The Influence of Integrating E-learning Technologies in Technical Education System

Rabiu Haruna  
Electrical and Electronic Department, School of Technical Education  
Federal College of Education (Technical) Bichi, Kano State  
rabsabr@foxmail.com

Abstract
E-learning requires the use of information and communication system to provide teaching and learning and is now progressively more important in the delivery of higher education. The scope of paper concerns the influence for integrating e-learning technologies to support teaching of some subjects in technical education system. The majority of students on our college or university are regular students, having lectures on weekdays. Classical methods of teaching are used, because technical subjects usually require presence of student in laboratory and direct contact with the teacher. However growing number of students and reduced number of lecture hours for specific subjects, caused by growing number of subjects, as well as challenges of modern world, is a reason of searching for the improvements of teaching methods. The paper provide an introduction to e-learning and its role in technical education by outlining key terms, the components of e-learning, the evidence for its effectiveness and evaluation strategies for e-learning. E-learning technologies offer learners control over content, learning sequence, pace of learning, time, and often media, allowing them to tailor their experiences to meet their personal learning objectives. The integration of e-learning into technical education can catalyze the shift toward applying adult learning theory, where educators will no longer serve mainly as the distributors of content, but will become more involved as facilitators of learning.

Keywords: E-learning, Technical Education, Internet Technologies, Digital Libraries

Introduction
E-learning refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance (Rosenberg, 2001; Sharpe, Benfield et al. 2006). E-learning can be used by technical educators to improve the efficiency and effectiveness of educational interventions in the face of the social, scientific, and pedagogical challenges noted above. E-learning is a concept derived from the use of information and communication technologies (ICT) to deliver teaching and learning. A common definition states that e-learning in higher education is a technique to enhance learning and teaching experiences and is used to educate students with or without their instructors through any type of digital media (Christie and Ferdos, 2004). E-learning has also been defined as learning and teaching facilitated online through network technologies (Penny, 2010; Garrison, 2011) and described as utilizing many ICT technologies (Kahiigi Kigozi, Ekenberg et al. 2008).
E-learning can either be used to replace traditional face-to-face teaching completely, or only partially, for example, the use of ICT is sometimes introduced as an additional resource alongside traditional teaching methods. A major advantage of ICT is that accessing online learning resources is flexible and fast and has no geographical barriers (Concannon, Flynn et al. 2005). According to (Dalsgaard, 2006), e-learning technology offers a wide range of opportunities for development of education, and the major advantages of the use of e-learning are independence of time and space and individuality, e.g., courses can be adapted to the individual student and materials can be reused or rearranged.

Technical Education remains the popular means by which trained manpower is produced for economic and industrial growth of both developed and developing countries in the world. The Federal Republic of Nigeria, specifically stated in its National Policy on Education (2004) that, “Technical and Vocational Education is used as comprehensive term referring to those aspect of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in the sectors of economic and social life”. This could be one of the reasons why Technical Education (TE) is integrated in almost all educational levels; primary, secondary and tertiary institutions. It is also an area that is attracting the attention of young and old researchers as well as educationists around the globe (Bappa-Aliyu, 2012). Moreover, the impact of TE in curtailing the menace of unemployment, reduction of poverty and the breakthrough in industrial development makes it one of the field of study that requires full deployment of Information and Communication Technologies (ICTs), especially in the present era where world of work is rapidly changing its requirement for workers from skill based to an ICT capable (Karahoca, Duld et al. 2010). This is because recent developments in technology, globalization and changing demand for new skill sets in the job market have necessitated a need for a new teaching and learning paradigm (Chijioke 2013).

Components of E-Learning
Creating e-learning material involves several components: once content is developed, it must be managed, delivered, and standardized. Content comprises all instructional material, which can range in complexity from discrete items to larger instructional modules. A digital learning object is defined as any grouping of digital materials structured in a meaningful way and tied to an educational objective (Njenga and Fourie, 2010). Learning objects represent discrete, self-contained units of instructional material assembled and reassembled around specific learning objectives, which are used to build larger educational materials such as lessons, modules, or complete courses to meet the requirements of a specified curriculum (Littlejohn, 2003; Welsh, Wanberg et al. 2003) Examples include tutorials, case-based learning, hypermedia, simulations, and game-based learning modules. Content creators use instructional design and pedagogical principles to produce learning objects and instructional materials.

