

Making learning and web 2.0 technologies work for higher learning institutions in Africa

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Abstract

Purpose – This paper seeks to assess the extent to which the learning and web 2.0 technologies are utilized to support learning and teaching in Africa's higher learning institutions, with a specific focus on Tanzania's public universities.

Design/methodology/approach – A combination of "content analysis" and "semi-structured interviews" was used to collect data. The study conducted semi-structured interviews with ICT personnel from six out of the eight public universities in Tanzania in 2011.

Findings – The study found that the adoption of e-learning and web 2.0 technologies is still in its infancy stages in the Tanzania public universities. However, there was much enthusiasm amongst respondents for developing the potential of e-learning and web 2.0 tools in their universities.

Practical implications –The study seeks to promote an academic inquiry about the need for innovative web 2.0 technologies in learning and teaching and the adoption of these emerging technologies in African's higher learning institutions

Originality/value - The study provides empirical findings on the use e-learning and web 2.0 for higher education, specifically in the Tanzanian context. The study provides a basis for further research on the use of Web 2.0 technologies in higher education

Keywords: e-learning, e-learning 2.0, web 2.0, higher education, Africa, Tanzania

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Introduction

In the past decade in African's universities, the growing number of student enrolment and academic programmes, and declining number of trained lecturers have enlarged demands on faculty, leading in less time for teaching than has previously been the case. Research shows that access to education in the developing countries is limited with less than five percent of students in higher learning education compared to the world average of 16 percent (Prakash, 2003). The demand for tertiary education in Africa does not match with the expansion of existing facilities and resources, and is not offered to significant portions of the population. With the reduced public funds, universities are forced to find new ways to earn income to expand infrastructure, cater for a growing number of students, and ensure effective teaching, learning and research. A challenge facing universities in Africa is to strike a balance between effective use of existing resources and intensified demand for a delivery of better education (Sawyerr, 2004). E-learning systems and services can help higher learning institutions to cope with the growing demand of education and address the growing decline of trained teachers. Technologies have had a significant impact on the curricula, the methodology of teaching, and learning processes (Rhema and Miliszewska, 2010). These technologies are being referred as "cognitive tools that transform, augment, and support engagement among learners" (Kinuthia and Dagada, 2006).

Among other learning technologies, web 2.0 tools and services support much flexibility in the learning processes and allow for easy creation, sharing and re-use of study contents that are managed by the teachers and learners themselves (Majhi and Maharana, 2010). Web 2.0 technologies are suitable for active and meaningful learning and collaborative knowledge building (Majhi and Maharana, 2010). The integration of e-

learning and web 2.0 tools into the existing university curricula promotes a shift towards lifelong learning in higher education, wherein instructors no longer serve solely as distributors of content, but become facilitators of learning and assessors of competency (Ruiz *et al*, 2006). Presently, the transformation towards competency-based curricula signifies the outcome, not the process of education (Stanescu *et al*, 2008), which is suitable for e-learning.

To improve the delivery of its educational programmes, and cope with other challenges, most universities in Africa including those in Tanzania have taken various initiatives to integrate information and communication technologies (ICTs) to improve their curricular. The use of ICT has increased student's enrollment and thus enabled more qualified applicants to access higher education through open and distance learning in Tanzania. In spite these notable achievements, there is still lack of empirical findings on the extent to which Tanzania universities have integrated these web 2.0 technologies into their existing curricular. Research shows that the deployment of various learning and web 2.0 technologies in Africa has, however, often turned out to be problematic (Afifi, 2011; Bitew, 2008).

This paper seeks to assess the extent to which the innovative web 2.0 technologies are utilized to support learning and teaching in African's higher learning institutions, with a specific focus on Tanzania's public universities. The paper, drawing on literature, various case studies, and recent research evidence on web 2.0 applications in higher education, first reviews the e-learning and web 2.0 aspects, secondly presents overview of web 2.0 in higher education, thirdly discusses the use of web 2.0 tools in the higher learning institutions in Africa and developed world, fourthly, presents the research methodology, fifthly, addresses the extent to which web 2.0 tools are applied in Tanzanian's public universities, and lastly concludes and provides useful recommendations.

E-learning in context

E-learning refers to the design, development and delivery of instructional materials through technologies to enhance and support

teaching and learning activities. E-Learning is an ideal learning environment using modern means of ICTs, through the effective integration of information technology and the curriculum to achieve, a new learning style which can fully reflect the main role of the students to thoroughly reform the traditional teaching structure and the essence of education, to train large numbers of high quality personnel (Ma *et al*, 2008). According to Ehlers (2009), e-learning mainly has five characteristics:

- Learning takes place any time and any where, not only in the classroom.
- Learners take on the role of organizers. Instructors serve as both the distributors of educational content, and facilitators of learning process.
- Learning is a lifelong process and thus it is not solely linked to educational institutions.
- Learning takes place in communities of learning or community of practices, learners participate in formal, as well as informal communities.
- Learning is informal and non-formal, takes place at home, at the work place and during leisure time and is no longer centered on teachers or institutions.

