrated only in urban centers and a few higher learning institutions. Furthermore, most of the telephones in the urban areas are within offices rather than households. This situation calls for institutions of higher learning and the private sector to prioritize investments in this sector in order to accelerate growth in offering e-Learning education programs as well as enhancing delivery of educational content in general. Poor ICT infrastructure in many of the campuses of our Universities in Nigeria can slow down the implementation of some of the technology-supported instructional methods. We hope that with a new e-learning platform and increased awareness, as well as the desire for more flexible delivery alternatives, our Universities will find reason to move even faster and extend the infrastructures to their campuses. Because of the problems stated above, it is imperative to explore the provision and integration of ICT Infrastructures in Nigerian Universities.

3. Purpose

Effective Internet access is dependent on the availability of technological, physical and support infrastructures. Despite their availability, the full benefits cannot be obtained if there is too little use of the facilities and if the level of customer satisfaction is low because of poor management of the facilities. The purpose of this study is to assess the provision and integration of e-Learning infrastructures in Nigerian Universities and the impact of infrastructures on both educator and the students. Specifically, we will explore the technological and physical infrastructure for ICT and Internet access in the campus and the support infrastructure, including financial assistance and the proportion of ICT-oriented courses of studies and of academic staff and officials with an ICT background working in the concerned sectors of the university; investigate some aspects of using the Internet.

4. Research Questions

To fulfil the purpose, this study seeks to answer the following research questions:

1. What is the status of e-learning and ICT infrastructures in Nigerian universities?
2. What are the current views of learners towards e-learning and ICT infrastructure?
3. What are the current views of lecturers towards e-learning and ICT infrastructure?
4. How do these views differ across various universities?

5. Research Methodology

A quantitative approach was used in this study. The study reviewed the relevant literature published in books, journals and websites. The research conducted a survey of three universities in Nigeria (University of Lagos, Covenant University and Babcock University respectively) to evaluate the provision and integration of ICT infrastructures in their respective schools.

5.1. Data Analysis

Given the parameters of this study a descriptive analysis was deemed as an appropriate statistic for data analysis. With the exception of a small number of open-ended questions, the responses were pre-coded for ease of data entry. The data, including comments, were first entered on to an Excel spreadsheet. Following checking and correction, the data were then uploaded onto SPSS for statistical analysis (frequency analysis and factor analysis). Questionnaires were distributed to lecturers and students at university of Lagos, Covenant University, and Babcock University in the Nigeria.

5.2. Findings

The distribution of the questionnaires was done directly during school period. The researchers went to the schools, asked for the permission of the schools' authorities, and distributed to the students and the lecturers that were around. A total of 215 valid questionnaires were obtained. Forty one percent of the participants were male and 59% were female; 12% of the participants are between 19 to 20 years old, 78% are between 21 to 25 years old, 3% are between 26 to 30, while 7% are over 30 years old.

When it was asked, how many of the participants have a personal computer or a laptop, 54% indicated they do not have either a personal computer or a laptop while 46% indicated they have personal computer or a laptop.

i. Demographic Information (Profile of the Respondent)

By means of a combined reading of the data obtained from the survey on population and the socio-demographical variables it is possible to identify the most characterizing elements amongst students and lecturers. Gender appears to be the first characterizing element:

44% of men stated that they had used Internet for school and academic work and 56% of women said the same thing. Using other information of a socio-demographic nature such as age, it is possible to say that, as regards the frequency of Internet usage, participant between 26 to 30 years old use the Internet the most for school and academic assignments.

ii. Users' Access to Computer and Internet

Teachers, students, and administrative staffs were identified as computer and Internet users in the campus. The study finds that (see Table 1) 69 out of 89 male respondents indicate that they use the Internet very frequently while only four indicate that they have never used it at all. Also, 81 out of 126 female respondents indicate that they frequently use the Internet, but five indicate that they have never use it. Based on this data, we concluded that most students had limited access to computers and Internet in some of the departments, institutes, and faculty labs. However, academic staffs had computer access in either in their offices or in the departmental offices.