Content management includes all the administrative functions (e.g., storing, indexing, cataloging) needed to make e-learning content available to learners. Examples include portals, repositories, digital libraries, learning-management systems, search engines, and ePortfolios. A learning-management system, for example, is Internet-based software that facilitates the delivery and tracking of e-learning across an institution.(Phelps and Micheal, 2003; Smith, 2004) A learning-management system can serve several functions beyond
delivering e-learning content. It can simplify and automate administrative and supervisory tasks, track learners’ achievement of competencies, and operate as a repository for instructional resources twenty-four hours a day (Phelps and Michea, 2003; Smith, 2004).

Content delivery may be either synchronous or asynchronous. (Sharpe, Benfield et al. 2006) Synchronous delivery refers to real-time, instructor-led e-learning, where all learners receive information simultaneously and communicate directly with other learners. Examples include teleconferencing (audio, video, or both), Internet chat forums, and instant messaging. With asynchronous delivery, the transmission and receipt of information do not occur simultaneously. The learners are responsible for pacing their own self-instruction and learning. The instructor and learners communicate using e-mail or feedback technologies, but not in real time. A variety of methods can be used for asynchronous delivery, including e-mail, online bulletin boards, newsgroups, and Weblogs.

The Evidence for Effective and Efficient E-Learning
The effectiveness of e-learning has been demonstrated primarily by studies of higher education, government, corporate, and military environments (Mioduser, Tur-Kaspa et al. 2000; Bernard, Abrami et al., 2004; Lim and Morris, 2009). However, these studies have limitations, especially because of the variability in their scientific design (Bernard, Abrami et al. 2004). Often they have failed to define the content quality, technological characteristics, and type of specific e-learning intervention being analyzed. In addition, most have included several different instructional and delivery methodologies, which complicates the analysis (Smaldino, Lowther et al., 2008). Most of these studies compared e-learning with traditional instructor-led approaches (Bernard, Abrami et al. 2004; Smith, 2004). Yet three aspects of e-learning have been consistently explored: product utility, cost-effectiveness, and learner satisfaction. Utility refers to the usefulness of the method of e-learning. Several studies have revealed that most often e-learning is at least as good as, if not better than, traditional instructor-led methods such as lectures in contributing to demonstrated learning (Mioduser, Tur-Kaspa et al., 2000; Sharpe, Benfield et al., 2006). (Mioduser, Tur-Kaspa et al. 2000) cited several studies from the pre-Internet era, including two meta-analyses that compared the utility of computer-based instruction to traditional teaching methods. The studies used a variety of designs in both training and academic environments, with inconsistent results for many outcomes. Yet learners’ knowledge, measured by pre-post test scores, was shown to improve. Moreover, learners using computer-based instruction learned more efficiently and demonstrated better retention (Lawal, 2014).

Evaluating E-Learning Processes and Outcomes
Adopting e-learning and its technology requires large investments in faculty, time, money, and space that need to be justified to administrators and leadership. As with other educational materials, there are two major approaches to the evaluation of e-learning: process and outcomes. Process evaluation examines an e-learning program’s strengths and weaknesses and how its results are produced, often providing information that will allow others to replicate it. Peer review is one type of process evaluation. Traditional peer review for journal articles verifies the quality of content. E-learning requires the consideration of additional dimensions. For example, is it easy to “navigate” through the online material? Is the appearance conducive to education? Are multimedia elements used effectively? Is the interactivity appropriate for the level of the learner? Are special computer skills, hardware, or
software required? These and other questions place new demands on peer reviewers engaged in process evaluation of e-learning.

Satisfaction measures learners’ reactions to the material: was it easy to use, hard to use, fun, boring, and so forth. But satisfaction measures alone do not measure learning. For example, excellent content that learners find difficult to use may be rated as poor. Likewise, a module that is highly entertaining in its use of multimedia but superficial in its content may be rated as excellent.

Tracking and monitoring learners’ knowledge, attitudes, and skills via a learning-management system can greatly simplify the process of evaluating the gains made through e-learning. An approach that combines assessment of skills and attitudes using e-learning technology with facilitator-mediated observation would allow a more in-depth evaluation of skills and behavior. By contrast, evaluating the direct result of an education program by measuring changes in learners’ behaviors, institutional changes, time-consuming, and mostly. E-learning assessments can be one valuable component in such overall evaluation of technical school curricula.

E-learning Technologies in the Context of Technical Education

Usage of e-learning methods comparing to classical methods of education has some advantages, e.g. possibility of learning at any time at home (journey to school or course-centre is not necessary), possibility of learning speed adjustment for every single course participant and possibility of matching learning style to perception of each student. Possibility of taking part in rehabilitation and learning course at the same time gives student great chance to acquire knowledge and skills moreover opens access into labour market and new workplaces that was very restricted till now (Ademola, 2015).

