CHALLENGES AND SOLUTIONS TO PROVIDING ONLINE COURSES IN KENYA: A LECTURER'S PERSPECTIVE AT A KENYAN UNIVERSITY

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ABSTRACT-What solutions are there to universities facing challenges in providing e-learning? E-learning has the potential to provide increased educational opportunities for students and enhance lecturers´ effectiveness and efficiency. However, in order to experience the full benefits, factors such as adequate infrastructure, e-learning policy, right attitude, among others, should be present. This unfortunately is not the case for every university that wishes to provide e-learning. This paper presents the case of a Kenyan university currently experiencing challenges in combining conventional face-to-face education and e-learning. It examines the current situation at the university and identifies the specific challenges hindering the efficient provision of online courses by lectures. Based on the identified challenges, solutions are recommended that take into account the university's organizational and budgetary situation. The solutions can further be transferred to other universities facing similar challenges.

INTRODUCTION

E-learning has several definitions including computer-based training, or learning with the assistance of computers. This new approach to delivering educational materials to students has many advantages compared to traditional face-to-face approaches, for example, no classrooms or lecture halls are required, a teacher can reach many students in different areas at the same time, and fewer libraries and/or bound books are required. Looked at this way, e-learning has real potential in many developing countries where infrastructural challenges overwhelm the education sector. As a result, many institutions of higher education are introducing e-learning systems to provide students with online access to learning materials. The University of Eldoret (UoE), a public university in Kenya, recently introduced e-learning. The aim of this initiative was to not only deal with problems of space (class rooms and lecture halls, staff shortages) but also to make education available to many more students who cannot afford the cost and/or the time to sit in a conventional classroom as they have to work to provide for their families, concurrently. So far, one course has successfully been offered fully online to 12 students while the other courses were given using a blended learning approach. Blended learning is defined as "a mixing of different learning environments and approaches that often includes both face-to-face class-room methods and computer mediated activities in and / or outside the classroom", and this is differentiated from pure e-learning where there is "complete reliance on e-learning materials without any face-to-face classroom methods" (Frehywot et al., 2013, p3).

Delivering e-learning content is beneficial to many Kenyan institutions including UoE as it tackles one of the main problems facing Kenyan higher education, the lack of enough qualified staff and adequate infrastructure. In addition, it provides flexibility and addresses the needs of a growing population of students seeking university education in a country where classrooms and infrastructure are not growing at the same pace (Etiegni, 2014). Also, as will be argued, Information and Communication Technology (ICT) has much potential to help in transforming the present isolated, teacher-centered and text-bound classrooms into rich, student-focused, interactive knowledge environments (Omwenga, 2007).

However, providing e-learning services has not always been successful in developing countries. Factors such as social, cultural and economic affect the thinking of people and play an important role in shaping motivations and acceptance of technology (Qureshi et al., 2012). Furthermore, developing countries have challenges that make it difficult to provide efficient e-learning services, for instance, lack of consistent and affordable electricity, lack of affordable and high speed Internet connection, and lack of adequate computer skills among the lectures and students (Amiel and Reeves, 2008). ICT has vast potential to provide and improve learning at a lower cost, improved accessibility, and greater flexibility. This imposes a number of challenges such as; IT support requirements, training, infrastructure, among others; all which must be addressed by institutions before e-learning services can be offered successfully to students (Qureshi et al., 2012). In addition, providing e-learning services requires changes and motivation within the staff in order to redesign the curriculum, learn how to use the required technology, and provide institutional support and infrastructure (Frehywot et al., 2013).

Tarus et al., (2015) in their quest to identify challenges to e-learning in Kenyan institutions conducted a survey with 148 staff members from three Kenyan public universities which are currently using e-learning in blended mode approach. Their work, similar to other related work (Frehywot et al., 2013; Qureshi et al., 2012) identified several challenges affecting e-learning and provided recommendations at a broad level. Though their findings are discussed in this paper, this work delves deeper into providing practical and even low cost recommendations that can easily be adopted and implemented at UoE and other similar universities. For example, one of the recommendations, implementing a Moodle club to provide IT and Moodle support and provide training, is currently being executed at UoE.

In summary, this work particularly focused on identifying and analyzing e-learning challenges from the lecturers' perspective, as the adoption of e-learning among lectures is central to its success. Six broad categories of challenges were identified that include; lack of infrastructure, insufficient training, poor Internet access, lack of technically adept users as well as lack of university support, privacy/security concerns, and lastly, motivation, and contextual factors. Based on the challenges, practical solutions are presented that address all of them. The recommended solutions provided are not only applicable to UoE but can also be useful for other universities at a similar stage.