Various studies have demonstrated the effectiveness of e-learning in higher education, government, corporate, and military environments. For instance, a review of four e-learning studies in medical and non medical HEIs showed that e-learning was at least as good as, if not better than, traditional instructor-led methods such as lectures in contributing to demonstrated learning. The review further revealed that e-learning can result in significant cost savings and the studies further demonstrated that students are very satisfied with e-learning (Ruiz *et al*, 2006). A survey of e-learning experiences among students of two universities in Ghana also revealed that e-learning programmes were "more effective" in comparison to other methods of learning (Adanu and Dagada, 2010). Students' prior learning experiences, conceptions of learning, and study approaches underpin the quality of their learning outcomes (Chikasha *et al*, 2010). E-learning can thus improve teaching and learning practices in the higher education, if appropriately deployed taking into consideration the pedagogical issues.

Web 2.0 and higher education

A new landscape for education is emerging as a result of developments in ICTs and internet technologies, referred to as Web 2.0. The emergence of web 2.0 has led to the new concept known as, “education 2.0” or “e-learning 2.0” which refers to the use of the technologies and social engagements of Web 2.0 in a relatively unchanged institutional framework that characterises education 2.0 (Keats and Schmidt, 2007). Web 2.0 represents a shift from stagnant Web to a more user-driven, collaborative, participatory, and personalized Web (Sodt and Summey, 2009). Web 2.0 concept was coined by O'Reilly Media in 2004, and it has become popular, and undoubtedly a standard technology that is used to support collaborative learning, which is referred to as e-learning 2.0. Web 2.0 refers to the “social use of the Web which allows people to collaborate, to get actively involved in creating content, to generate knowledge and to share information online” (Grosbeck, 2009). Web 2.0 or Social Web technologies enable communication, information sharing, collaboration, interoperability, participation, and user-centered design (Carpan, 2010). The increasingly ubiquitous access, ease of use, functionality, and flexibility of innovative Web 2.0 technologies has made them much more appealing to support and transform teaching-learning environments. Web 2.0 comprises a number technologies and services that can support teaching and learning activities, such as: wikis, blogs, syndication of content through Really Simple Syndication (RSS), media sharing, instant messaging, tag-based folksonomies, social bookmarking, social and virtual networking, and other social software artifacts.

Selwyn et al. (2008) further categorizes Web 2.0 services as follows: *expressive* (media creation and sharing) e.g. YouTube, Flickr and Slideshare; *reflective* (blogging, wikis and social networking); *exploratory* (social bookmarking, syndication, folksonomies); and *playful* (games and virtual worlds). Strawbridge (2010) adds a fourth - *social* technologies - to include social networks such as Facebook and MySpace which Selwyn had included within the *reflective* category. This is because the type of activity

within social networking tools is infrequently seriously reflective and is more to do with individuals' identities, their friendships and communities.

Web 2.0 is very new, and that it has only been around in anything like its present form for about three years, yet it is already having an impact on higher education. However, this newness has resulted into fragmented adoption and implementation of these technologies in higher education institutions (HEIs) due to the lack of institutional policies and inadequate knowledge and skills on web 2.0 which have contributed to lack of clear framework on the effective use of these technologies pedagogically or for support (Kelly, 2008).

These web 2.0 tools can transform higher education, by supporting the preparation of learning materials and presentations, evaluation of the progress made by students, time management, planning the timetable and the calendar of activities, developing projects in collaboration, digital storytelling, and students eportfolios. This fact suggests that there are three fundamental shifts: “a shift from a focus on information to communication, a shift from a passive to more interactive engagement, and a shift from a focus on individual learners to more socially situative learning” (Conole, 2007). Ways in which these web 2.0 tools might promote new forms of learning include inquiry-based and exploratory learning; new forms of communication and collaboration; new forms of creativity, co-creation and production; and richer contextualisation of learning (Conole and Alevizou, 2010). Web 2.0 appeals to instructional learning because it is an active set of technologies in which the learner contributes, rather than passively consuming content (as with television). They are also generally easy to use, affordable, and are often already familiar to students and staff (Strawbridge, 2010).

Web 2.0 technologies can support constructivism-oriented pedagogical approaches such as active learning, social learning, and student publication, by providing environments and technologies that promote and foster these interactions. Web 2.0 can thus transform teaching-

learning environments, by providing new features that might constitute a new ICT pedagogy in the 21st century, or termed as pedagogy 2.0 (Hargadon, 2008). Pedagogy 2.0 shows how individuals link with communities and networks in the process of knowledge sharing, construction and understanding. The interdependence between ideas, individuals, communities and information networks, supported by technology, underpin the demands of pedagogy 2.0, and offer a range of choices to individuals to suit their personal needs and goals. This fact reiterates the core principles of the Web 2.0 era that the web is about linking minds, communities and ideas, while promoting personalisation, collaboration and creativity leading to joint knowledge creation (McLoughlin and Lee, 2007). Pedagogy 2.0 makes use of the affordances of social software tools to enable connectivity, communication, participation and the development of dynamic communities of learning (McLoughlin and Lee, 2007).