Table 1: Frequency of Internet Usage for school and academic assignments

Variables	*Not at all*	*Seldom*	*Very frequent*	*Neutral*	*Total*
Male	4	11	69	5	89
Female	5	40	81	0	126

Based on this analysis and other data collected in this study, we were able to conclude that e-learning is fairly new in Nigerian universities; ICT has been in use for some time, but the infrastructures to support both are not where it supposes to be in many universities in Nigeria.

iii. Access to a range of technologies

Respondents were asked to indicate whether they had access to a list of ICT technologies (Desktop PC, Laptop computer, CD-ROM drive, Internet connection,
Fax, Digital TV, ISDN line, DVD Player and Mobile phone). They were given a number of options to indicate where these technologies could be accessed (no access, home only, university only, work only, other place only, or a combination of these options). While a number of respondents indicated that they had no access to PCs or the Internet, in fact, all students are provided with some access on campus through computer laboratories and Internet cafes at minimal cost. It is apparent from examination of the non-responses that some respondents were not familiar with the technology. Learners are anxious about e-learning and ICT, but the infrastructures are not available in many of their campuses.

Experience of ICT in education

The data on usage of email and accessing educational material were further analyzed by programme, to establish if there are any variations in patterns of usage. The first research question was answered by looking at various variables as shown in Table 2 below. This question was investigated in many ways; specifically, 15 Deans of Education from 15 universities in Nigeria were surveyed during a conference that was held at the University of Lagos. They were asked the following question: What is the status of e-Learning and ICT infrastructures in Nigerian universities?

Based on the survey of the Deans from the fifteen universities, 87% of the university has its own dedicated web site. Most of the university web sites contain the general information about the university, its faculties, institutes, departments, library, publications, admission, etc. The study reveals that only 67% of the universities has Internet connectivity for each academic staff, 64% indicated they could access computer network remotely, while 73% claimed they had computer for individual academic staff. The Deans claimed that in almost all cases, the existing infrastructures could support e-learning and ICT. How do these views differ across various universities?

Table 2: Percentage of Responses to e-Learning and ICT infrastructures in Nigerian Universities

	Computer for individual academic staff	Internet connectivity for each academic staff	Computer network accessible remotely	A dedicated website
Don't know	7%	0%	13%	0%
No	20%	33%	20%	13%
Yes	73%	67%	64%	87%
	100%	100%	100%	100%

Also, when the Deans were asked, "of their views and which of the statements in the table below they think best describes their department's approach to ICT and e-learning, their responses are discussed below:

Fifty three percent indicate they have not considered e-learning, 53% considered e-learning activities but do not think it is appropriate, 4% have considered e-learning activities but not taken it forward yet, 31% are putting in place plans for implementing e-learning, 62% are piloting e-learning activities, and 29% do not have appropriate infrastructures for e-learning and ICT.

Student ICT abilities, experiences and attitudes

The questions concerning ability to use different applications were answered on a four point scale, ranging from 1 ('beginner) through 2 competent) to 3 advanced and 4 no knowledge). These were a subset of the questions used in this project in three universities with a total of 215 respondents and which proved highly reliable.

In general, the students in our sample reported good skills with different applications. The highest abilities were found with Microsoft Office products, Internet usage, downloading information, sending emails, and playing games on PC. A slighter lower ability for web design and programming were reported.

Experience of e - learning methods

The questions with respect to experience of e-learning methods were answered on a four point scale; 1 ('never heard of this'); 2 ('used this once'); 3 ('never used this'); 4 ('used it several times'). Students at the different universities reported most experience of academic support and advice from a teacher using e-mail, followed by on-line discussion forums and a website with interactive features. In contrast, students had less experience with virtual learning environments and even less experience with video-conferencing. Given the known high use of email for support and low use of videoconferencing in undergraduate teaching at many of the universities these patterns are to be expected and confirm the reliability of the students' responses.

Internet Application Software

Among the Internet application software available, Internet Explorer was remarkably used by all the sectors (100%) of the university. Other software was less used including Netscape Navigator and SN Explorer.

Internet Access Benefits

General overviews of the responses indicate some common Internet access benefits, and options were given to answer more than one item. It is found that all respondents (100%) identified Internet as a platform for online communication most commonly via e-mail, while 91% considered Internet as a tool for academic and professional excellence. About 80% respondents mentioned that Internet facilitated them to access a wide range information sources including e-books, e-journals, digital theses and dissertations on diverse subject fields. Another benefit indicated by students was the access to basic and general information of different universities in home and abroad which would help them to know other universities, network, do home works, conduct research etc.

Major Constraints

Here are some of the specific issues the participants consider as challenges for ICT and e-learning usage.