BACKGROUND
E-Learning and ICT in Kenya
According to Oredo (2008), the past decade has seen tremendous growth in the use of ICT, particularly in education in Kenya. ICT is embraced by a wide range of stakeholders in education including the government (Ministry of Education, Science and Technology), tertiary institutions, colleges, as well as the private sector. Many of these stakeholders agree that delivering courses online is beneficial for many Kenyan institutions as it tackles one of the main problems facing Kenyan higher education, the lack of quality staff (Etiegni, 2014). In addition, it provides flexibility and addresses the lack of classroom space for the growing population of students seeking university admission. A not so common benefit is that it reduces the number of students having to travel on the roads. With the increasing number of road accidents in Kenya, allowing students to take courses in the safety of their homes or offices might save lives (Etiegni, 2014).

Whilst the justification for e-learning is established, challenges to adoption, implementation and use of e-learning exist. For instance, universities like the Jomo Kenyatta University of Agriculture and Technology and the United States International University boast e-learning platforms such as Moodle and WebCT respectively (Odhiambo, 2009). However, students from both universities complain that their sites are not interactive, that more could be done as far as usability is concerned (Odhiambo, 2009). In addition, there have been hindrances to adoption of ICT in teacher training which naturally will adversely impact e-learning, namely lack of ICT infrastructure and poor access by teachers; lack of training and poor usage (Oredo, 2008). As an example, in his research on Kenyan public Primary Teacher Training colleges, Oredo (2008) found that the quantity of computer use in these colleges is as low as 14%, most of the time computers are just lying idle.

ICT and E-Learning at the University of Eldoret
UoE, (former Chepkoilel University College, a Constituent College of Moi University) has a student population of over 12,000 and is located in the town of Eldoret in the Rift Valley, Kenya. The university has full time working professionals and students who would like to take courses even if they work or reside outside of the university town. With the aim of improving education outcomes and in anticipation of increased number of students, UoE realized the significance and role that e-learning can provide. With the large number of students, e-learning can offer an opportunity for customized interactions, especially for marginalized students or those living in towns other than Eldoret.

ICT Preparedness at the University of Eldoret
Currently lectures at UoE use and have the ability to use technologies such as; laptops, projectors, desktops, Microsoft Office, Internet and email, among others in order to research, create and present learning materials to students. Other uses to which computers are used include administrative work such as project management, statistical analysis, management of student records, and accessing other online services at UoE (such as library services). These interactions with technology assure the researchers that the lectures at UoE are computer literate. They further indicate that they have the capability to absorb and implement new online web technologies in education.

E-Learning at the University Of Eldoret

E-learning, more specifically, the Moodle Learning Management System (LMS) platform was introduced at UoE in 2013 as part of a collaborative project between UoE and the University of Eastern Finland (UEF). The project aims to strengthen the use of ICT in education. UoE made its first effort in adopting e-learning by installing and integrating Moodle in their curriculum. Moodle was selected because it offers an opportunity for customized interactions and it is both effective and efficient - in terms of overall financial costs to the university. Also, UoE has made strides to improving their ICT infrastructure (for example, providing faster Internet access) which provides better support for e-learning.

In 2013, after installing Moodle, a hands-on, one-on-one training was provided to many of the lecturers by a researcher from UEF. The lecturers were trained in creating e-content, creating Moodle accounts, creating courses, and uploading and downloading materials. The rationale for training the lectures first was it was envisaged the lecturers would then also be competent and adept at cascading the knowledge to the students through issuance of tasks. In 2014, one more training session was held with the lecturers, with 2 other intensive training sessions further provided in early 2015. The second training session held in 2015 provided the setting for this work's research methodology, described in the section below. Overall, the training sessions have been effective in improving the skills of the lecturers as more lectures were able to create courses on Moodle.

So far, one course has been successfully run fully online; 12 students completed the course and received certificates. Other courses (59 courses to date) have primarily been provided using a blended approach, utilizing a mix of traditional face to face and e-learning. The blended-learning approach is suitable for UoE at this stage as it helps students to gradually get accustomed to new ways of teaching (Qureshi et al., 2012).

However, it has been noticed that currently Moodle is only being used for providing course materials, in the same format as they would be given in classroom. In addition, other Moodle functions, such as discussion forums, chats, assignment handling, have not been utilized at all. In addition, it has been noticed, that even though lectures are able to create a course on Moodle and upload materials, Moodle has not yet been well adopted and integrated into the learning process by both the lecturers and students; negating potential student-centred learning approaches inherent in the use of e-learning. Understanding the reasons behind this current state also motivated this study.

METHODOLOGY

This study adopted a qualitative and quantitative approach using mainly a questionnaire as its data collection tool. In order to understand the current usage and identify challenges of lecturers using Moodle, a questionnaire was prepared and administered to a sample of 17 participants who are members of staff at UoE. The 17 participants were chosen for the study because of their participation in the first intensive Moodle training held at the beginning of 2015. Hence, the participants were familiar with Moodle and could report on the practical challenges they have faced.

