

LEARNING MANAGEMENT SYSTEMS: UNDERSTANDING THE EXPECTATIONS OF LEARNERS IN DEVELOPING COUNTRIES

Grace Ssekakubo, Hussein Suleman and Gary Marsden
University of Cape Town

ABSTRACT

The main objective of this study was to identify strategies of enabling learners in developing countries to fully exploit the potential of learning management systems (LMSs).

The study set out to: (i) identify the services of learning management systems that are most needed and desired by university learners in developing countries, and (ii) to identify appropriate access strategies that would guide design decisions on how to effectively and satisfactorily deliver such services to the university students in developing countries.

A total of 144 students from two African universities participated in the study by responding to an online survey questionnaire. The questionnaire asked students; how often they accessed LMSs to obtain, create and exchange information and knowledge; their preference for the different devices used for accessing the LMS; the LMS services they are most often required to access; and the services they most desire to use.

The findings of the survey indicate that the most desired and most accessed LMS services by the students include assignments, announcements, resources, course outlines and the chat room. At the same time, mobile phones are rated the least used devices for accessing the LMS services.

KEY WORDS

Accessibility, Learning Management Systems (LMSs), Sakai, Moodle, Developing Countries

1. INTRODUCTION

Over the last decade, there has been a remarkable increase in the adoption of learning management systems (LMSs) in developing countries, where open source LMSs have had a clear market dominance over proprietary systems (Cavus *et al.*, 2007). The majority of universities in developing countries, especially in Africa, view learning management systems as the most appropriate e-learning tool in blended learning environments, and they (the LMSs) are often regarded as the starting point of any Web-based learning program (Akeroyd, 2005; Cavus, 2007; Kakasevski *et al.*, 2008). However, our earlier research (Ssekakubo *et al.*, 2011) shows that, despite the increased adoption of LMSs by institutions in developing countries, their potential to support e-learning has not been fully exploited. Sife *et al.* (2008) and Saeedikiya *et al.*, (2010) also noted that e-learning initiatives in general and LMSs in particular register relatively few users in developing countries, thereby not justifying the high infrastructure investment costs.

One way to attract and retain the learners on the LMSs is by identifying the LMS services that are most desired by the students, refactor the LMS and make such services more effectively and intuitively accessible by the students through various technology platforms.

In this paper, we present the findings of a survey in which we identified: the most needed and desired LMS services; how the students currently prefer accessing the LMS services; and the students' perceptions on the appropriate access strategies that would guide design decisions on how to effectively and satisfactorily deliver such services to them. The survey was carried out in two of the five universities that were involved in our earlier research entitled "*Have Learning Management Systems fulfilled their potential in developing countries?*", namely University of Cape Town and Makerere University.

The paper has five sections. Section 1 is the introduction. Section 2 presents some related literature, including: the services of LMSs; LMS generations and standards; and the accessibility and usability of LMSs.

Section 3 describes our approach, including: an overview of the e-survey methodology; study design; and our study population. In sections 4 and 5 we present our findings and conclusions respectively.

2. RELATED LITERATURE

2.1 The LMS Services

Learning Management Systems are Web-based software application platforms that use Web technologies and Internet services to support online course creation, maintenance and delivery; student enrolment and management; education administration and student performance reporting (Dagger *et al.*, 2007; Hadjerrouit, 2010). LMSs also allow learners to use interactive features such as threaded discussions, chatrooms, discussion fora, and other methods of communication. A typical LMS, such as Sakai or Moodle, may have as many as twenty or more service components. Table 1 shows some of the core service components of learning management systems.

Table 1. Service Components/ Tools of LMSs.

