Reflection on the 21st Century Challenges and Development of STM Educators: A Focus on e-Learning Platform

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Abstract
This paper gives a reflection of some basic principles underlying the deployment of e-Learning strategy with its attendant challenges on development of Science, Technology and Mathematics (STM) Educators as e-Learning Practitioners based on global standards and practices that drive the Education Systems in the 21st Century.

Introduction
Varied terminologies such as online learning, internet learning, distributed learning, networked learning, tele-learning, virtual learning, computer assisted learning, web-based learning, and distance learning have been used for e-learning. All these terms suggest that learner uses technology to interact with the tutor or instructor and other learners and that some form of support is provided to learners (Anderson & Elloumi, 2004) and that the e-Learner is at a distance and uses technology to interact with the learning materials. This implies that e-learning involves diversity of practice and associated technologies. Ally (2004) defined online learning (e-learning) as the use of the internet to access learning materials, to interact with the content, instructor, and other learners, and to obtain support during the learning process in order to acquire knowledge to construct personal meaning and to grow from the learning experience. Therefore, e-learning must create challenging activities as advance organizers to serve as scaffolding that enables learners to link new information to old, acquire meaningful knowledge and use their meta-cognition abilities to promote higher order thinking on the Web since instructional strategy influences the quality of learning while specialized delivery technologies provide efficient and timely access to learning materials. This calls for flexibility in teaching approach and in providing where none is in existence updating online courses. Succinctly put, Science, Technology and Mathematics (STM) educators as e-learning practitioners are and would be continually challenged to update courses which depend on volatile information to keep the subject matter current and relevant. They are also challenged to encourage flexibility in developing their personal teaching approach while utilizing the variety of options offered by technology which is a global trend towards eradication of illiteracy and the attainment of Education For All.

The STM Educators as e-Learning Practitioners
Three sets of qualities define an excellent e-learning practitioner – the e-teacher. Primarily and foremost, an excellent e-learning practitioner is an excellent teacher. They like dealing with learners; they have sufficient knowledge of their subject down; they can convey enthusiasm both for the subject and for their task as learning motivators; and they are equipped with a pedagogical understanding of the learning process, and have a set of learning activities at their disposal by which to orchestrate, motivate and assess effective learning. Beyond these generic teaching skills is a second set of technical skills. One does not have to be a technical expert to be an effective online teacher. However, one must have sufficient technical skills to navigate and contribute effectively within the online learning context, access to necessary hardware and sufficient internet efficacy to function within the inevitable technical challenges of these new environment ((Eastin & LaRose, 2000). Internet efficacy is a personal sense of competence and

comfort in the environment, such that the need for basic trouble shooting skills does not send the teacher into terror filled incapacity. Finally, during this early period of creation and adoption of this new learning context, an effective online learning teacher must have perseverance typical of all pioneers in un-familiar terrain.

Information and Communication Technology (ICT) plays a major role in supporting learning through reaching the students wherever they are via a flexible mode. Effective e-learning platform implementation requires Information Technology (IT) infrastructures such as hardware equipment, internet connectivity, telephone and fax.

The Role of Technology in e-Learning

e-Learning operations take various forms such as Video-Conferencing, Satellite Broadcasting, Compact Disks, World Wide Web (WWW) and Internet. The global trend nowadays is towards WWW and Internet with these advantages:

- provide interoperability;
- combine text, graphics and multimedia content easily;
- provide synchronous and asynchronous interpersonal and inter-group interaction;
- make cross-cultural and collaborative learning possible;
- make any time, any place and any pace learning possible.

(Koul, 2005:59)

However, successful operations of WWW and Internet cannot exist without challenges. Some issues had been identified by Koul (2005:59) as important for e-learning operations. These include:

- need for Personal Computer (PC) or at least access to a PC, telephone line and literacy skills;
- narrow bandwidth that poses a bottleneck;
- need to change teaching method;
- need for technical support and dynamic learning techniques,
- needs high investments;
- needs retraining teachers and learners;
- requires different financial and management systems; and
- promises immense possibilities.

Networked technologies add many new dimensions to the educational process and experience by

- connecting to the professional resources;
- including people who could not participate in the past methods of education;
- preparing students for the work environments of the future;
- networking among students, faculty and professionals beyond the University.

Technology is used as a means of increasing the scope, scale, quality and impact of education and training systems globally. The design of the technology supports involves choice of the authorizing software to use in the development of the online environment. Presently, there are over one hundred authorizing software such as first class, decent, author ware, course information, learn line, question mark, Saba, toolbox, TLM, Vcompus, Virtual –U and Web CT. These are generally grouped into self-pace and group learning products. It is therefore imperative that anybody developing web-based materials must assess the appropriateness of the software for the clientele to be served.