Recently, there have been developments of education 3.0 that institutions need to take the necessary steps in order to remain relevant institutions and lead higher education in the future. Education 3.0 is characterized by rich, cross-institutional, cross-cultural educational opportunities within which the learners themselves play a key role as creators of knowledge artifacts that are shared, and where social networking and social benefits outside the immediate scope of activity play a strong role (Keats and Schmidt, 2007). Institution which need to be a leader in education 3.0 need to take the following steps: adoption of appropriate free and open sources software; free and open standards for sharing and co-creation; a good base of Free and Open Resources for Education (FORE) to which the institution contributes and from which it draws; adopt collaborative learning processes and structures, which can be both student-focused, lecturer-focused, or both; change of mindset; institutional policies and strategies that foster progress towards collaboration and sharing, and students as producers rather than consumers; solid evidence-based research on the educational and economic implications of education 2.0 and 3.0; and the information systems able to

cope with the administrative challenges of education 3.0 (Keats and Schmidt, 2007). However, most HEIs are still in the early phases of adopting web 2.0. Thus, education 3.0 is still not yet to be realized in most HEIs especially in Africa as narrated in the following sections. It is thus important to assess the extent to which these technologies are used to support teaching and learning in the African context, and develop strategies for effective implementation of e-learning systems in the continent.

The utilization of Web 2.0 in higher education in the developed world

The literature shows that web 2.0 technologies are being deployed across a broad spectrum of university activities in the developed world due to advanced technical expertise, and good infrastructure. For instance, a qualitative survey of 180 higher learning institutions across five countries (i.e. Australia, the Netherlands, South Africa, the United Kingdom and the United States of America) revealed that web 2.0 is deployed across all areas in higher education including academic, administrative and support areas (Kelly, 2008). This study indicated that all countries are beginning to exploit the potential in Web 2.0 technologies with the greatest differences relating to the current levels of technical infrastructure which enable or inhibit use. The UK and Netherlands lead the way in enabling use, through supporting national infrastructure developments, and some USA States have policies and strategies in place which encourage use of technologies in support of student learning. The utilization of web 2.0 in all countries is led by individual academics, faculty and administrators rather than being driven from national policy or even institutional policy levels (Kelly, 2008).

A study in UK also indicated that Web 2.0 technologies are being deployed across a broad spectrum of university activities in the UK due to technical expertise in developing Web 2.0 technologies and good infrastructure (Conole and Alevizou, 2010). Similar to (Kelly, 2008) (2008) study, (Conole and Alevizou, 2010) also found that

the deployment is in no way systematic and the drive is principally bottom up, coming from the professional interest and enthusiasm of individual members of staff. Advice and guidance is available to institutions, but there is no blueprint for implementation of Web 2.0 technologies, and each is currently deciding its own path (Conole and Alevizou, 2010).

However, a study by Wyld (2008) found that the use of blogs in USA and Canada amongst top academic officers was limited. However, the projections are that this will grow exponentially in the future as blogs become more common (Wyld 2008). Another study of 46 lecturers in Spain also revealed that there was a serious lack of knowledge concerning the use of web 2.0 applications (such as blogs, wikis or podcast) in teaching at the Gijón EUITI University (Rubio *et al*, 2010). It is important for faculty and not the students to be at the forefront of all the technological means that may improve their teaching.

Generally, the literature shows that adoption and implementation of web 2.0 in the developed countries is still fragmented due to the availability of expertise, facilities and reliable and stable infrastructure. The use of these technologies is mainly driven by individual efforts rather than institutional policies and strategies, which limits the wide utilization of these technologies to support learning and teaching in HEIs. It is thus important to assess the extent to which these technologies are deployed in Africa, with a specific focus on Tanzania public universities for effective and efficient teaching and learning in HEIs.

Integration of web 2.0 tools in the African's higher education

The adoption of various learning technologies in developing countries and Africa in particular has, often shown to gain its popularity. For instance, a study regarding the status of e-learning in Africa based on 358 responses from 25 African countries revealed that 174 respondents (49% of total sample) had used a Learning Management System (LMS) for teaching in the previous 12 months, and 185 respondents (52%) had used one for learning across most of the universities in the

continent (Unwin *et al*. 2010). Similarly, a previous study of 54 tertiary institutions from 27 African countries revealed that only 47% of the respondents have installed e-learning applications (Gakio, 2006). It is clear that most African universities have established e-learning systems in their institutions.