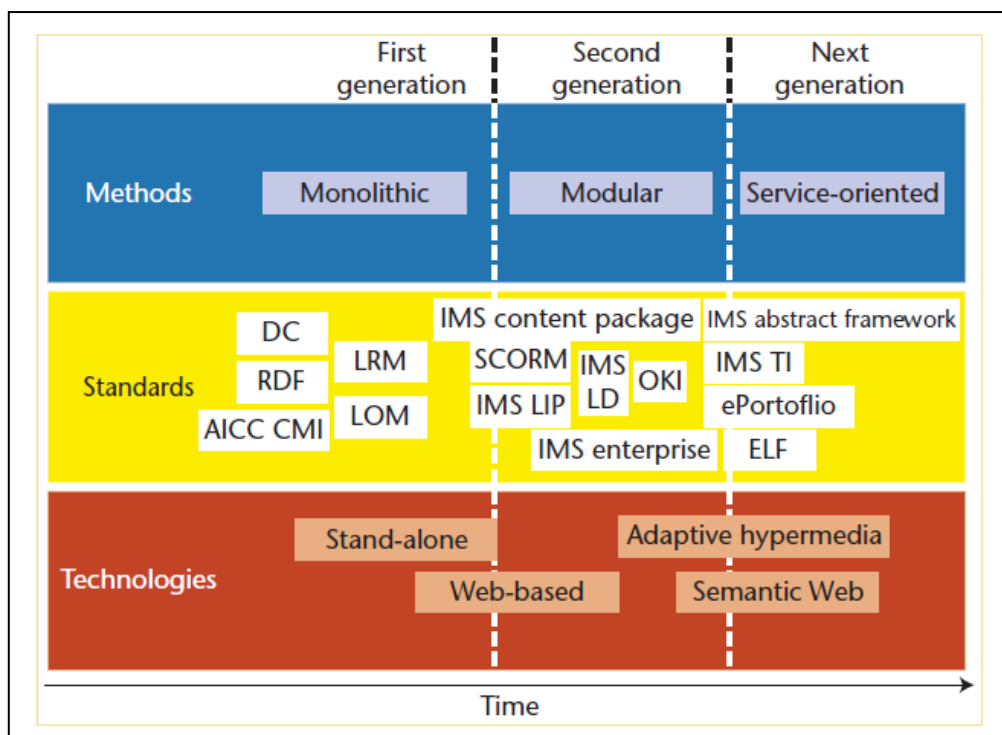
Service Component	Description
Announcements	For viewing current, time critical information
Assignments	For posting and submitting assignments
Blogs	For course or project blogging or journals
Calendar	For viewing deadlines, events, etc
Chat Room	For real-time conversations in written form
Course Outline	For summary outline and/or course requirements
Drop Box	For private file sharing between instructor and student
Email Archive	For viewing e-mails sent to the site
Forums	Display forums and topics of the course
Maps	For using interactive Google Maps
Messages	Display messages to/from course participants
News	For displaying news and updates from online sources (RSS feeds)
Participants	For viewing course participant list
Podcasts	For managing individual podcasts and podcasts feed information
Polls	For anonymous polls or voting
Q&A	For asking and answering questions
Resources	For accessing documents, URLs or other websites
Search	For searching content within course or across courses
Slideshow	For showing and viewing slideshows of image collections from resources
Tests & Quizzes	For taking online tests/quizzes
Wiki	For collaborative editing of pages and content

Source: Moodle (www.moodle.org), Sakai (www.sakaiproject.org)

2.2 LMS Generations and Standards

Literature reveals three LMS generations: the first generation, the second generation and the future generation. According to Dagger *et al.*, (2007), the first generation systems were monolithic and supported content-only interoperation; during this generation, a range of standards emerged, such as Dublin Core (DC), IMS Learning Resource Metadata (LRM), and IEEE Learning Object Metadata (LOM) (Figure 1). The second generation systems (which is the current generation) are largely modular, they take account of users and their associated profiles and focus not only on sharing content but also on sharing learning objects, sequences of learning objects, and learner information (Dagger *et al.*, 2007; Leal *et al.*, 2011). The standards

that have emerged during this generation include Shareable Content Object Reference Model (SCORM), IMS Content Packaging, and IMS Learning Design. The next-generation systems focus on targeted personalization and letting consumers choose the right combination of services for their requirements—service oriented (Figure 1).



Source: Dagger et al., (2007)

Figure 1. Generations of learning management systems

2.3 Accessibility and Usability of LMSs

Du Plessis, et al. (2005) and Koohang, et al. (2011) define accessibility as the ability of the learning objects (LO) to be accessed by learners in any location regardless of the learner experience, device or the type of platform the learner uses. Learning Objects (LO) are units of instructional content that can be used and reused on Web-based e-learning systems (Leal et al, 2011). In LMSs, Learning Objects are presented in the various service components such as: announcements, assignments, resources, forums, chat rooms, course outlines and wikis.