The university has eight schools which include: Agriculture and Biotechnology, Business and Management Sciences, Education, Engineering, Environmental Studies, Economics, Natural Resource Management, and Science. At least two members of staff from each school were targeted. Eventually the participants in the training were distributed as follows: Agriculture and Biotechnology (1), Business and Management Sciences (1), Engineering (1), Environmental Studies (1), Economics (1), Education (2), Science (2). The remaining participants were drawn from the departments within the School of Natural Resource Management as follows: Department of Wildlife (1), Fisheries (2), and Forestry and Wood Science (5). The sample selection of participants was purposive; the main criterion to select trainees was based on the fact that the members of staff were involved with the curriculum (both courses and course descriptions) development and which forms the bulk of their day to day duties. Further, each of the participants had the requisite ICT skills due the nature of their current duties.

The questionnaire comprised of both multiple choice and open-ended questions, with the issues being explored along a four-point Likert scale, ranging from Strongly Disagree, Disagree, Agree and Strongly Agree. The respondents here were asked to rate their level of agreement. In addition, two open ended questions to mention any other relevant e-learning issues and opportunities were also included.

RESULTS
In this section, findings from the questionnaire are discussed. The discussion focuses on each of the seven main challenges that have an effect on the provision of courses on Moodle at UoE.

Infrastructure
Infrastructure is arguably 'the' key to having successful provision of e-learning. In the questionnaire, participants were asked to give their views on the current ICT infrastructure situation at UoE, both from within and outside campus. Table 1 summarizes the views of 16 lectures who responded to this question.

Table 1: Participant's responses on ICT infrastructure

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
I find that the supply of electricity interferes with using Moodle	23.53	**52.94**	17.65	5.88
I find the cost of Internet affordable to me	18.75	**50.00**	31.25	0.00
I find access to Internet reliable (available everyday)	5.88	29.41	**47.06**	17.65
I find the speed of Internet convenient to download or upload course material on campus	5.88	23.53	**52.94**	17.65
I am able to access Moodle outside of campus	23.53	**41.18**	29.41	5.88
I find the speed of Internet convenient to download or upload course material at home	18.75	18.75	**47.06**	12.50

From Table 1 it can be noted that infrastructure is a concern to providing e-learning successfully at UoE; majority of the lecturers both strongly agree and agree that electricity is an issue on campus. This adversely impacts the use of Moodle, for example, if there is a power cut at the exact time when an assignment is due, or during an online quiz.

Additionally, the cost, speed, and access to Internet is an issue of concern. 68.75% both strongly agree and agree that they can afford to pay for their own Internet connection, while 64.71% feel that they do not have adequate reliable Internet. And 70.59% feel that the Internet speeds are not adequate. These Internet issues therefore pose a negative impact on the delivery of courses, especially if students are not able to interact with their lecturers online or are unable to upload/download learning materials due to unreasonable Internet speeds.

ICT Support
This section sought to examine the level of support provided for Moodle for lecturers and students within campus. Table 2 reveals the views of 16 lectures who responded to this question.

Table 2: Participant's responses on ICT support

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
The university provides enough support for e-learning	5.88	**35.29**	**35.29**	23.53
There is adequate IT support for lecturers when using Moodle on campus	5.88	23.53	**58.82**	11.76
There is adequate IT support for students when using Moodle on campus	6.25	18.75	**43.75**	31.25

Based on the agreement to all the three statements in Table 2, it can be observed that the lecturers view the support for Moodle and e-learning in general, for both students and lecturers, as inadequate. Support for e-learning from senior management has been identified as critical for its successful implementation (Birch and Burnett, 2009; Browne et al., 2008); thus, the lack of support at UoE further poses a great concern.

Security, Privacy and Copyright

The aim of security-related questions was to investigate whether there was a general awareness and or concern among the lectures regarding the security and data privacy of accessing and sharing materials on Moodle. 16 responses were received to these questions which are displayed in Table 3.

Most lecturers are aware of existing standards which can be used to support privacy/data protection requirements. Furthermore, most lecturers do not think their students would spread malware through Moodle in the uploaded assignments. However, this needs to be understood within the backdrop of ICT security awareness - for which training is yet to be undertaken for staff and students. The real or perceived ICT threats are also not yet well understood and appreciated.

Table 3: Participant's responses on security concerns

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
I am aware of existing standards which can be used to support privacy/data protection requirements in Moodle	5.88	**70.59**	23.53	0.00
I (would) feel safe when downloading assignments from students	0.00	**70.59**	23.53	5.88
The university has guidelines for using Moodle for lecturers	6.25	31.25	**56.25**	6.25
I am comfortable with providing my course material online	11.76	**58.82**	17.65	11.76

Based on Table 3, 62.50% of the 16 participants who responded both disagree and strongly disagree that there are guidelines in place to address the usage of Moodle at the university. This shows that the importance of guidelines on ICT usage, specifically Moodle, have not yet been articulated and disseminated at the university. Whilst policies and guidelines will not ascertain proper online conduct, they are important to put in place for both students and lecturers.

Altogether, based on the lecturers' responses, they are optimistic as they would go ahead to provide courses online despite security/privacy/copyright challenges.