Although establishment of LMSs would appear to be quite high, their level of actual usage is distinctly low across the continent. A study of 25 African countries revealed that about 46% (out of 358 responses) of respondents used LMSs for teaching and uploaded material less frequently than once a month, and only 9% claimed to do so on a daily basis. Amongst learners, this pattern was different, with 28% claiming to access their LMS on a daily basis, and only 35% doing so less frequently than once a month (Unwin *et al*, 2010). A study of Egyptian tourism higher education also showed that most universities had established the required infrastructure for e-learning. However, e-learning was limitedly applied in the surveyed universities due to the inadequate numbers of qualified Egyptian academics to participate efficiently in the e-learning process (Afifi, 2011). Another study of 74 lecturers of the University of Ghana showed that two-thirds (66.2%) of lecturers did not have knowledge of the e-learning facility (Dadzie, 2009). Of those who did know about it (33.8 %), only 10.8% knew how to access it due to lack of awareness, skills and time (Dadzie, 2009). The study findings show that in spite of the improved investment on e-learning systems, actual usage of these technologies for teaching and learning is quite low in Africa due many factors such as lack of training, time and resistance to change towards e-learning issues.

Low use of internet for learning purposes can also be noted by the MIT open courseware statistics, which show that only 1% of MIT OpenCourseware traffic since 2004 came from users on sub-Saharan Africa (Simões and Gouveia, 2008). Limited ICT infrastructure and low internet bandwidth may have limited most African Universities to use e-learning systems at a high rate. Actually, the level of internet usage in Africa is less (10.9 percent) than the rest of the

world (31.8%). In Tanzania, usage is even less, accounting to 1.6% (Internet World Stats, 2011).

However, the situation is different in some regions of Africa, such as South Africa where the use of e-learning technologies for teaching and learning is quite high. A study in the Western Cape University showed that most students (98 %) and lecturers (97%) used computers for teaching or learning (Brown *et al*, 2007). In spite of high use of ICTs for teaching, the use of ICTs for this activity was lower in frequency compared to other activities. A study in Western Cape University showed that only 32% of academics used a computer daily for teaching and learning activities, with the use of ICTs for communication and administration being a more frequent activity (Brown *et al*, 2007). Therefore, the use of technologies to support teaching and learning varies across the continent.

The use of web 2.0 technologies to support learning and teaching activities is very low in Africa. A study of 25 Africa countries revealed that the dominant e-learning practices seemed to be user management, glossaries, document delivery, e-mails, quizzes and tests, presentation delivery, and digital libraries. The use of web 2.0 features such as wikis, blogs, and RSS feeds were ranked at a low rate (Unwin *et al*, 2010). Another study on podcasting experience by faculty and students in a South African HEIs revealed that most respondents were still on the early stages of the decision-making process on the use of podcasts as an add-on to existing lecture resources (Mugwanya *et al*, 2011). Reasons behind this could be resistance to change, and lack of knowledge, skills and awareness on the importance of web 2.0 in teaching and learning practices. Other factors could be lack of speedy and reliable internet connectivity, lack of e-learning policy, and lack of ICT facilities such as computers.

Few universities in South Africa are adopting education 3.0 technologies but still they are largely within the education 1.0 paradigm, although uptake is happening at a more rapid pace. For instance, the University of Western Cape in South Africa has established the African Virtual Open

Initiatives and Resources (AVOIR) project, established e-learning strategy, and created the KEWL.NextGen (soon to become KEWL 3.0) e-learning platform as an AVOIR product. They have also established a free Content/Free and Open Courseware project (Keats and Schmidt, 2007). For instance, a review of current and developing international practice in the use of social networking (Web 2.0) in higher education revealed that the use of Web 2.0 in South Africa is largely developing on the fringes of institutional education programmes, through experimentation by individual university staff, small research and pilot projects, or student initiatives (Kelly, 2008). This finding is also similar to other studies in the developed world (Conole and Alevizou, 2010). HEIs in South Africa are not yet as well served with widespread and necessary broadband-width and this limits the development potential as issues of equity of access still dominate (Kelly, 2008).

The use of web 2.0 tools for social purposes in African countries is however very high as compared for other education purposes. Statistics show that African users on facebook counts 34,163,600, with 3.66% penetration rate. Egypt, South Africa and Morocco take a lead in this (Socialbakers, 2011). An earlier study of Fourth year medical students (n=92) attending Muhimbili University of Health and Allied Sciences in Tanzania also showed that most students had the highest levels of competence in email, Internet and file management. The main reasons for using a computer were to communicate by email (75%), Internet navigation (33%), learning purposes (27%), and to prepare reports (22%) (Samuel *et al*, 2004). This fact shows African universities should take a lead in using web 2.0 tools to enhance learning and teaching activities since most of its students are already using them.