The ISO 9241 standard defines usability as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. According to Costabile et al., (2006); Ardito et al., (2005) and Wong et al, (2003), usability plays a significant role towards the success of e-learning applications—if an e-learning system is not usable enough, it obstructs students’ learning: the learners would spend more time learning how to use the system rather than learning the content.

Leal and Queirós (2011) contend that, despite the success in the promotion of the standardization of e-learning systems, usability and accessibility are still a major user concern with the existing systems. Earlier work by Leal et al., (2010) and Dagger et al., (2007) claims that adapting Service Oriented Architectures (SOA) to e-learning systems so as to provide flexible learning environments for learners could improve the usability and accessibility of the services. Dagger et al., (2007) also argues that the current generation of LMSs embraced a significant development, the “services” principle, exposing certain aspects of their functionality externally. This means that, as designs became more modularized, it is easier for platforms to

integrate new functionality as it arises. Furthermore, the LMS community has made an increased move towards separating content from tools, and the learner information has become more distinguished. However, these systems aren't entirely learner-centric; they still focus strongly on learning administration (course management) rather than on the learner (Dagger *et al.*, (2007).

This study is, however, distinct from prior research, in that our main goal is to enhance accessibility from the point of view of a specific group of LMS users constrained by poor ICT infrastructure such as electricity outages and slow Internet bandwidth, rather than improving or extending the functionality of LMSs. Similar studies on LMS accessibility were carried out within the framework of the European Commission Web-edu project by Paulsen *et al* (2003) on the accessibility and satisfaction of LMSs in 113 institutions across 17 European countries. The studies revealed no major technical problems with LMSs, and the users rated accessibility to the LMS services as satisfactory. The studies also noted that in the European Nordic region and North Western Europe where Internet penetration was high, it is not easy to find a university without experiences with LMSs, compared to the Southern European region where Internet penetration low. The study concludes that Internet penetration determines the level of use of LMSs.

In Developing countries, where Internet penetration is still very low, in addition to other constraints, there is need to identify effective ways of deploying and accessing LMSs services.

3. STUDY APPROACH

3.1 The e-Survey Methodology

Electronic survey (e-survey) methodology was used because we wanted to reach out to more respondents in a short time without the need to travel. However, there are some concerns on the effectiveness of e-surveys, which include: access to and familiarity with technology (Thompson *et al.*, 2003); how to include incentives for completion (Couper, 2000); response quality (Couper *et al.*, 2001); invasion of privacy (Gurau, 2007); and low response rates (Kaplowitz *et al.*, 2004). In this study, the shortcomings due to such concerns were minimized by the fact that: the survey respondents were university students who were familiar with and had access to technology; no incentives were to be offered to the respondents; and the intent of the survey was well outlined in the introduction, creating a high perceived importance of the study to the respondents so as to provide genuine responses

3.2 Study Design

The study was conducted in two universities, Makerere University (implementing Moodle LMS) and the University of Cape Town (implementing Sakai LMS). The two universities were selected for this study firstly for convenience reasons; having carried out a closely related research meant that we had established contacts in these universities which would benefit this study. Most importantly, however, was the fact that these universities had for long enough implemented two of the most popular open source learning management systems—Moodle and Sakai respectively. In addition, our earlier research also showed that, while there had been various attempts at LMS implementation (Blackboard, Kewl, and now Moodle) at Makerere University with relatively little success, the University of Cape Town had to a good extent successfully implemented Sakai. This contrast in success stories would also benefit our study.

An electronic questionnaire was sent out to students in the two Universities. The invitation to participate in the survey was sent to students' e-mail lists and in some cases directly to individual students' e-mail addresses by the principal investigator. The potential respondents were identified with the help of contact persons, who were faculty staff in the participating universities. Upon sending out the invitation to the students, announcements were also sent to them so to avoid them treating the invitation to participate in the survey as spam e-mail.