Due to the flexibility, simplicity and affordability of ICT facility in all areas of human endeavour, its application in the field of education is gaining popularity among educational organisations and their stakeholders (Tondeur, Van Keer et al. 2008). TVE in this context is not an exception too; the use of ICTs to foster employability skills is highly recommended (Saud, Shu et al. 2011). However, the use of Information and Communication Technologies (ICTs) toward the preparation of TVE graduates; and in their mode of training should also incorporate the use of e-learning in teaching learning process. E-learning enables students, trainees and teachers/instructors interact virtually without physical contact. The consensus among educational practitioners is that e-learning is ‘the use of processes and technologies to create, distribute, manage, and enable learning via an electronic network. By the implication of the above definition, one may wonder how e-learning environment that is similar to distant learning in designed and presentation can support the nature of courses offered in TVE, considering the fact that majority of the courses require hands-on activities (practical activities). But above definition offered some explanation to that effect, as to e-learning environment and its flexibility to allow for the development of course content by lecturers/instructors, in order to give both teacher and student an opportunity to upload and download course material (interaction) and of course the material dealing with practical (hands-on) activities; such as machining, measurement and so on. E-learning in the delivery of hands-on activities have found application in engineering education (Gupta, 2002; Bappa-Aliyu, 2012).

The use of interactive electronic media has proven advantageous in recent study on
vocational and technical education students and even seen as a solution to shortage of staff and materials in the field (Karahoca, Dulda et al. 2010). The integration of e-learning to facilitate problem based learning in engineering and technical education will give students some sort of support to comfortably take part into learning activities, gives them an opportunity to work independently and developed new ideas on the problem at hand (Tasir, Harun et al.; Fung, 2004). It was further identified that some strategies for the effective integration of e-learning in problem based learning (PBL) for engineering and technical education are as follows:-

1) The use of online assignment tool;
2) The use of both synchronous communication tools (such as chatting) and asynchronous communications tools (such as forum and journal);
3) Lecturer-initiated communication for the PBL case on the e-learning platform,
4) Frequent availability of lecturers online for facilitation, and
5) The use of online journal for reflection and assessment.

Integrating E-Learning into Technical Education

The integration of e-learning into existing technical education curricula should be the result of a well-devised plan that begins with a needs assessment and concludes with the decision to use e-learning (Xin, 2007). Although some institutions have tried to use e-learning as a stand-alone solution to updating or expanding their curricula, we believe it is best to begin with an integrated strategy that considers the benefits and burdens of blended learning before revising the curriculum. In undergraduate Technical education, e-learning offers learners materials for self-instruction and collaborative learning.

The complexity and breadth of Technical education content, together with the scarcity of experts and resources in e-learning, make the creation of centers of excellence in e-learning a reasonable proposition. Such centers could offer a wide range of services, including system deployment and administration, training of faculty and administrators, assistance in content development, the design of learning pathways and programs, marketing and support, supervision, maintenance and research. The Internet is a U.S.-based, collaborative, university-led project started in 1996 to develop additional infrastructure for the Internet backbone capable of superhigh bandwidth. (Ruiz, Mintzer et al. 2006; Muhsin, 2008; Tyagi, 2012). The Internet2’s vision of extremely fast speed, complex real-time multimedia capabilities, and quality of service would provide educators enormous potential to enhance the learning experience (Tyagi, 2012) Larger bandwidth offers the promise of sophisticated immersive simulations and the use of full-motion video in real time, in both asynchronous and synchronous modes of instruction, delivered to any desktop computer (Zhang, Zhou et al. 2006).

Benefits of Integrating E-learning in Technical Education System

Generally, the preparation of course material for online, web-based or e-learning environment is time consuming at the initial stage. However, the flexibility of the tools enable teachers obtain high quality materials, update lecture note at any given time, facilitates self learning, support student group work, and support laboratory learning tools such as virtual labs etc. (Michau, Gentil et al. 2001). The development and delivery of e-learning contents is feasible through the following ways:

- Map Competencies to Courses:
- Schedule Classes/Register Students:
- Track Learning:
- Develop Learning Content:
- Deliver Learning Content: (Singh 2004; Mobasher 2005)

**E-learning technologies in Teaching of the Technical Subjects**

Most of students on technical institution are regular students, having lectures on weekdays. Classical methods of teaching are used, because characteristic feature of technical education is that technical subjects usually require presence of students in laboratory and direct contact with the teacher and laboratory equipment. However growing number of students and reduced time of lectures for specific subjects, caused by growing number of subjects, as well as challenges of modern world, forced us to look for the improvements of our teaching methods (Ćwikła, Kampa et al. 2010). Significant amount of educational materials at technical institution is now available as many types of computer files, like presentations, movies, animations, drawings, electronic PDF documents and so on. First step in this situation can be sharing of those materials with students using one of available e-learning platforms (Consortium, 2002; De Marsico, Kimani et al. 2006). Many of the technical subjects seem very difficult to be taught using pure e-learning methods. In many cases main problem is laboratory equipment – it has to be operated manually and requires presence of qualified personnel. Sometimes this problem can be solved using computer models or virtual laboratories.