Wireless and mobile technologies however make it possible to provide e-learning 2.0 opportunities to African learners that are either without infrastructure for access (e.g. rural or remote learners) or continually on the move (e.g. business professionals). The relevance of m-learning for Africa lies in the fact that the majority of learners in Africa are without infrastructure for access. It is

important to note that the adoption rate of mobile technologies in African countries is among the highest rates globally. Statistics show that there were 360 millions of mobile subscribers, compared to 86 millions internet users in Africa by the end 2010 (International Telecommunication Union, 2011). A study of 290 first year students in two South African universities also showed that three of the top five uses of technology particularly for their studies relied on their mobile phones (Thinyane, 2010). M-learning is increasingly becoming an important technology for teaching and learning in Africa. Thus, the integration of web 2.0 features in the delivery of education content via mobile technology can enhance teaching and learning activities in Africa.

Major challenges that limit most African universities to adopt education 2.0 and/or education 3.0 are related to poor ICT infrastructure, limited access to computing technologies, and high cost and scarcity of internet bandwidth (Keats and Schmidt, 2007). A study of 54 tertiary institutions from 27 countries showed that the average African university had bandwidth capacity for the uplink and downlink is 706 and 1254 Kbps which is equivalent to a broadband residential connection available in Europe (Gakio, 2006). The survey further showed that African HEIs pay US\$4.58 per kbps (down from \$5.46 in 2004) per month which is 50 times more for their bandwidth than their educational counterparts in the rest of the world. Further, the analysis of computer access showed that the highest number of users per computer is 388, the lowest is 1.53 and the mean is 53 in African HEIs (Gakio, 2006). It is thus important to improve the ICT infrastructure, including the internet bandwidth in the continent for effective teaching and learning activities.

Other challenges to the deployment of education 2.0 in Africa are related to differences in geographical and economic conditions, different educational backgrounds and pedagogical views, language and content issues, usability and technical literacy issues, attitudes and prejudices, and even differences in climate have posed challenges to initiatives in technology-enhanced education (Tedre *et al*, 2010). Other factors that inhibit

implementation of e-learning in Africa include lack of infrastructure (particularly connectivity, and especially in rural areas), lack of e-learning policy, the need for appropriate training and capacity development, a lack of relevant digital content, and the cost of implementation (Unwin *et al*, 2010). Understanding these barriers is important for effective implementation of e-learning in Africa.

Methodology

Data for this research was collected by adopting a combination of "content analysis" and "semi-structured interviews". This study conducted an exploratory survey where ICT personnel from six out of the eight public universities were interviewed between February and April, 2011. These public universities included: Ardh University (ARU); Muhimbili University of Health and Allied Sciences (MUHAS); Mzumbe University (MU); Open University of Tanzania (OUT); Sokoine University of Agriculture (SUA); and the University of Dar es Salaam (UDSM). The other two public universities (i.e. Dodoma University and State University) did not meet the selection criteria. The criteria for selecting such universities were their existence as higher learning institutions for at least 10 years as well as evidence of a well developed ICT infrastructure, and postgraduate programmes at respective institutions. It was perceived that by meeting the above criteria, the selected institutions had comparatively well established teaching, learning and research infrastructure, generated more teaching and learning materials, and research output and hence they were more likely to benefit from the use of ICTs than new institutions. The interviews were mainly conducted in order to establish the following: ICT infrastructure; deployment of learning technologies and web 2.0 in the universities; and challenges of applying e-learning and web 2.0 in these universities in Tanzania.

The study also reviewed ICT policy and strategic plans and other relevant documents from Tanzania Universities in order to supplement data gained from the interviews. A review of websites for the respective universities was conducted in March, 2011 with the aim of getting more

information on the establishment on ICT infrastructure, application of learning technologies and web 2.0, and challenges of deploying e-learning and web 2.0 in public universities in Tanzania.

The study findings and discussions

The study findings are presented according to the following themes: ICT infrastructure; deployment of learning technologies and web 2.0 in HEIs; and challenges of applying e-learning and web 2.0 in the public universities of Tanzania.

ICT infrastructure in the public universities of Tanzania

The study findings showed that all surveyed universities had basic ICT infrastructure to support teaching and learning activities. Most building in these universities were connected to a powerful fibre optic network and there was a wide coverage of wireless connection, at least in most of the strategic learning area in these Universities. The internet bandwidth was also good in some Universities, where the University of Dar es salaam (155 Mbps) had a high bandwidth amongst other Universities, followed by OUT (10 Mbps), and MUHAS (8 Mbps). Other Universities had low bandwidth, which included SUA (4 Mbps), ARU (4.69 Mbps) and MU (512 Kbps). UDSM had high bandwidth because it was connected to the SEACOM undersea cable that provides high speed internet connectivity. SEACOM is part of the national backbone project that is expected to be ready by end of 2011. To date there is still debate on its management, distribution and utilization, with only a few ISPs connected. SEACOM expects to provide capacity to another 60 plus research and educational institutes at a discounted rate. All universities possessed other basic ICT facilities such as computers, CDs and DVDs facilities that form the basis for the establishment of e-learning platform.