Motivation

Motivation has to do with a focus on 'self-drive' and how it impacts Moodle being successfully implemented at UoE. In this study, the lectures motivation was investigated by looking at their skills levels, willingness to use Moodle, as well as need for incentives. 16 of the participants responded to this question and their views are summarized in Table 4 below.

Table 4: Participant's responses on motivation

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
I find that providing courses online is a good idea	**58.82**	41.18	0.00	0.00
I am motivated to provided courses on Moodle	29.41	**35.29**	29.41	5.88
I believe I have sufficient skills to provide a course on Moodle	**41.18**	17.65	**41.18**	0.00
I am confident in using Moodle	23.53	**41.18**	35.29	0.00
I find Moodle user-friendly	25.00	**62.50**	12.50	0.00
Being able to be compensated for putting content on Moodle is important to me	**58.82**	17.65	17.65	5.88

Based on the responses, it was observed that on the one hand most of the participants strongly agree that online courses are a good idea and that Moodle is user friendly. 64.71% of the lecturers both strongly agree and agree that they are motivated to provide courses online in Moodle. On the other hand, an even larger number, 76.47% both strongly agree and agree that they would want some incentives and compensation to use Moodle. These results seem

to contradict each other; it is therefore arguable that the desire for incentives might be contributing to the slow up-take of Moodle at UoE mentioned earlier.

Moreover, that 41.18% disagree they have sufficient skills to offer courses online using Moodle; is quite significant in light of the sample. Perhaps it can be argued even though they have some have received some training, they are not yet confident in using Moodle.

Social Aspects
The questionnaire further inquired from the participants if enabling online communities for student interaction and discussion was desirable for learning. Table 5 shows the 17 responses from the participants.

Table 5: Participant's responses on social concerns (%)

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
I like that I can engage with students online	**47.06**	**47.06**	5.88	0.00
I think online discussions are important (student-student) for learning	**58.82**	41.18	0.00	0.00
I think online discussions are important (student-teacher) for learning	**47.06**	**47.06**	5.88	0.00
I find that using Moodle makes it easier for students to communicate with lectures	41.18	**52.94**	0.00	5.88
I prefer more face to face interaction	23.53	17.65	**52.94**	5.88

Based on the responses, 94.12% both strongly agree and agree that they like that they can engage with students online. All the participants both strongly agree and agree that these online discussions are important: either between students or between lecturers and their students. In addition, all the participants both strongly agree and agree that Moodle facilitates easier communication between lecturers and their students. These are all scenarios afforded by Moodle, which are important in improving learning outcomes.

Nevertheless, 58.82% both strongly disagree and disagree that they prefer face-to-face interaction than online communication. This stems from the view that if online interactions are encouraged, many students might not attend classes. This indicates a need for exposure to blended learning pedagogical approaches because they might not be well understood at this stage of the implementation.

Course Administration
The functions of an LMS, such as Moodle, are meant to provide more efficient handling of assignments, grading, structuring and sharing of learning materials. With this item, it was important to find out from the participants on which functions of Moodle were important to course administration. Table 6 displays the views of 16 participants who responded to these items.

Table 6: Participant's responses on course administration

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
Receiving assignments and providing feedback to students on Moodle is important	35.29	**58.82**	5.88	0.00
Receiving assignments and providing feedback to students on Moodle is convenient	29.41	**70.59**	0.00	0.00
I find it easy to get online support in using Moodle (e.g. Internet search, Moodle docs)	18.75	**56.25**	25.00	0.00

94.12% of the participants both strongly agree and agree that using Moodle to receive soft copy assignments and to give feedback to students is important and convenient. This certainly makes it easier for students and lecturers to submit and provide feedback on assignments respectively.

Preparation of Learning Materials

The introduction of e-learning at any university causes shifts in how lecturers prepare their lessons, issue handouts and generally carry out their teaching. Thus, questions were posed to the participants to obtain their views in this area. All 17 participants gave their responses on these items.

Table 7: Participant's responses on learning material preparation

	Strongly Agree	Agree	Disagree	Strongly Disagree
	Percentage Scores %			
I find it difficult to layout/structure course material for Moodle	0.00	11.76	**70.59**	23.53
I find communicating concepts with students in Moodle restrictive	0.00	11.76	**64.71**	23.53

Most of the participants find that structuring of courses and communicating through Moodle is not difficult. Additionally, most lecturers do not find Moodle restrictive in terms of pedagogy - and they were confident that they could handle a broad spectrum of subjects in their courses adequately. This is positively reinforces the existence of capability and understanding at UoE for carrying out e-learning, but only at a general level.

Despite this, there were certain exceptions; there are courses that participants felt could not be provided efficiently on Moodle, due to their abstract or practical nature; these are shared below.

Contextual Concerns

In this section, other concerns that were brought up by the participants are discussed, apart from the above challenges. To begin with, three lecturers cited courses like Entomology, Pathology, Fluid Mechanics, Physics and Mathematics as being difficult to teach using Moodle. Reasons for this included the practical nature of the courses, inability for students to problem-solve without hand-holding.