The electronic survey questionnaire was powered by LimeSurvey¹, an open source survey application. The questionnaire consisted of four sections. Section 1 focused on demographic information. Section 2 focused on the students' prior experience with learning management systems and comfort level with

¹ <http://www.limesurvey.org/>

information technology in general. Section 3 had questions that required the student to rate the different LMS access devices, to score the importance of the various LMS services (on a scale of 1-5) and to select the most desirable LMS services to them. Section 4 was the narrative response section, which allowed the students to provide additional comments or suggestions on any issues that were not addressed in the previous three sections of the questionnaire.

The survey responses were anonymous, and no incentives were offered to the respondents. However, since the survey required the use of human subjects, we had to obtain permission in the form of ethical clearance from the participating Universities.

3.3 Respondent Demographics

Although the study targeted about 200 respondents (100 respondents from each University), a total of 144 valid submissions were obtained, indicating an acceptable response rate of 72% (Kaplowitz et al., 2004; Cobanoglu et al., 2001). The distribution of the respondents over the different participating universities is presented in Figure 2. The distribution of the respondents according to domain of study, qualification pursued by respondents and the year of study are presented in Figures 3, 4, and 5 respectively.

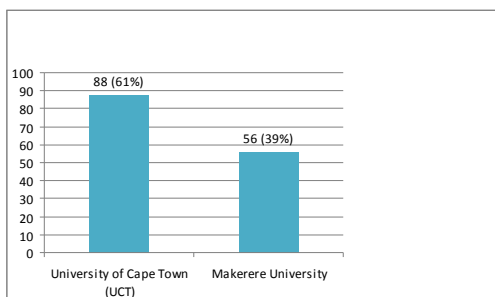


Figure 2. Distribution of Respondents According to University

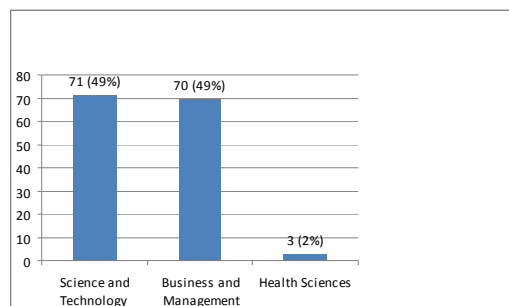


Figure 3. Distribution of Respondents According to Study Domain

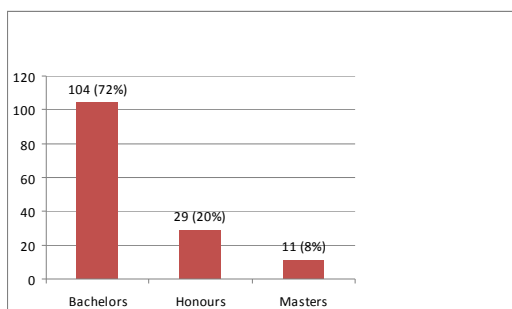


Figure 4. Distribution of Respondents According to Qualification

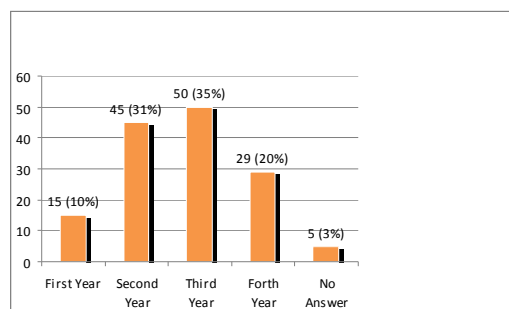


Figure 5. Distribution of Respondents According to Year of Study

Students from specific faculties were purposely targeted. The targeted students were those who were more actively using the LMS, and these were mainly from the disciplines of Science and Technology (e.g. Engineering, Mathematics, Computing and Information Systems) and Business and Management (Figure 3). The skewed distribution of respondents according to qualification pursued (Figure 4) is explained by the fact that bachelors students are assumed to be more actively using LMSs, especially those in later years of study (2nd,3rd and 4th year) who had had more time to interact with the LMS, and so these were targeted (Figure 5).

4. FINDINGS

4.1 Access to, and Ease of use of Technology

While most of the students who responded to the survey said they did not have access to computers most of the time, all of them own a mobile phone. Thus, mobile phone proliferation in the surveyed is 100%, of which 79% can access the Internet (Figure 6). Overall, 58% of the respondents had smartphones while the rest had non-smartphones.