Major Considerations in e-Learning Platforms

Designing online learning materials

e-learning has many promises but it takes commitment and resources, and must be done right to derive its full benefits. "Doing it right" means that online learning materials must be designed properly with the learners and learning in focus and that adequate support must be provided (Rossett, 2002). The development of effective online learning materials are based on proven and sound learning theories. This is because the delivery medium is not the determining factor in the quality of learning but the design of the course which determines the effectiveness of the learning (Rovai, 2002).

Online learning materials can be designed by using a combination of theories of learning. For instance, the behaviorist school of thought postulates that learning is a change in observable behaviour caused by external stimuli in the environment (Skinner, 1974). To them, it is the observable behaviour that indicates whether or not the learner has learned something and not what is going on in the learner's head. To this school of thought, educators claimed that not all learning is observable and that there is more to learning than a change in behaviour. Cognitive psychologist on the other hand claimed that learning involves the use of memory, motivation and thinking and that reflection plays an important part in learning. Thus they see learning as an internal process in which the amount learned depends on the processing capacity of the learner, the amount of effort expended during the learning process, the depth of the processing (Crack & Lockhart, 1972, Craik & Tulving, 1975) and the learner's existing knowledge structure (Ausubel, 1974). For the Constructivist theorists, a more recent theorist based on the precept that learners interpret information and the world according to their personal reality and that they learn by observation, processing, and interpretation and then personalize the information into personal knowledge (Wilson, 1997).

The design of online learning materials can include principles from all three theorists as close analysis shows overlaps in the ideas and principles. Ertmer and Newby (1993) suggest that the three schools of thoughts can be used as taxonomy for learning where:

- Behaviorists' strategies can be used to teach the "what" (facts);
- Cognitive strategies can be used to teach the "how" (processes and principles); and
- Constructivist strategies can be used to teach the "why" (higher level thinking that promotes personal meaning, situated and contextual learning).

Thus, three components are integrated in instructional design models that support quality design of web-based instruction and a variety of learning activities should be used to accommodate the different learning styles while learners choose the appropriate strategy to meet their learning needs. As research progresses, new theories are evolving and should be used in developing online materials. Hence, the online developer must know the different approaches to learning in order to select the most appropriate instructional strategies. The following are to serve as guide to online developers in selecting appropriate instructional strategies. Learning strategies should be selected to:

- motivate learners;
- facilitate deep processing;
- build the whole person;
- cater for individual differences;
- promote meaningful learning;
- encourage interaction;
- provide feedback;
- facilitate contextual learning;
- encourage interaction; and
- provide support during the learning process.

(Ally, 2004)

Ally (2004) proposed a model that is based on educational theory which shows important learning components that should be used when designing online materials. He emphasized that *neither placing information on the Web nor linking to other digital resources on the Web constitutes online instruction.* Earlier, he (Ally, 2002) opined that online instruction occurs when learners use the Web to go through the sequence of instruction, to complete the learning activities and to achieve learning outcomes and objectives. Therefore, while designing online learning materials, the key components of effective online learning, namely: learner preparation, learner activities, learner interaction, and learner transfer ought to be considered. The interactions among these components are very relevant in an e-learning environment.

Implications of e-Learning to STM educators as course material designers

The implication of online education has shown that:

- e-learning does not merely involve access to convert lecture notes to be passively used;
- it calls for consideration of the type and scope of interactivity to be engendered;
- e-learning course material developers should be knowledgeable in pedagogic and multimedia instructional design;

- they ought to be aware that developing and running e-learning courses is a conceptual development process;

- the design of the technology supports involves choice of the authorizing software to use in the development of the online environment; and

- developing web-based materials calls for assessment of the appropriateness of the software for the clientele to be served.

Preparing for e-Learning

In preparing for e-learning, the people, the process and the technology must be united as an entity. That is, e-learning strategy must pull all of these together. This is because according to Elfick (2005:10),

- people are the most important;
- technology is the enabler;
- people need to be able to use the technology;
- the process must support the people and technology; and
- the project execution is essential to get the whole thing off the ground.

The 21st Century Challenges for STM Educators as e-Learning Practitioners

Education in Nigeria in the 21st Century poses a lot of challenges for STM educators as e-Learning Practitioners. This evolves as a consequence of the boom in the higher education experienced in the last few decades with the emergent of Education For All (EFA), fostered by Universal Basic Education (UBE) and has resulted in:

- tremendous expansion of secondary education;
- increase in jobs and professional activities requiring high level knowledge and skills;
- continuing demand for higher studies;
- more need for continuing education; and
- Education For All and social justices.