Also, six lecturers do not see Moodle complementing but rather competing with class attendance, and so have a problem with Moodle as a substitute. Reasons for this include that face to face interaction actually motivates and inspires learners (the LMS might be impersonal); a teacher can gauge the level of comprehension in class through student interactivity, that using Moodle might encourage academic dishonesty (sharing of logins, cheating on exams and tests) and impede direct communication between lecturers and students.

Whereas these are valid concerns to the lecturers, it shows the broader need for tackling training in Moodle from a stance that highlights the role of pedagogy and what a blended approach entails. All the same, it reinforces the need for a blended approach at this stage of Moodle implementation at UoE.

CHALLENGES AND RECOMMENDATIONS

This study set out to explore existing challenges impeding the effective provision of courses on Moodle at UoE. Based on the questionnaire responses (from the Methodology), the seven broad challenges have been banded into six categories; lack of e-learning and Moodle skills, infrastructure, Internet access, university support, security, and motivation. Figure 1 illustrates the challenges and in the subsections to follow, each category is discussed in more detail. Moreover, for each category, practical recommendations are provided to the staff and the university in order to move beyond these challenges.
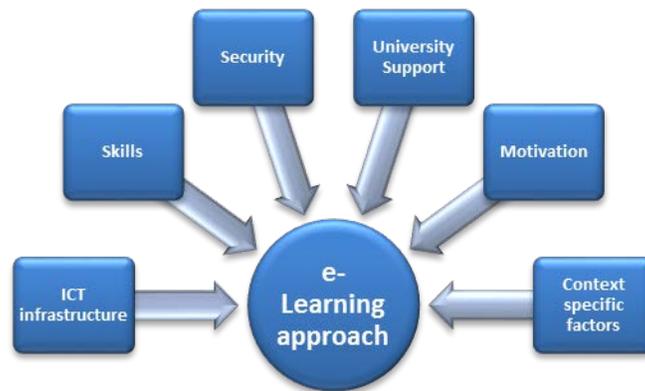
Figure 1: Challenges that adversely impact the provision of online courses at UoE

E-Learning and Moodle Skills
Description: The ability to use e-learning tools is a significant success factor in the provision of online courses. However, from the questionnaire responses, it was identified that there is a lack of sufficient e-learning and Moodle skills. Among all the responses, the majority stated that they had received between 0 and 3 training sessions on Moodle (66.7%), which is insufficient. Especially since the majority (72.2%) has had no previous training on any other e-learning platforms; Moodle is their first e-learning tool. This was also reiterated by some staff members who said that 'hands-on' awareness was needed among the staff and students, suggesting that further training is needed. So this is an important challenge that needs to be resolved systematically since in the current UoE setting the lecturers are responsible for introducing and guiding their students on using Moodle.

Recommendations: All the lectures who responded to the questionnaire are computer literate and currently use computers for their lesson preparation and classroom teaching. However, these skills may not be adequate for them to intuitively use Moodle in teaching as well as in developing effective and well-designed e-content. The solution to this is an emphasis on more training in the effective use of Moodle and encouraging users to practice on their own.

Based on the responses, there is a group of staff (11 %) that has received more training than the others. With further training, this particular group can become the champions of Moodle at UoE. Each staff member from this group, can then team up with a less experienced colleagues for a period of time to also train them to improve and increase their use of Moodle.

In addition to this group of Moodle champions, another solution is envisioned. The solution lies in the formation of a Moodle student club. The club would be the change agents appointed to drive the use of Moodle and provide support. The club would comprise of students who have been trained on Moodle and have skills in IT (for instance, installation, and maintenance), digital content creation, and communication and research (i.e., training). When the Moodle club is institutionalized, it will lower the total cost of ownership of the Moodle implementation - because students can be cheaper to train, hire or issue with study credits, than hiring professionals to do similar work. Additionally, it would create a sense of ownership and responsibility to the students and the university.

Finally, the university should further encourage the lecturers and students from the Moodle student club to attend and participate in e-learning conferences and workshops for increased knowledge management (for example, e-learning Africa; International Conference on e-learning - http://elearning-conf.org; IST Africa conference - http://www.ist-africa.org).

Infrastructure
Description: Infrastructure by far is the biggest barrier to providing courses on Moodle. The biggest concerns over the infrastructure include electricity, availability of computers, and access to existing computer labs at the

university. Infrastructure is arguably the key to a successful provision of e-learning. With electricity concerns, majority of the responses agreed that (yes) it is a big problem and interferes with e-learning. The frequency of power outage cited currently is almost once a week, with each power outage ranging from 20 minutes to almost 24 hours (during study time).

Another significant barrier to Moodle usage is lack of computers and access to current computers. Challenges to do with access to computers are of two kinds; firstly that there is a lack of sufficient computers, and secondly, that students lack access to the existing computers. This is attributed to real concerns over the physical loss of computer equipment in the labs - and which has occurred in the past. Consequently, some labs at UoE are completely inaccessible to some students without the present supervision of a staff member.