Table 3: Frequency of Internet Usage for school and academic assignments (n=215)

	f	*%*
Not at all	8	3.7
Very Little	40	18.6
Extremely Important	167	77.7
Total	215	100

Table 4: Provision of sufficient funding for ICT infrastructures (n=215)

	f	*%*
Not at all	20	9.3
Very Little	14	6.5
Extremely Important	181	84.2
Total	215	100

Table 5: Obtaining different software that are specific enough for different course (n=215)

	f	*%*
Not at all	20	9.3
Very Little	14	6.5
Extremely Important	181	84.2
Total	215	100

The perceived barriers in tables 3, 4, and 5, which prevent or restrain ICT and e-learning usage indicated by the greatest number of people, are that of frequency of Internet Usage for school and academic assignments, cost (funding), and the ability to obtaining different software that are specific enough for different courses.

Conclusion

It should be remarked that the quantity and quality of e-learning initiatives in Nigeria is grossly inadequate and poorly maintained. The present situation should not be

allowed to continue more so as we are a country aspiring to be technological buoyant. The potential benefits, which the new technologies can bring to our educational system, if implemented and exploited effectively do not seem to be in question. However, fundamental issues need to be considered relating to the possibilities and practicalities of integrating them in a meaningful way into the system. There will be some major obstacles to their use in our higher educational institutions and the wider community. Some of these obstacles include poor infrastructure, professional competence, teachers' attitudes, cost, lack of technical expertise and skilled Manpower, conflict with the curriculum, lack of information, and content development.

Poor Infrastructure - Nigeria today lacks the infrastructures for the full-scale deployment of e-learning. This is besides the high cost of using the technology and maintaining it. Telephone density in the rural areas is still low while Internet access is concentrated only in urban centers and a few higher learning institutions. Furthermore, most of the telephones in the urban areas are within offices rather than households. This situation calls for institutions of higher learning and the private sector to prioritize investments in this sector in order to accelerate growth in offering e-Learning education programs as well as enhancing delivery of educational content in general. Poor ICT infrastructure in many of the campuses of our Universities in Nigeria can slow down the implementation of some of the technology-supported instructional methods. We hope that with a new e-learning platform and increased awareness, as well as the desire for more flexible delivery alternatives, our Universities will find reason to move even faster and extend the infrastructures to their campuses.

Professional Competence - Teacher education is considered to be the single most important factor in ensuring the successful use of ICTs in education. Its importance has tended to be overlooked or underestimated in the development of initiatives for introducing these technologies into our educational institutions with the result that many projects fail outright or are never developed to their full potential. Teacher education is not only vital for equipping educators with the necessary skills for using ICTs effectively in the classroom, but also for helping teachers to overcome their often strong resistance to these technologies and to develop positive attitudes towards them. Hence, there is the need to introduce two levels or types of training for our teachers. These include: 1) an introduction to the technologies and preparation to operate and manage the hardware; and 2) training in the pedagogical use of the technologies. The latter might pose a particular major challenge since it remains a relatively new area of teacher education.

Teacher attitudes - Teachers are likely to resist the introduction of ICTs into the classroom for a variety of reasons. Their unfamiliarity with the technologies, the additional time and effort necessary for their effective use, and perhaps the feeling that ICTs pose a threat to their professional role and image, are some of the reasons for this resistance. Hence, there should be a constantly involvement of teachers in the logistics of implementation, courseware preparation, experimentation and piloting of the e-learning system.

Costs - The price of hardware and software, although constantly decreasing, remains considerable for many of our higher educational institutions' budgets in Nigeria. They are also under-equipped with personal computers, CD-ROM drives, appropriate and adequate software packages. In addition to ordinary maintenance costs, the rapid evolution of information and communication technologies implies constant upgrading of equipment and facilities if our higher educational institutions are to keep abreast of these developments in the classroom. The various learning technologies have major differences in their cost structure. On the one hand, the major cost of using online communication technologies to provide flexible tutorial support is frequently the cost of tutors' wages as the number of hours which tutors can spend online is potentially very substantial. On the other hand, the major cost element in the use of online resource technologies is frequently the initial cost of producing the resources (especially as one goes up the levels of these resources). The cost of on-line telephone charges for use of the Internet remains high and it is a major deterrent to the use of Internet in many institutions. Installation of faster connections such as ISDN digital telephone lines or fiber optic cables, which would in theory reduce time spent on the network, is also expensive. It is however important to remark here that the Federal Government of Nigeria has already started to install fiber optic cables in all the hooks and corners of the country especially in major cities.

