ELECTRONIC TECHNOLOGY IN TEACHING LEARNING PROCESS

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Introduction

Today's computer-mediated or online administrators and instructors are investigating ways to foster a dynamic learning environment. Currently, "Internet technology empowers the joint exploration of the delivery mechanisms of previous generations, adding stronger collaborative learning elements (Passerini & Granger, 2000, p.3)." Contemporary Internet technologies are helping remove the idea of distance from online education. The online teaching and learning process could produce more relevant and consistent interaction than what is produced in the traditional undergraduate classrooms. A large traditional classroom does create communication barriers that make it more difficult for all students to participate in class discussions. It is interesting that university students are using emails more often to share with their classmates and teachers. The Internet is providing a practical way to remove learning barriers and encourage greater access to intellectual resources. The idea of distance education has fostered the pursuit of new educational paradigms that encourage online education to be more personal and student centered.

The application of Information and Communication Technologies (ICTs) is already changing the organization and delivery of higher education. The pedagogical and socio-economic forces that have driven the higher learning institutions to adopt and incorporate ICTs in teaching and learning include greater information access; greater communication; synchronous and asynchronous learning; increased cooperation and collaboration, cost-effectiveness and pedagogical improvement. However, ICTs have not permeated to a great extent in many higher learning institutions in most developing countries due to many socio-economic and technological circumstances. This paper discusses new learning and training technologies considering their pedagogical, cost and technical implications. It also discusses challenges for integrating these technologies in higher learning institutions with examples from Tanzania, and giving best practice approaches for addressing each of the challenges.

UniModule

The UniModule is the recommended curriculum for a given course; it is developed in a format that provides course guidance for instructional training, whether conducted in the classroom, online, or in a directed study format. This document contains course topics, objectives and assignments, as well as a content outline for instructors. Faculty members have the flexibility to make modification to the curriculum, as long as they adequately

address specific course objectives as outlined in the UniModule. In doing so, the University ensures that course content is consistently delivered to students across all campuses.

E-Text

The e-text is the selected "textbook" for each course. In some cases, this material is simply an electronic copy of an existing textbook; in other cases, the e-text is a compilation of material from multiple sources, including chapters from several textbooks, associated selected readings and other printed materials. Students view this material using Microsoft® Reader or by printing all or part of the text from their personal computers.

Supplemental Materials

Information contained in this link will vary from course to course. It may contain course-specific Power Point presentations, assessment tools, case studies, unique learning activities, topic-specific tutorials, video clips and more.

Web Links

Each course will also have 2-5 associated web links. These links direct students to areas on the web that will further enhance their professional development. Typically, students will explore the sites of professional associations, other related organizations and sites that encourage professional collaboration and/or community involvement.

Multimedia

The University has partnered with several companies to allow students to develop ancillary skills that will further facilitate their learning. In this section, students are provided with a variety of tutorials, from novice to advanced levels, designed to enhance their technological and professional skills. Examples of online tutorials available to students are: Windows, Word, Power Point, Access Excel, and more.

This model suggests that successful teachers:

- Support students' acquisition of substantive learning by designing units of instruction that employ a range of strategies that build on each student's strengths, needs and prior experiences.
- Align learning goals with state and district content standards.
- Adjust the classroom environment and instruction to address important contextual characteristics of the classroom.
- Employ a variety of instructional resources to help students attain learning goals and to offer them new opportunities to explore important ideas or to learn new skills that have relevance to their lives.
- Use multiple assessment methods that appropriately measure learning gains towards the selected goals.

- Explore students' understanding and thinking processes while evaluating the effectiveness of their teaching.
- Analyze student learning by examining individual, small group, and whole class achievement.
- Use their analysis of student assessment to guide instruction, to provide feedback to students, and to plan for professional development.
- Provide credible evidence of their instructional effectiveness through student performance (Pokay, et al, 2001).

E-Learning Technologies

Functionally, e-learning includes a wide variety of learning strategies and ICT applications for exchanging information and gaining knowledge. Such ICT applications include television and radio; Compact Discs (CDs) and Digital Versatile Discs (DVDs); video conferencing; mobile technologies; web-based technologies; and electronic learning platforms. This section discusses what these ICTs entail and their pedagogical, technical and cost implications.

Television (TV)

Television (TV) refers to a receiver that displays visual images of stationary or moving objects both live or pre-recorded and mostly accompanied by sound which is electronically captured, processed and re-displayed. Likewise, this applies to the term radio – both live generated sound as well as pre-recorded sound. Both TV and radio can improve teaching and learning process in different ways such as by showing processes and activities that may not otherwise be available to the learner. However, digitalization has taken over analog audio and video systems.

Compact Discs (CDs)

Compact Discs (CDs) and Digital Versatile Discs (DVDs) are based upon laser technologies for writing and reading data. They provide a way in which a large amount of multimedia trainingmaterial can be stored and made available to end-users: CD-ROM can store up to 1GB while DVD can store up to 17 GB. CD-ROM and DVD-based products can be linked with online information sources. This hybrid approach provides the user with access to media-rich up-to-date information.