Recommendations: Whereas power outages may be beyond the control of UoE administration, it is prudent for universities in a similar position to make alternative power arrangements such as generators or batteries. For instance, some departments at UoE (e.g., Department of Forestry and Wood Science) have already installed a generator. However, challenges still remain because there is no in-house expertise to service and maintain the equipment. Thus, due to lack of maintenance of generators, power problems still persist. This indicates a need for the procurement department to work closely with the respective schools and departments in order to identify support services which need to be out-sourced. Ideally, a third-party supplier with the requisite service level agreement would be able to give specialized maintenance and service to the power backup arrangement.

In order to address the challenge of access to existing computer labs, many of the departments at UoE can follow a model in their labs, where a student is designated a role to look after a computer. This model is currently being used in the School of Agriculture labs at UoE and has proven to work for them. It is something that other schools and departments can borrow and learn from. The model, in particular, requires the right kind of personnel, with the right skills and responsibilities to oversee lab equipment during their shift hours. The Moodle club proposed in previous sections is a probable solution to this challenge; as it could be mandated to also manage the labs for longer period of time.

Moreover, at UoE, it has been observed that many students have smartphones as opposed to personal laptops. Thus deploying a mobile version of Moodle could prove to be another solution to the limited number of computers available.

It is further recommended that UoE nurtures the requisite strategic partnerships with industry or other academic institutions with an overall goal of improving the provision of computer access and availability, for example through leasing of equipment.

Internet Access
Description: Whilst Internet access is part of infrastructure, it deserves to be discussed separately as it is also one of the big barriers to e-learning at UoE. Whereas the questionnaire responses indicated that the cost of Internet access was affordable to the participants; majority said that the access is not reliable and the connection speed when it is available is not satisfactory. Furthermore, Internet access is poor outside of campus which makes it difficult for UoE to achieve its vision of providing courses everywhere at anytime.

Recommendations: Internet access ought to be a right for everyone in this academic setting, particularly for the lectures and students at UoE. With the growing provision of Internet access at reasonable prices in Kenya and projects like Internet.org (https://internet.org/) and Google's project loon (https://www.google.com/loon/) that aim to provide Internet connection to areas that do not have, reliable and fast Internet, access is envisioned to not be a big hindrance to UoE in a few years' time.

Currently, UoE has installed a fiber optic cable connection at the university. The cable is connected to the University main Internet server. Moreover, monitoring systems can be improved and a proxy server, including bandwidth allocation put in place, such that the bandwidth use is closely monitored to ensure emphasis on learning related work. On the other hand, it is still notable that there is no redundant provision of Internet access to the university. It means there is no failover whenever the main ISP links are unavailable - and this impacts adversely on access to

Moodle. The university therefore has to consider procuring from a different ISP backup links that ensure learning continues.

Similarly, the bandwidth speeds have to be improved from the current 30Mbps in order to support multiple concurrent users - especially during peak times of the day whence staff and students might be accessing Moodle and the Internet.

Also, in case there is continued poor Internet access, UoE can further customize their Moodle version to allow it to be accessible offline. This can be addressed with the use of for instance, the application cache interface (https://html.spec.whatwg.org/#appcache). Using the application cache, allows for offline browsing and availability of learning materials even when the Internet is down.

University Support
Description: For e-learning to succeed, it needs to be supported by the university. Unfortunately, more than half of the responses (55,5%) acknowledged that the university does not give enough support to e-learning, 66,7% felt that there was not enough IT support to the lectures when using Moodle, and even more (72,2%) felt that there was not enough IT support for students when using Moodle.

Recommendations: UoE should create an e-learning policy in order to streamline the activities. These activities include providing access to computers or creating a plan to optimize the use of existing computers. Providing a good reliable Internet connection and providing IT support can in particular be provided by the Moodle student club described in the discussion section below. The club would be responsible for installations, maintenance, assisting with uploading, downloading, etc. The policy should further outline guidelines for using Moodle, and in particular address security issues as discussed further below.

Another important consideration, closely related to the recommendation, is the need for the university to allocate a dedicated staff member from the ICT department whose role will be to coordinate and oversee the overall implementation of Moodle across schools and departments. The Moodle club might address training and adoption challenges among staff and students; but there are other concerns that require purely technical and strategic interventions. These may include issues such as software patches in case of security or upgrades, business continuity planning for e-learning, planning and monitoring allocation of resources (computers, servers, bandwidth and even technical support), software audits or reports in the event of security breaches. This is therefore an important technical role that can support all the activities of the e-learning community at the university.

Security
Description: Although the questionnaire results show that majority of the staff are comfortable with providing their course material online (72,2%), the open question asking about the biggest challenge to providing online courses provides different insight. Some of the lecturers are quite worried about providing their lecture materials online. This concern was expressed by the following phrases and words: 'mistrust of materials being pirated by others', 'piracy and plagiarism', 'security' and 'Internet security issues'. This comes down to the concern about the protection of their hard-work included in the learning materials. The lectures do not want their materials to be downloaded or distributed to just anybody as this increases the chances for them being misused to profit others, with no attribution to the original author of the material. This security concern was also reiterated by the Dean at the School of Natural Resource Management, as being a major hindrance to the lectures to providing online courses.