Deployment of learning technologies and web 2.0 in the public universities of Tanzania

The adoption of e-learning platform in Tanzanians universities is still low despite of the opportunities that are provided by the open source technology, web 2.0, mobile technology and the conducive environment

created by the government. In the surveyed universities, there was adequate awareness of ICT and e-learning. All Universities had developed and institutionalized ICT policy. E-learning issues were covered in ICT policy of only one institution (OUT), while two Universities (MUHAS, UDSM) were in the process of developing e-learning policies. Other institutions did not have e-learning policy in place, and their ICT policies did not adequately address e-learning issues. This finding is consistent with a previous study of 54 tertiary institutions from 27 African countries which showed that few institutions (39%) had e-learning/ ICT policy (Gakio 2006). A study of 14 universities in South Africa also showed that four institutions had an e-learning policy, followed by four institutions which their documents were still in draft form, while six did not have any policy in place (Brown *et al*, 2007). These findings indicate that the commitment of University management on e-learning in the African institutions is not satisfactory. E-learning policies are important in guiding the establishment and implementation of e-learning and web 2.0 in HEIs.

Similar to other studies in the developed countries (Conole & Alevizou 2010; Kelly 2008), this study also found that the implementation and use of e-learning systems was mostly initiated by individuals in the institutions instead by the management. For instance in one university, e-learning system was established following a project that was done by a group of students who installed moodle as part of the course assignment. All universities had installed e-learning systems in their institutions, however these systems were being utilized to support teaching and learning in four universities. Moodle software was the popular e-learning system in all the surveyed institutions, where it was installed in all universities with exception to MUHAS which implemented TUSK (Tufts University Sciences Knowledgebase) software. Moodle software was found to be a popular e-learning application in other studies of African HEIs (Gakio, 2006; Unwin *et al*, 2010).

In these Universities, e-learning was firstly introduced and used to support teaching and learning in ICT related programmes, and

then replicated into Arts courses in four universities. It was assumed that it was easy for students in ICT related programmes to adopt and use e-learning systems than other programmes. Distance learning was only established in two Universities (UDSM, OUT), where they run various undergraduate and postgraduate academic programmes across the country. The distance learning programmes had enabled these universities to cater a growing number of students and academic programmes. Thus, the dominant content delivery mode in the surveyed universities was still in printed-based materials supported largely by face-to-face sessions. However, the use of printed materials faces challenges as they are expensive and sometimes while printing the learning material new knowledge might emerge. E-learning can be used to supplement face-to-face sessions in Tanzanian universities.

Other e-learning tools that were used at a high rate in these universities included emails, discussion forums, presentations, web and CDs. Half of the Universities had installed video-conference tools. However, these facilities were inadequately used for teaching and learning purposes due to many factors including technical support, and lack of users' awareness and skills. Some universities (MUHAS, UDSM, and SUA) used the video conference services provided by Tanzania Development Learning Center (TDCL). TDCL works under the Tanzania Presidents Office – Public Sector Management (PO-PSM), and it is a member of the Global Development Learning Network (GDLN) with over 120 networked development communication hubs globally. Its core function is to enable decision makers and mid-level professionals and practitioners to access and share the wealth of knowledge and experiences available in the world through the global communication system including video conferencing, internet, video, CD and print. Similar findings were revealed by another study of higher learning institutions in Tanzania that most instructors (77%) often used power point presentation, followed by virtual learning software in the lab (36%) and video conferencing (44%) (Ndume *et al*, 2008). Likewise, a study of 25 distance learning programmes at health training institutions

in Tanzania showed that most programmes (17) utilised learning technologies including computer-based (5), web-based (8), mobile device (3) and videoconferencing (1) technologies, and some programmes used more than one of these technologies (Anya *et al*. 2010). The use of power point presentation for teaching purposes was also found to be popular than any other technologies in Ghana University (Dadzie, 2009). These findings show that the use of power point presentation, CDs, email and web for teaching and learning purposes is common as compared to virtual learning software and other technologies such as video conferencing in Tanzania.

Similar to other African studies (Mugwanya *et al*. 2011; Unwin *et al* 2010), the use of web 2.0 to support teaching and learning in these universities was also very low. All interviewed respondents in these universities acknowledged that they were aware of the web 2.0 tools and its importance to support teaching and learning in their institutions. However, only one university was using wikis, but the actual usage of this tool was still very low. Other Universities had integrated web 2.0 features (such as, wiki, blogs, RSS, instant messaging) into their LMS, however only one university was planning to start using these tools for teaching and learning purposes. In this case, only discussion forums were popular and they were heavily used by students and faculty to support teaching and learning. Teaching staff have to take a lead in the use of new technologies for teaching and learning purposes, since most students are already using web 2.0 tools for social purposes in Tanzania. Statistics show that there are 350,280 facebook users in Tanzania, which is 0.84% compared to the country's population and 51.82% in relation to number of Internet users. The largest age group is currently 18 - 24 with total of 133,106 users, followed by the users in the age of 25 – 34 (Socialbakers, 2011).