Video conferencing

Video conferencing is a system where two or more participants, based in different physical locations, can see and hear each other in real time (i.e. live) using special equipment. It is a method of performing interactive video communications over a regular

high-speed Internet connection. A videoconference can be either two-way (point-to-point) or multipoint, linking three or more sites with sound and video. It can also include data sharing such as an electronic whiteboard where participants can draw on, or text based real time 'chat'. Interactive whiteboard is simply a surface onto which a computer screen can be displayed, via a projector (Department for Education and Skill, 2004).

Mobile e-Learning

     Mobile e-Learning (sometimes called 'm-Learning') is a new way to learn using small, portable computers such as personal digital assistants (PDAs), handheld computers, two-way messaging pagers, Internet-enabled cell phones, as well as hybrid devices that combine two or more of these devices into one (Hunsinger, 2005). These technologies have enormous potential as learning tools.

World Wide Web (WWW)

     World Wide Web (WWW) is set of software tools and standards that allow users to obtain and distribute information stored on a server and connected to Internet. WWW is a decentralized information system, in which anyone can add new information whenever he/she wants. Lecture notes and other teaching materials are placed on the WWW and linking useful websites to these resources for students to access. In the recent years, web and Internet technologies have matured significantly by providing a uniform access media for both asynchronous and synchronous learning. This phenomenon has significantly increased the popularity of on-line learning (Chen *et al.*, 2004). The usage of web technologies in e-learning are further enhanced with the web 2.0, which is a set of economic, social, and technology trends that facilitate a more socially connected Web where everyone is able to add to and edit the information space (Anderson, 2007). These include blogs, wikis, multimedia sharing services, content syndication, podcasting and content tagging services (Anderson, 2007).

E-learning

     E-learning platforms (sometimes called learning management systems (LMS)) are applications used for delivery of learning content and facilitation of learning process. They are developed for administration and teaching in tertiary education. This software enables the administrators and lecturers to treat enrolment data electronically, offer electronic access to course materials and carry out assessments (OECD, 2005). The activities managed by the LMS vary from instructor led classroom training to educational seminars to Web-based online training. In addition to managing the administrative functions of online learning, some systems helps create, reuse, locate, deliver, manage, and improve learning content. These systems are called Learning Content Management Systems (LCMS)

(Rengarajan, 2001). LCMS actually provide tools to deliver instructor-led synchronous and asynchronous online training. The LCMS provides tools for authoring content as well as virtual spaces for learner interaction (such as discussion forums and live chat rooms). Rengarajan (2001) emphasizes the importance of integrating both LMS and LCMS because they share different levels of administrative interests in the same entities. Lack of smooth integration between the products results in a broken solution with administrative conflicts. Many e-learning platforms (both LMS and LCMS) currently available are based on either proprietary e-learning software (PES) or open source e-learning software (OSS). OSS usage in implementing e-learning systems is more emphasized in developing world due to the challenges faced when implementing the PES. Coppola (2005) describes two characteristics of PES that make it ill-suited:

1. the rapidly escalating cost of proprietary software leaves too little of an institution's ICT budget available for creative exploration, once the software has been installed and minimally supported;

2. reduced flexibility to adapt to institutional culture, teaching practices, and disciplinary uniqueness occurs when software development is driven by mass market economics.

Open source software offers the potential to reduce the cost of the software while providing the universities greater control over its destiny. Elimination or reduction of license leaves more budgets available to invest in adapting and managing the software; offers reliability, performance and security over proprietary software due to the availability of the source code, which allows vulnerabilities to be identified and resolved by third parties and it is easy to customize (Wheeler 2003; Coppola, 2005).

S. No	e-learning technologies	Pedagogical	Implications	Technical
1	TV/radio	Effective use of TV/radio depends on three key moments in the application: before, during and after the viewing session and give instructions, explanations, questions or evaluation before and after each moment	Equipments are needed depending on the objectives and the scope of the training application, which includes audiocassette, video camera, PCs, editing software, distribution channel and receiving and displaying equipment.	Costly in terms of TV/radio production, which includes, animation and graphic designers, hardware, access to the broadcast network
2	CD/DVD	• Simulation for selfstudy • Used with the presence or remote support of	Hardware that meets their specifications - graphic screens, MPEG2 cards, CD or DVD reader and appropriate software	Costs are higher than for printed materials -

		the trainer		replication downloading free products or buying ready-made products can lower the costs.
3	Web-based technologies	Permanent accessibility (24 hours, all days of the week), speed, direct communication, links to related topics and up-to-date notes.	▫▫Fast computers with sound cards and reliable Internet connection are required. ▫▫The following team is needed for implementing web-based training: (a) Instructional designer familiar with computer delivered instruction; (b) A programmer or author to use the authoring tool; (c) A graphic artist; (d) A subject matter expert; (e) A webmaster for maintaining the programme on the server.	Hardware, technical expertise and Internet subscriptions costs
4	Video conferencing	New pedagogical methods required to provoke interaction ▫▫Require small groups ▫▫Both trainers and learners require some basic training	Required equipment: (i) Sound proofing and controlling the lighting conditions; (ii) Audio-visual peripherals – TV monitor or video projector, camera(s), microphone(s) and sound playback; (iii) Videoconferencing codec (Rollabout) (iv) Multimedia PC (with PCI-based as well as software based video conferencing code c) and (v) More bandwidth is needed	There are two types of costs: setting up the Video conferencing system and operational costs.
5	e-learning platforms	▫▫Adding and changing content as course is progressing. ▫▫Template for inclusion of course content. ▫▫Support multimedia presentation of course content while others are text based.	(i) Server platform Hardware requirements; (ii)Client platform Hardware requirements; (iii) Operating system/cross platform; (iv) organization/ registration/ administration; and (v) The learning content should be in standard formats that can easily be stored, accessed and	▫▫Hardware Cost implications ▫▫Cost for maintenance