Additionally, there were concerns about security including mistrust of other students being able to login on behalf of others. The concern on security in this context has two aspects: protection of learning material and assurances that only the authorized students will access the materials and participate in the course discussions or submit assignments.

Recommendations: Protecting learning materials from misuse without acknowledgment; is almost impossible. Once material is online, it is difficult to prevent those who want to misuse it from to doing so. However, there are measures that UoE can take to deter these actions or make it difficult. A simple approach would be to watermark and / or password-protect the pdf documents uploaded on Moodle. The watermark would ensure that even when redistributed, the original author's name or signature is there. Password protecting the documents ensures that only students with the password are able to read the materials - especially if they are distributed electronically. Secondly

lectures could be encouraged to upload slides using Slideshare (http://www.slideshare.net/) or videos rather than text to deter the efforts; however these methods can disadvantage the students who have slow Internet speeds.

For successful protection of the materials, the students must also be made aware that they should not share the material outside of the school or profit from them in any way. Thus UoE should have in place regulations and guidelines mandating the use of Moodle, for instance, by including copyright clauses in the course syllabus and Moodle course pages. The clauses should state that lecturers hold copyright to the course materials they create and, as a result, students are not allowed to reproduce, distribute, or publicly post their course materials without express faculty permission. This can be aligned to an e-learning policy.

In addition, because technology such as biometric access can be quite expensive, access to course content should be restricted to university students who are enrolled at UoE. That means integrating the registration system with Moodle. This capability will also give the staff the security that only their students have access and the staff can also be trained to add students whom they want. Moreover, the students should be held accountable for their accounts, and not allow other students to login on their behalf. The dire consequences of misusing Moodle should be stipulated in the policy.

Motivation

Description: 64.7% of the lecturers both strongly agreed and agreed that they were motivated to use Moodle, however when asked whether they would like incentives for using Moodle, an even larger number (55.6% strongly agreed and 22.2% agreed) consented. Thus it seems reasonable to say that the motivation is there but compensation is important for the adoption of Moodle among the lectures. The incentives ought to encourage adoption, integration, and make the lecturers feel "appreciated" for creating and updating online course material.

Recommendations: The University, when creating the e-learning policy, should take into account that online teaching takes about three times the work load than face-to-face teaching (Robert and Kedrayate, 2011). Th, compensation methods taking into account this added teaching load and time, should be identified. Compensation could include; promotion, tenure offer, or remuneration.

Unfortunately, these compensation methods might require a very bureaucratic process, especially for public educational institutions. Thus, it might be better for UoE to consider other compensation alternatives and business models, for example, adjusting students' fees to include a budget vote-head which is dedicated to administration of e-learning services at UoE.

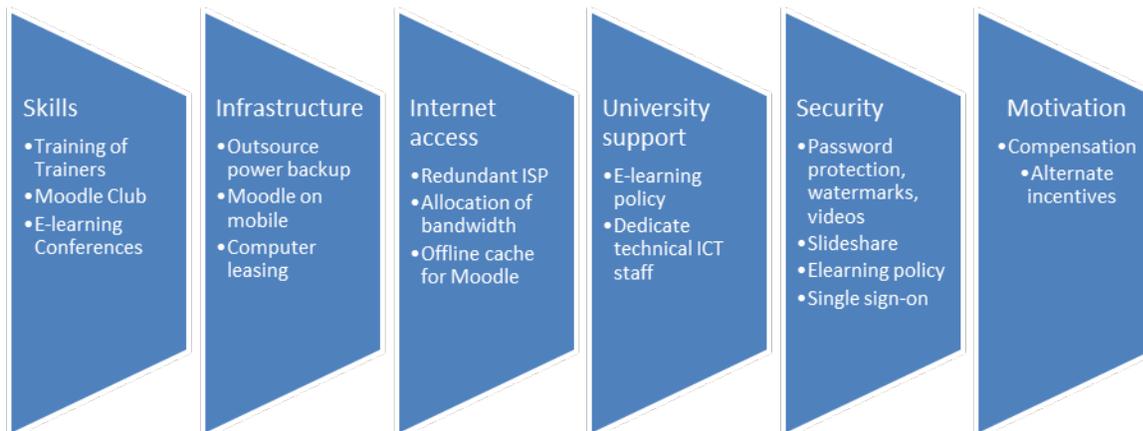Figure 2 below summarizes all the challenges and the recommendations discussed above.

Figure 2: Challenges and recommendations for e-learning implementation at UoE.