In terms of staff training, the findings showed that workshops on e-learning and information literacy to faculty members were regularly organized in four out of six universities. All universities had integrated course of basics ICTs in their existing

university curricular, which shows that all universities were aware on the importance of ICT in supporting teaching and learning. However, few public universities had integrated a course on either information literacy or e-learning into their curriculum. MUHAS had integrated both aspects into its curricular of its undergraduate programmes, while four public universities had incorporated information literacy course into their curricular, which includes SUA, MUHAS, OUT and ARU. Information literacy aspects are important in equipping students with skills on how to access, use and evaluate electronic resources which is significant part of implementing e-learning practices in the institutions.

Challenges of applying e-learning and web 2.0 in the public universities of Tanzania

The surveyed universities faced a number of challenges when implementing e-learning activities in their institutions. These challenges are associated with: the poor technological infrastructure and the often prohibitive cost of educational technologies; awareness of and attitudes towards e-learning; the lack of local expertise in curriculum development for e-learning; and, the lack of ICT technical support to e-learning initiatives.

Poor infrastructure including low Internet bandwidth, lack of technical support and high cost of internet connectivity were major barriers that inhibited e-learning activities in the surveyed universities in Tanzania. In this study, one university paid 104 millions TShs per year which was very expensive for most universities to afford. Similar observations were also made in other studies in Tanzania that costs of internet connectivity and e-learning equipments with its associated after sales contract adversely affects the implementation of e-learning in higher learning institutions (Bakari *et al*, 2010; Ndume *et al*, 2008). An AVU study also found that internet connectivity in higher learning institutions in Africa is inadequate, expensive and poorly managed (Twinomugisha *et al*, 2004).

Further, the electricity power-distribution national network was also another limiting factor to e-learning activities in Tanzania. According to Lema (2004), only 10 % of

Tanzania population is connected to the national grid electricity. Town dwellers are the main electricity consumers while rural grid electrification is less than 1% of 8600 villages in the country. There has also been power rationing since 2006 in the country which has pose a great challenge to universities in the implementation of e-learning tools in their institutions. The study findings were also similar to other studies that were conducted elsewhere in Africa. For instance, a study to explore the types of ICT at three major universities in South Africa showed barriers to e-learning including large class sizes, limited bandwidth, time, and financial limitations (Kinuthia *et al*, 2006). Similar findings were also identified in Tanzania (Anya *et al*, 2010).

In this study, most universities had a large number of students which did not match with the required ICT facilities. Lack of computers for reading on screen, searching web information, and being able to return the assignment in e-learning or content management system was a major limiting factor to e-learning activities in these universities. Thus, it was difficult to set up practical examinations and computer-administered examinations due to limited number of computers. Most computers were prone to mechanical wear and tear due to virus problem, dust and frequent power outages.

Low awareness on e-learning and web 2.0 issues and change of mindset were other barriers to e-learning activities in Tanzania universities. Most faculty members are reluctant to use ICT for teaching purposes. Literature shows that the resistance to change is the most difficult part of implementing a new technology like e-learning more than infrastructure issues (Njenga and Fourie, 2010). Similar observations were made in Libya that most students and faculty had little, or even no, experience in using ICTs; and those who were familiar with ICT generally used it as a tool for entertainment and communication (Rhema and Miliszewska, 2010). Tedre, According to Tedre *et al*, (2010), a notable portion of Tanzania's academic and support staff received their education in the conventional, rather instructivist or even behaviourist educational system, where the

teacher is a guru and where the students' role is to receive and store knowledge instead of actively processing or creating it. Further, the attendance of academic staff and students on eLearning workshops has not been encouraging as noted by some respondents in the surveyed universities. As a result, only few faculty members have been trained on the use of e-learning systems and services in their universities. Similar observations were also made in other higher learning institutions in Tanzania (Bakari *et al*, 2010; Ndume *et al*, 2008). Understanding the human complexities, both of the lecturers and learners, can enhance acceptance and use of e-learning systems and services in Africa.

Other challenges are related to inadequate skilled staff and lack of incentives to retain ICT experts. In most public universities, it was difficult to retain ICT experts because they were attracted to private institutions where they are highly paid. Similar observations were made in Libya that the technical support was almost unavailable in most universities, which led to delays in installation, operation, and maintenance of equipment and software, and further discourages users (Rhema and Miliszewska, 2010). Other studies in Tanzania also revealed similar findings (Bakari *et al*, 2010; Ndume *et al*, 2008).