Asked to rate themselves on their comfort levels using technology and technology applications, 67% said they were very comfortable while 1% said they were very uncomfortable (Figure 7).

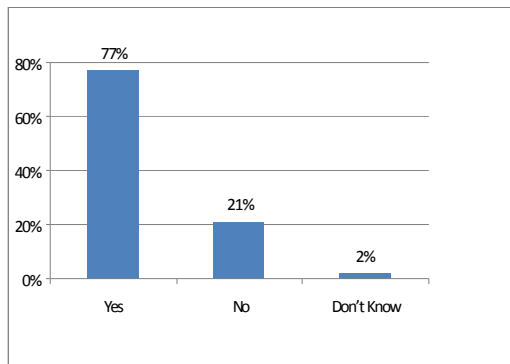


Figure 6. Can you access internet on your phone?

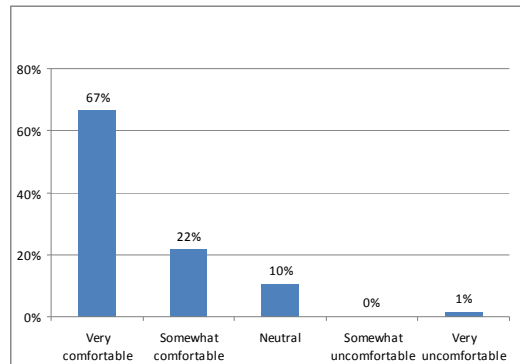


Figure 7. Students' Comfort Level using Technology and Technology Applications

There was, however, a significant variation between the students from the different participating universities in terms of the type of phones they possessed as well as their self-reported comfort levels with technology. For example, over 70% of the students at the University of Cape Town reported to have smartphones, while less than 40% of their counterparts at Makerere University had smartphones.

4.2 Experiences with LMSs, Access and Use

At the University of Cape Town, Sakai (branded 'Vula' locally) is the major LMS used, and all the respondents from UCT used Vula. At Makerere University, Moodle (branded 'MUELE' locally) is the major platform used, and all of the respondents from Makerere University used Moodle. The question with respect to experience with LMSs was asked on a five-point scale; (1-Highly experienced; 2-Somewhat experienced; 3-Neutral; 4-Somewhat inexperienced; 5-Struggling). Overall, the students rated themselves as shown in Figure 8.

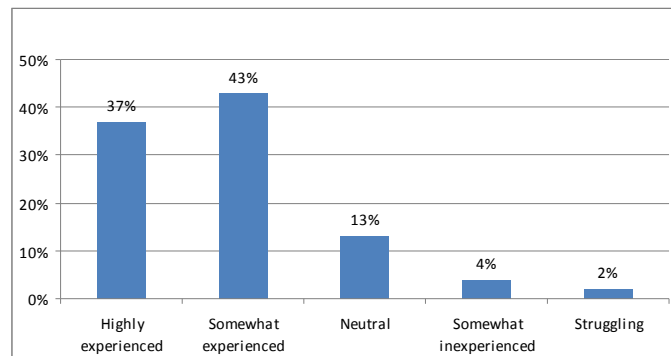


Figure 8. Students' Experience with LMSs

However, as might have been expected, the variation between the students' experiences with LMSs at the different universities was quite significant, demonstrating the fact that universities and students vary in their use of the technology. For example, while the majority of students from UCT reported high experience, the majority of their counterparts from Makerere University reported lower experiences. Table 2 shows how the students rated themselves on their experience using LMSs.

Table 2. Differences in experiences with LMSs between students at different universities.

	Highly Experienced	Somewhat Experienced	Neutral	Somewhat Inexperienced	Struggling
Makerere University	9%	50%	25%	11%	5%
University of Cape Town	56%	38%	6%	0%	0%
Total	65%	88%	31%	11%	5%

Asked how often they access the LMS and the devices they use, 51% of the respondents said they access the LMS several times a day, while 3% never access the system at all (Figure 9).