Methods used in E-learning, that can be adapted for teaching technical subject are described in Table 1. Common feature of all e-learning methods is that computer with fast Internet connection is required. It can be restriction in some cases, where Internet access or bandwidth is limited. People wanting to use this form of education should have their computer equipped with additional hardware and software, depending on type of their ability.

**TABLE 1**
Method used in Teaching of the Technical Subjects

<table>
<thead>
<tr>
<th>Types of E-learning</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard method of E-learning</strong></td>
<td>Presentations, web pages, e-mails, audio and video materials, lectures audio and video recording</td>
<td>Small hardware requirements, using standard web-browsing and office software</td>
<td>Small interactivity, limitation in control of the laboratory equipment</td>
</tr>
<tr>
<td><strong>Virtual desktop, desktop sharing, virtual whiteboard</strong></td>
<td>Teacher can share his desktop or part of desktop, student’s feedback possibility</td>
<td>Online method, full interactivity, excellent method of software usage teaching</td>
<td>Only on-line meetings, additional software requirements, limitation in control of the laboratory equipment</td>
</tr>
<tr>
<td><strong>Videoconferences</strong></td>
<td>Extended version of virtual desktop</td>
<td>On-line method, full interactivity, direct</td>
<td>Only on-line meetings, additional</td>
</tr>
</tbody>
</table>
Challenges of integrating E-learning Technologies in Technical Education System

Though, e-learning is identified as interactive media environment that facilitate teaching and learning online via internet connectivity, certain challenges have been identified by scholars (Peterson and Feisel, 2002; Abdellah, Taher et al. 2008). Their work were on engineering education, but can be applied in technical education as well due to the interchanging nature of the nomenclature of the two areas of study. According to them, the following issues have been identified to pose a challenge to the application of e-learning to engineering education (Peterson and Feisel, 2002; Abdellah, Taher et al. 2008):

- Identifying the skills required by admitted students
- Identifying the appropriate teaching strategy
- Evaluating the progress of students
- Choosing to use electronic means in laboratory work and the resource required for sharing remote labs.
- Estimating the cost of resources serving online engineering education
- Estimating human and technical infrastructure required.
- Assessing student and staff satisfaction.
- Assessing class software requirement.

Pirani, (2004) in his paper titled “supporting e-learning in higher education” states that while institutions adopt e-learning some new issues arises; redesigning courses to be taught using e-learning environment, provision of technical infrastructure and possession of technical skills to use e-learning by staff and students. The major challenges to the implementation of e-learning in Technical Education system lie on technological development, human resources development, infrastructure development, economic issues, managerial and policy making issues.

Conclusion

E-learning refers to the use of Internet technologies to deliver a broad array of learning modes that enhance learners’ knowledge and performance The application of technological innovation in education and the need for Technical Education graduates to compete in a technology biased labour market necessitated the need for integrating e-learning tool in teaching and learning of hands-on courses. There is evidence for the effectiveness and acceptance of e-learning within the Technical education community, especially when combined with traditional teacher-led activities in a blended-learning educational experience. Several digital repositories of e-learning materials exist, some with peer review, where instructors or developers can submit materials for widespread use or retrieve them for creating new materials. The evaluation of e-learning should include a peer-review process.
and an assessment of outcomes such as learner satisfaction, content usability, and demonstration of learning. Faculty skills in creating e-learning may differ from those needed for traditional teaching; faculty rewards for scholarly activity must recognize this difference and should be commensurate with effort. With technological advancement, the future offers the promise of high-fidelity, high-speed simulations and personalized instruction using both adaptive and collaborative learning.

The integration of e-learning into undergraduate, graduate, and continuing technical education will promote a shift toward adult learning in Technical education system, wherein educators no longer serve solely as distributors of content, but become facilitators of learning and assessors of competency. Moreover, the development in internet connectivity, availability and affordability of network service providers enable Technical Education students to download virtual lecture materials and laboratory manuals and perform laboratory experiments virtually. Despite its benefits and challenges outlined above, full deployment of e-learning tools for enhancing the teaching and learning of engineering related disciplines is something the management of such institutions should dwell on.

References