DISCUSSION

In section above, the barriers impeding the adoption and successful use of e-learning at UoE were identified and discussed. The challenges further inform research and practitioners on the factors that are essential when trying to provide e-learning. Many of the challenges are similar to the ones that have been identified in literature (e.g., Tarus et al., 2015). However, the work presented in this paper differs through the recommendations given to address the challenges. For the discussion, more focus is given on those recommended solutions that require minimal costs and resources to implement for UoE. Optimizing the use of existing resources would yield faster results than trying to allocate more budgetary resources (which might not be forthcoming upfront). Ultimately however, an e-learning budget and policy are necessary.

Moodle Club

To address the lack of skills, IT support and security of materials, the set-up of a Moodle club was recommended. The Moodle club is envisioned to be set-up as a special interest student group having the aim of ensuring the effective use of Moodle by both students and lecturers at UoE. Having a Moodle club run by skilled students will cost UoE less than if they had to hire an experienced ICT person. It is due to the fact that one professional-person's salary can be used to hire more students who would be tasked with 1) providing assistance and technical support to students and lecturers, 2) promote the utilization of Moodle for the courses offered by UoE, and 3) provide assistance in the development of learning material and subsequent dissemination.

The duties of the club will include providing:
  i.   Training and support: the club will be mandated with providing training sessions and user support on Moodle to both students and lectures. For instance, the club will assist lectures and students access functions and resources when requested. In addition, the students will also facilitate access and supervision of existing computer labs.
  ii. Technical: members with technical skills/experience who will handle the technical aspects of the Moodle platform such as upgrades, maintenance, and performance tweaks, among others.
  iii. Research and material development: the club will provide a service for material development when requested. This could be to transfer learning materials to digital format, organizing and formatting the materials for online use, among others. In particular, they will investigate how they can protect the copyright of the material, for instance password protect them. In addition, the club will periodically and purposefully engage with students and teaching staff with a view of improving or providing suggestions for improvement of the e-learning services and experiences through obtaining feedback in areas such as; quality, contexts, content, pedagogy, infrastructure, among others.

The supervision and support for Moodle Club will be provided by those UoE lectures who have participated in training (such as those identified in the Methodology section) as 'champions' of Moodle as well as the dedicated ICT staff members. The supervisors will also be responsible for bridging and ensuring effective communication between other lecturers and club members.

The sustainability of the club can be ensured through its structuring - each year, new students will be absorbed into the club and trained to ensure continuity of the club. Moreover, external funding will be actively sought to supplement remuneration of the participating students as well as acquisition resources on need basis.

Mobile Version of Moodle

Infrastructure, lack of computers and limited access to existing computers was another major impediment to effective use of Moodle. In Kenya however, there is a proliferation of smart phones, tablets and mobile Internet access. According to the Communications Authority of Kenya (CAK), as at the end quarter 1 of 2014, 99% of Internet access was from a mobile device (that is, a phone, modem or tablet); it represents a penetration of about 13.1 million out of 13.3 million Internet subscriptions in Kenya (CAK Quarterly Statistics Report, 2014).

Moodle has an official mobile application for Android, iOS, and Windows Phone 8.1 that is freely available for download. The app allows convenient access to Moodle sites, with access to course content, contacts and ability to view discussion. Having a mobile version additionally allows access to Moodle for students and lectures at home.

To accomplish this, UoE has to activate the Moodle site to allow the site to be available on mobile devices.

Offline Moodle Option

 Having Moodle also available offline is an attractive option for UoE considering the Internet access challenge that they currently have. This work's suggestion is for UoE to implement an application caching mechanism for browsers that access UoE Moodle server. The application cache mechanism creates a cache manifest file which allows web-based applications to run offline. A developer or even a member of the Moodle club can be hired to implement this, and they would need to specify resources that the browser should cache and make available to offline users.

Besides offline browsing which is useful for the lectures and students, the application cache has the following benefits (Mozilla, 2014):
  i.   Increased speeds - cached resources load faster improving also the user experience.
  ii. Reduced server load - the browser will only download update/change resources from the server.

CONCLUSIONS

In order to efficiently provide online courses, certain resources and support structures are required to be in place. This work showed that there are specifically six major factors that pose the biggest barriers to the provision of online courses at a Kenyan public university. By analyzing and understanding each of the challenges, practical solutions to address them were recommended. In particular, this work focused and delved deeper into those recommendations that would easily be integrated into the organizational structure at the University of Eldoret and especially be within the budget constraints. Such detailed solutions are lacking in previous related works. Tentative to the success of the recommended solutions at the University of Eldoret, they are planned to be extended to other universities that have a similar setting.

The researchers recognize that in the short- to mid-term, the recommended solutions will need to be extended from a baseline to actual implementation and monitoring of their success in the university setting. It is expected that most will have a positive impact, for instance the three solutions discussed in the discussion section, while others will need more inputs and resources. The long-term goal is that this study will inform the conceptualization of a practical framework which can form as the basis for implementation of e-learning at public universities in Kenya. For the framework, there is a plan to also investigate student's views and concerns towards e-learning. As stakeholders of e-learning, their perspective is important in providing a more holistic solutions and framework.

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