		▫▫Complex structuring of content allowing for multiple links and cross reference possibilities.	distributed. Such formats include HTML, PDF, RTF, GIF, JPEG and MPEG.	

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ICT Implementation Challenges in Higher Learning Institutions

Despite of the achievements revealed by some of the Tanzanian universities in implementing ICT for teaching and learning processes, these universities still face a lot of challenges in undertaking such a process.

Lack of Systemic Approach to ICT Implementation

Integration of ICTs in the functions of any organization is a complex process that needs to be fully conceptualized and defined from the beginning. However, this is not the case in many higher learning institutions in developing countries as most of them have embraced the ICT integration process without clear plans to guide the way. The institution ICT policy and strategic plan should be defined to provide a framework for the development and implementation of specific ICT projects. The diversity and competing interests of different stakeholders in the institution should be recognized when developing ICT policy and a strategic plan. The following issues, amongst others, should be taken into consideration: (i) ICT infrastructure already in place; (ii) ICT skill levels in the institution; (iii) number of staff and students in each department and projected growth; (iv) academic management process: curriculum development, assessment methods and administration; (v) cost-effectiveness analysis (including hidden costs) and the choice of proper technologies for the needs of the institution; and (vi) staff development in new technologies *Awareness and attitude towards ICTs:* It is important for all stakeholders in the institution to know the existing ICT facilities and services and their importance in relation to their specific tasks. However, according to Tusubira and Mulira (2004), there tends to be some vague knowledge about ICTs, some interpreting them as simply advanced technologies that require a lot of money and very advanced skills. They are not appreciated as a means of creating efficiency and cost effectiveness.

Lack of awareness goes along with attitude. Positive attitude towards ICTs is widely recognized as a necessary condition for their effective implementation (Woodrow 1992). Full involvement of all stakeholders in the implementation process is a key to addressing awareness and attitude problem. Formally organized awareness programmes, visits to similar institution where success has occurred, and short trainings can contribute to raise the awareness and change the attitude of stakeholders towards facilities and services.

Administrative Support

Administrative support is critical to the successful integration of ICTs into teaching and learning processes. Administrators can provide the conditions that are needed, such as ICT policy, incentives and resources. The commitment and interest of the top management and other leaders at every level is the most critical factor for successful implementation of ICTs. According to Cameron and Ulrich (1986), a transformational leadership is a leadership that involves a process of fundamental change which is required for the institutions to adapt to changes brought about by the information society3. Dwyer *et al* (1997) emphasize that for the integration of ICTs to be effective and sustainable, administrators themselves must be competent **64** *IJEDICT* in the use of the technology, and they must have a broad understanding of the technical, pedagogical, administrative, financial, and social dimensions of ICTs in education.

Technical support

This includes issues like installation, operation, maintenance, network administration and security. This is an important part of the implementation and integration of ICT in education system. In most cases however, technical support is not available, which implies that trainers and students require some basic troubleshooting skills to overcome technical problems when using ICTs. However, in most of the developing countries including Tanzania there are very few technical experts to implement and maintain ICTs (Bakari *et al.*, 2001; National Committee for WSIS Prepcom II 2003). Appropriate strategies should be in place to ensure that integration of ICTs in teaching and learning process goes together with the recruitment, training, retaining and retention of required staff.

Transforming higher education

Many institutions fail to integrate ICTs into teaching and learning because they are using ICTs to replicate their traditional practices, content and control. Their plans appear to be driven by ICTs and not by pedagogical rationale and focus (Ehrmann 1995). However, effective integration requires a transformation process where all stakeholders are involved to re-examine their existing structures and practices, as pointed out by Bates (2000: 13), if universities and colleges are to successfully adopt technologies for teaching and learning, many more than minor adjustments in current practice will be required. Indeed, the effective use of technology requires a revolution in thinking about teaching and learning. Part of that revolution necessitates restructuring universities and colleges – that is, changing the way higher education institutions are planned, managed and organized.

Conclusion

ICTs provide great opportunity for universities in developing countries to improve their teaching and learning processes. So far most of the universities in developing

countries possess basic ICT infrastructure such as Local Area Network (LAN), internet, computers, video, audio, CDs and DVDs, and mobile technology facilities that form the basis for the establishment of e-learning. It is argued that, universities in developing countries should adopt e-learning technologies to improve teaching and learning processes. Pedagogical, technical and cost issues should be taken into account for each specific technology when integrating ICTs in teaching and learning practices.

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