Lack of technical expertise and skilled Manpower - Nigeria, like most other developing countries, lack technical expertise in this domain at all levels. Their limited resources mean that the country usually has neither the local capacity to develop the necessary human resources in this field nor the means to attract highly skilled and expensive experts from abroad. Therefore, skilled manpower for the administration of the e-learning environment's technical issues is crucial to the success of the methodology. Content must be updated as and when it is necessary, hosted and made available for access. Where CD-ROMs must be cut for remote access, such activities must be done speedily and availed with minimum delay.

We need to train middle-level skilled manpower for the successful implementation of the e-learning programmes.

Conflict with the curriculum - Problems may arise during implementation that conflict with the present curriculum being used in our higher education institutions, especially with the development of educational software, which may be imposed, on teachers without their being involved in its selection, development or evaluation. For example, some educational CD-ROMs are often not curriculum-based and teachers will need to take permission or spend a lot of extra time devising appropriate ways to incorporate them into the regular curriculum. There is therefore the urgent need to update our curriculum in line with modern technological trends.

Lack of information - A significant obstacle to the use of ICTs in education in Nigeria hinges on the lack of information that is available both to educational decision makers and practitioners. The type of information lacking is broadly of two major categories i.e. information about the role and value of these technologies in education and more specific information relating to available hardware and software and how to use it in the curriculum. It is important therefore to sufficiently educate the populace.

Content development - Teachers will need to be trained especially in content development, which is the driving engine of any information system. It is often realized, after beautiful websites have been developed, that there is not enough content to justify the investment and hence failure to update them often. Also important is the development of such content into appropriate modes for use in the new instructional technologies.

E-learning materials can be delivered in different modes. However, choosing a mode will depend on such factors as proximity to the Internet facilities, access to the central server where the material is held, and access to computing facilities. Sometimes, a mix mode of e-learning with printed materials, classroom face-to-face teaching, chatting tools and even videoconferencing may be preferable. The following four main modes of rendering content can be used:

(i) Content on Media
This is content organized into logical units and made available in portable media such as CD-ROMs. The content may have limited interactivity inbuilt into it. Graphics, animations, audio and video forms of content can be included. This option is quite suitable for students in remote places.

(ii) Content on Intranet
Any content on CD can be made available within an intranet as a shared resource. The presentation of such content is largely similar to the one above but limited asynchronous interaction can be enabled by email.

(iii) Content on Web
This kind of content is similar to content on Intranet but is accessed using web browsers and therefore can be available on the Internet. An advantage of this is that content can be regularly updated and made more current.

(iv) Content on Electronic Learning Environment
An Electronic Learning Environment (ELE) is an elaborate Instructional platform that enables the development and delivery of content to learners. It also supports content

RECOMMENDATIONS

There is no doubt that the Internet has brought a great change in the nature of functions and activities in different sectors of Universities in Nigeria. Academicians are increasingly dependent on the Internet day by day. But as reflected in the present research, the infrastructures in Nigeria Universities are not at a satisfactory level. On the basis of the situation of Internet connectivity and accessibility in the campus, certain recommendations are made for future considerations.

- In most of the universities, the LAN should be extended to cover all academic buildings, teachers' and students' dormitories, medical centre, physical department, and other offices to ensure more connectivity and more accessibility.
- Initiatives should be taken to enhance the present bandwidth of VSAT data circuit so that the faster data transmission and quick access to Internet can be provided.
- Many authorities were not satisfied with the present Internet services and of the university computer centres. The university should establish a full-fledged cyber café equipped with a good number of latest computers, modern lab facilities with sufficient space to accommodate more users, and major Internet access services to meet the customer demand.
- All faculties, departments and institutes should be provided with sufficient computers and accessories to develop independent computer laboratories with Internet connection as well as to ensure more access facilities.
- The university authority should take a long-term plan to create Internet access opportunity for general students usage.
- Various faculties and departments should equally be provided with sufficient budget, and even special allocations only for ICTs on a priority basis.
- University authorities should take immediate action to automate their libraries and to introduce Internet library system. Moreover, the library, being a focal point, should establish an online networking and resource-sharing programme with the departmental seminar libraries,

institute libraries, faculty libraries and the libraries for students.

- Besides the common Internet access services, the authority should introduce some special type of facilities and value added services like- Internet telephony, fax-to-fax and voice over IP, etc.
- Since power failure has become a common problem in Nigeria, the university should take initiatives to ensure uninterrupted power supply within their capability so that Internet can be used without any hazard.
- The implementation of the suggested measures would ensure maximum utilization and benefits of the campus network. But it is beyond the university's means to implement all the measures at the same time. Therefore, a step-by-step priority-basis plan should be taken to make the recommendations more realistic and successful.

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