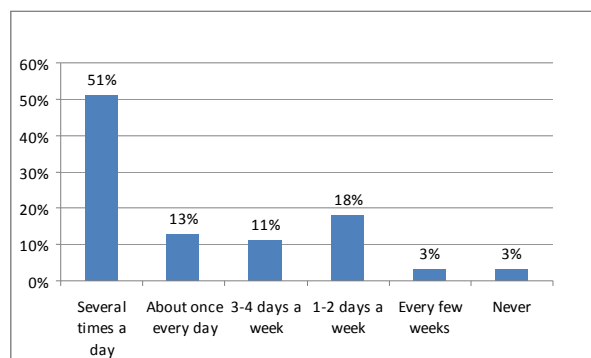


Figure 9. Frequency of LMS Access by the Respondents

On the devices they use to access the LMS, 60% use PCs and Laptops at least most of the time (Fig 10), while over 70% rarely or do not use their mobile phones at all (Figure 11).

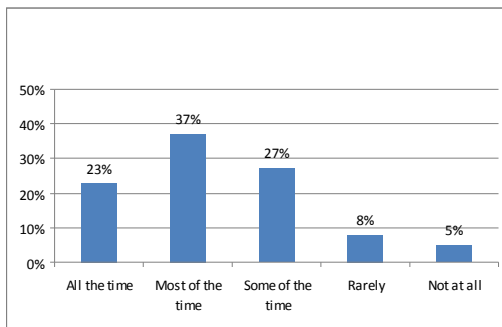


Figure 10. How often do You Access the LMS Using a PC/Laptop?

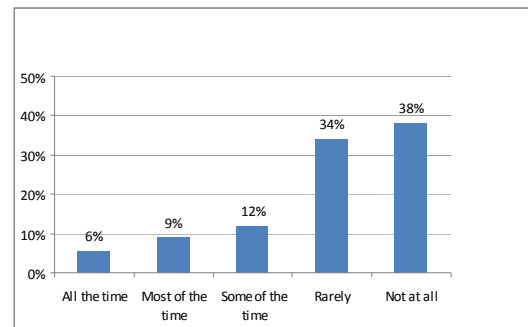


Figure 11. How often do You Access the LMS Using a Mobile Phone?

Overall there was no variation between the students from the different participating universities regarding the devices they use to access the LMSs. For example, although over 70% of students at the University of Cape Town have smartphones, and almost every smartphone can read and display full desktop websites, the students still do not find it appealing to use phones for accessing LMSs. Instead, the students ranked laptops as the most preferred device for accessing the LMS (Figure 12).

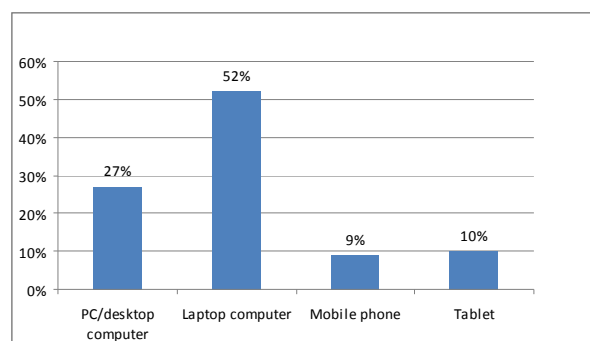


Figure 12. Students' Preferred Devices for Accessing LMSs

The preferences for the different devices for accessing the LMSs shown in Figure 12 become more important when we explore the over 100 views expressed by the students in choosing the devices to use. The views, some of which are quoted below, highlight issues of screen size, processing power, portability, power-save, wireless connectivity, etc.

“A laptop is the most convenient because it is portable, as fast to open a page as a Pc/desktop computer and its use is not limited to power availability. A mobile phone is as good as a laptop though it is slow when opening some page. A PC is good but limited to power availability. I don't know about the Tablet.”

“The laptop takes the first ranking because it is more reliable in terms of electricity and easily portable”

“A tablet is somehow smaller than a laptop or even a desktop, whereas a mobile phone lighter and easy carry compared to desktop and laptop...so I would choose a tablet and mobile phone due to convenience reasons.”