Curriculum was another challenge that faced Tanzanian universities. The curriculum and pedagogical methods need to be revised and developed to deploy ICT application effectively, and they should be specifically designed to fit the e-learning setting because e-learning is different from traditional learning (Andersson & Grönlund 2009). This means that traditional pedagogy needs to be adapted to pedagogy relating to a technology based learning environment, which promote and facilitate constructivist, interactive, and collaborative learning (Damoense 2003). However, the situation is different in Tanzania. Most universities have inadequate number of educational developers with experience in e-learning to assist faculty to redesign curriculum and pedagogical methods to fit e-learning settings. Similar observations were made in Libya (Rhema and Miliszewska, 2010) and

Tanzania (Bakari *et al*, 2010; Ndume *et al*, 2008).

Other challenges were related to limited security and privacy. These challenges included lack of centralized system for storage of data, inappropriate use of content, and difficulties in most users to manage a large of passwords that they need to have in order to use various types of web 2.0. It is thus clear that issues regarding infrastructure and power distribution, funding, human resources, awareness and attitudes towards e-learning, and curriculum development should be addressed for effective implementation of e-learning activities in Tanzania universities and beyond.

Conclusion and recommendations

Higher learning institutions have a critical role to play in helping students refine, extend and articulate the diverse range of skills they have developed through their experience of Web 2.0 technologies. However, the adoption of e-learning and web 2.0 technologies is still in its infancy stages in the Tanzania public universities. Nevertheless, there was much enthusiasm amongst respondents for developing the potential of e-learning and web 2.0 tools in their universities. These universities faced a number of challenges in their adoption and use of web 2.0, including the poor technological infrastructure and the often prohibitive cost of educational technologies; awareness of and attitudes towards e-learning; the lack of local expertise in curriculum development for e-learning; and, the lack of ICT technical support to support e-learning initiatives. Nevertheless, e-Learning and web 2.0 have as promising features for addressing the need for learners satisfaction within higher education while also ensuring that strategic imperatives of the institution are being fulfilled. Web 2.0 technologies are important to a range of pedagogical approaches, including constructivist, collaborative and reflective learning. Web 2.0 is likely to support efforts of increasing participation as creates learning environments that are student centred, free from barriers of space and time. Sharing of knowledge and experience is vital for success of eLearning for HEIs in

Africa. Best practices and strategies in the area of eLearning & web 2.0 should be adopted. For successful implementation of e-learning and web 2.0 technologies in Africa and beyond, this paper recommends that the universities should strengthen the following:

- Develop institutional policies and guidelines on ICT and e-learning. Guidelines for carrying out online teaching should be clearly stated and communicated to the university.
- Improve availability of hardware (particularly computers) and software to ensure access to appropriate technology for all students and faculty and continue to provide for the development of their technical skills
- Improve Internet connectivity/bandwidth. It should be reliable and fast so that students and faculty can access anytime and anywhere.
- Provide technical support for e-learning at a range of scales by recruiting and retraining ICT experts to ensure that they are regularly updated in the new technologies. Training will also attract more staff to work in public universities
- Ensure availability of reliable electricity by deploying other alternative power sources such as solar power.
- Include use of e-learning software into the university curricular to enhance use of e-learning application among students. Inclusion of information literacies in the university curriculum will also enable students to identify, search, locate, retrieve and, especially, critically evaluate information from the range of appropriate sources – web-based and other – and organise and use it effectively. Basic ICT training should also be incorporated into university curricular to enable students to use ICTs. The universities should treat web awareness as a priority area and support all students so that they are able to participate in web-based activities and use web-based services on an informed basis. The library can also enhance the awareness of the e-learning application through its orientation program for new students at the beginning of each academic year.
- Incorporate initial staff training and continuing professional development programmes on e-learning to enhance

awareness and use of e-learning software

- Partner with students to develop approaches to learning and teaching in order to steer the positive aspects of behaviours such as experimentation, collaboration and teamwork, while addressing the negatives such as a casual and insufficiently critical attitude to information. They should also explore ways in which the tutor/student relationship might be developed based on the Web 2.0 skills and attitudes of students
- Adopt a mix of other technologies such as mobile learning (m-learning). This technology is based on the use of mobile and wireless devices to support, enhance and deliver learning. Mobile learning can specifically improve the e-learning initiatives in Africa due to the specific cultural, technological and organizational affordance in this region. Currently, Africa experiences high levels of mobile phone ownership, acceptance and usage, lively and energetic mobile phone networks, and moderate regulatory and licencing systems. Therefore, mobile learning can enhance and improve e-learning initiatives in the continent if appropriately adopted.
- Support research into teaching and learning using Web 2.0 tools
- Seek collaborative networks of public–private partnerships to improve e-learning activities in the continent. These networks can include e-learning sponsors, policy makers, telecommunication network service providers and higher learning institutions. These networks can solve the problems related to infrastructure, to improve bandwidth access, the possibility of having consortia for purchasing bandwidth, as well as strengthening ICT policies, and technical and human capacity building for teaching, learning and research in Africa.

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