(Jegede, 2005a:4).

It is a common knowledge that our educational system at various levels is challenged with the problem of unqualified, untrained and under qualified teachers, spiraling population growth, population –doubling rate, high birth rates and very high teacher-pupil ratios. Available statistics (Jegede, 2005a: 5) has shown that:

- 16.89 million children in 41,000 primary schools then;
- average teacher : Pupil ratio = 1 : 45;
- highest 1 : 94 in Yobe state;
- lowest 1 : 20 in Anambra state; and
- about 27.5 million by 2006 in primary school system.

Again, the reality of the situation is that technology will increasingly dominate domestic and social life of the citizenry with a consequent change of financial and economic world into a plastic world. This has given rise to increase demand for constant communication and use of telecommunication and unrivalled demand for education as the society becomes less personal and concentrate more on nuclear family. Moreover, the STM educators are saddled with learners who know more technology than teachers and parents, and believed that learning is easy; prosperity requires no hard work while access to information is linked to acquisition of knowledge. The 21st Century STM educators are no longer the boss but the facilitator who are expected to guide learners to information. Therefore, learning with technology must begin with educating teachers because "change is coming whether we like it or not. If we are not involved in shaping it, others will shape it for us" (Elsenberg, 1998). It is expected that the STM educators should as a matter of necessity provide cross border (borderless) and cross border virtual education, to effect transition to e-learning, use emerging technologies and mobile learning in the 21st Century (Okonkwo, 2005).

The Challenge of e-Learning Platform

A change from conventional face to face classroom to online instruction is analogous to a change from model of efficiency to a model of quality. And, given the myriad of other variables to coincide with online learning instruction to consider in e-learning such as collaborative learning and web navigation, it is untenable to accept that teaching offline is about the same as teaching online (Jegede, 2005b). Hence, e-learning practitioners are challenged to provide student-centred learning environment full of multimedia resources, expanded interactivity and adaptable to different students' characteristics. They should always be conscious of the difference between delivery information and facilitating learning. Since, continuing use of traditional pedagogical principles of lectures and textbooks which basically deliver information is not appropriate and not satisfactory for e-learning. Effective Web-based instruction must as Jegede (2005b) opined integrate three crucial elements of epistemology, pedagogical strategies suitable for web and the characteristics of a Web-based teaching and learning environment to create a new instructional model.

The Challenge of Information Technology (IT)

Information technology as a partner and service provider in e-learning platform poses its own problems to the e-learning. The e-learning practitioners are to explore and understand the many challenges of e-learning from the IT department. The e-learning practitioners are to know and explicit IT key initiatives and dates for software and network upgrades, annual equipment purchases and other investments which impact on e-learning.

The Importance of e-Learning to STM Educators

STM educators should invest in e-learning for the following reasons:

- reusable content- the content once developed satisfactorily becomes assets since they are reusable;

- sharable content- well developed and easy to come by content developed by knowledgeable experts in the field can be shared and traded on;

- flexible use of content, flexibility in course design and delivery, and consistency in programme quality are also desirable features of e-learning;

- e-learning course materials are modular with shorter development cycles and flexible since learners can learn at their own time, at their own pace and their own pace;

- e-learning strategy takes care of tracking of students' progress; requirement for growth in students' numbers; opportunities in the adult learner markets, demand for increased learner flexibility;

- e-learning caters for the desire for new programmes and provides opportunities for sharing with other institutions; and

- it takes care of limitations on physical facilities and limitations on access to qualified staff.

Conclusion

e-Learning is presently a global trend in education and a desirable strategy for development and growth in a country like Nigeria where millions have no access to quality education and the educational system at various levels is challenged with the problem of unqualified, untrained and under qualified teachers. STM educators are not only un-exempted from the challenges and associated problems but should lead in the transformation of our conventional system to e-learning environment by using technology as a means of increasing the scope, scale, quality and impact of education and training in response to global order. Already, the STM educators are saddled with learners who know more technology than teachers and parents, and believed that learning is easy; prosperity required no hard work while access to information is linked to acquisition of knowledge. Hence learning with technology must begin with educating teachers because change is coming whether we like it or not.

The STM educators as e-Learning practitioners are to explore and understand the many challenges of Information Technology and apply it in the provision of student-centred learning environment full of multimedia resources, expanded interactivity and adaptable to different students' characteristics. The secret of success in this education imperative hinged on commitment, level of hard work, accepting and facing challenges in the scenario and capacity building.

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