4.3 Most Needed Vs Most Desired LMS Services

The needed services are those that the students are required to access most of the time, while the desired service are those that the students most want or would like to access most of the time. Table 4 shows how the students rated the need and desire of the different LMS services. The last column of the table gives the average percentage of the need and desire of services. The services with the highest percentage in this column are the most needed and desired LMS services by the university students in the surveyed universities; these are the highlighted services in Table 4.

Table 4. How the students rated the need and desire of the different LMS services

Service	Respondents who selected service as frequently used-needed		Respondents who strongly agree that the service is desirable		Average of 'need' and 'desire'
	Number	Percentage	Number	Percentage	
Announcements	106	74	99	69	72
Assignments	121	84	102	71	77
Blogs	16	11	23	16	14
Calendar	57	39	66	46	43
Chat Room	77	53	64	44	49
Course Outlines	74	51	90	62	57
Discussion Forums	48	33	55	38	36
Dropbox/File exchange	49	34	58	40	37
Email Archive	36	25	43	29	27
Messages	43	34	43	29	32
News/RSS feeds	18	12	28	19	16
Participants/Groups	52	36	44	30	33
Podcasts	11	8	18	12	10
Polls	16	11	24	16	14
Q&A:	34	23	57	39	31
Resources	97	67	96	66	67
Search	37	26	57	39	33
Slides	57	39	74	51	45
Tests&Quizzes	54	37	64	44	41
Wikis	18	12	26	18	15

In addition to the LMS services presented to the students for selection, the students were also asked to write down any other services that they would like the LMSs to provide. Below is a list of some of the services that the students mentioned.

Grade Book

Assignment Submission

Video Lectures/Tutorials

Video forums/videoconferencing

Automatic Marker

eCards for exams, graduation, etc

Free SMS

Notification of important deadlines

Picture blog

Receiving results

Updates on Current affairs

5. CONCLUSIONS AND FUTURE WORK

Firstly, the majority of the students from the surveyed universities have the desire and experience to use learning management systems (LMSs). They too reported high abilities and self confidence to use the different technology platforms available for accessing the learning management systems. At the same time, although the majority of the students (especially from the University of Cape Town) possess smartphones, and would have been expected to use them to access the LMS, they instead reported a stronger preference for using laptops and desktop computers for accessing the LMS. They expressed various views upon which their preferences were based. These broadly included: screen size, processing power, portability, usability, power-save, wireless connectivity and convenience of use.

Secondly, much as the students reported a stronger preference for using laptops and desktop computers to access the LMS services, they do not have access to these devices most of the time, as they do with their mobile phones. Furthermore, the use of such devices, especially the desktop computers, is most of the time dependent on the institutional ICT infrastructure such as computer labs and Internet bandwidth, which is a major constraint in most universities in the developing countries.

However, as literature reveals (e.g. Jones, *et al* 2006; Fling 2009), and also as highlighted by the students, mobile phones present usability and compatibility problems while trying to use them to access websites meant for desktop or laptop computers, and this is indeed the main reason why students do not use them to access the LMSs. Thus, if mobile phones are to be used to effectively access LMSs, the LMSs have to be optimized for mobile access. According to literature (e.g. Nielson 2012), this can be done in two ways, either: (i) provide fewer LMS services on the mobile phone, but with all the necessary details for each service or (ii) provide all the LMS services with little detail for each service. Both of these options are worth exploring if LMSs are to be effectively optimized for mobile access. A third option could also be a balance of the two options; i.e. provide fewer services with little details and defer secondary information to secondary pages, which can be accessible through more optimal devices such as the desktop computers or laptops. The design challenge is to optimize the LMS in such a way that the mobile site (optimized LMS) satisfies at least most of the mobile users' needs for the LMS. As Neilson (2012) argues, if this goal is achieved, the extra cost of accessing the full LMS will be incurred fairly rarely, and this will also reduce the over reliance on the institutional ICT infrastructure for accessing the LMS services all the time by the students.

Thirdly, this study also identified the services that are most desired and needed by the students in the surveyed universities. These include: assignments, announcements, resources, course outlines and chat rooms. These services therefore have to be given priority if an LMS has to be optimized for mobile access. In our on-going work, we are developing an LMS-Mobile Web App, dubbed mobile-LMS (mLMS) that will give effective access of the LMS services to the mobile user.

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