

Using a mobile application to support students in blended distance courses: A case of Mzumbe University in Tanzania

Ramadhani Shemahonge
Mzumbe University, Tanzania

Joel S. Mtebe
University of Dar es Salaam, Tanzania

ABSTRACT

Universities in sub-Saharan Africa have been adopting various forms of blended distance courses to meet the demand of higher education. However, the lack of reliable and efficient support services for students taking various blended programs has continued to be the main challenge. This study developed a mobile application for enabling instructors to provide support services during learning process. The development of the mobile application followed eXtreme Programming agile method involving 12 students and 4 instructors from Mzumbe University. To test the effectiveness of the developed application, data was collected from 5 instructors and 76 students through group discussions, and questionnaires. The study found that the majority of instructors indicated that the developed application enabled them to provide promptly and effective technical and pedagogical support services to learners. Moreover, instructors found the developed system being useful tool for tracking students' progress and conducting formative assessment through students' reflections. This study extends our knowledge on how mobile technology can be used to provide support services to students taking blended distance courses offered by several universities in sub-Saharan Africa.

INTRODUCTION

In the past few years, sub-Saharan Africa countries have witnessed enormous demand of higher education due to Millennium Development Goals' (MDGs) program and other related programs which expanded the primary and secondary education (Darvas *et al.*, 2017). At the moment, only 6% of Africans enroll in higher education (Kokutsi, 2011) compared to a world average of 26% (Darvas *et al.*, 2017), and 76% in Europe (World Bank, 2010). One of the reasons for the low rate of access to higher education in sub-Saharan Africa is the low number of universities relative to the population (Bezy, 2016). Bezy pointed out that there is nearly one university per million inhabitants in sub-Saharan Africa, which is ten times less than in North America. In order to meet the demand of higher education in sub-Saharan Africa many universities have been adopting various forms of blended distance learning. Universities have been combining various eLearning systems such as Moodle, Blackboard, KEWL to enable learners access a range of materials electronically (Unwin *et al.*, 2010) while complementing with some face-to-face teaching (Mtebe and Raphael, 2018b).

In Tanzania, more than 80% of universities have adopted blended learning programs using eLearning systems of various kinds (Munguatoshia, Muyinda and Lubega, 2011; Mtebe and Raisamo, 2014a). The University of Dar es Salaam (UDSM), for instance, have been offering four postgraduate blended distance programs: Postgraduate Diploma in Education (PGDE), Postgraduate Diploma in Engineering Management (PGDEM), Master degree in Engineering Management (MEM), and Postgraduate Diploma in Electronics Engineering and Information Technology (PGD-EIT) via regional centres in Mbeya, Mwanza, Dar es Salaam, and Arusha (Mtebe

and Raphael, 2013) since 2007. More than 450 students have benefited from these programs (Mtebe and Raphael, 2017).

The Open University of Tanzania (OUT) which, for a long time has been running pure distance learning through correspondence and exclusively face to face classes is now offering options for blended distance learning. The university is combining face-to-face teaching while using Moodle system to enable students access learning resources as well as communicating with their instructors. The university offers academic degrees, diploma, and certificate programs to over 60,000 students spread across 28 regional centers in Tanzania (Bhalalusesa, Lukwaro and Clemence, 2013). Similarly, Mzumbe University is offering Masters of Business Administration, Master of Science in Accountancy and Finance, Master of science in Procurement, and Master of Science in Project Planning and Management in blended distance mode via Moodle system (Mtebe and Raphael, 2018a).

Despite the increased adoption of various blended distance programs in Tanzania, the lack of reliable and efficient support services to students have continued to be the main challenge (Ssekakubo, Suleman and Marsden, 2011; Mtebe and Raphael, 2013; Nihuka, 2013; Kisanga and Ireson, 2015). Instructors do not make use of eLearning system tools such as chat, discussion forums, boards to support distant students during learning process (Bhalalusesa, 2005; Ssekakubo, Suleman and Marsden, 2011; Mtebe and Raphael, 2013; Nihuka, 2013; Raphael and Mtebe, 2016). The situation is similar in many universities in sub-Saharan Africa, including at Kenyan universities (Tarus, Gichoya and Muumbo, 2015), South Africa's universities (Mlitwa and Belle, 2011), and Uganda's universities (Kasse and Balunywa, 2013).

Some efforts exist to ensure that instructors provide effective support services to students taking those courses. These efforts include reviewing eLearning related policies (Mtebe, 2015) and conducting instructors trainings regularly (Ssekakubo, Suleman and Marsden, 2011). Nonetheless, the use of mobile applications have not been considered despite the proliferation of mobile telephony in the region (Mtebe and Kondoro, 2016; Kaliisa and Picard, 2017). Mobile digital devices, such as smartphones, and tablets, can be used as didactic tools for enhancing blended distance courses (Vázquez-Cano, 2014). These devices can enable instructors to deliver content, and provide timely support services in the learning process within a multitude of diverse physical locations (Koole, Mcquilkiln and Ally, 2010; Bhih *et al.*, 2016).

Much of existing mobile learning initiatives have been focusing on enabling students to access eLearning systems such as Moodle, Atutor, Blackboard, Vula using mobile phones. For instance, Makerere University in Uganda developed the MobiClass application to enable faculty members to interact with their students via mobile devices (Network ICT for Education, 2014). Similarly, Ssekakubo, Suleman, and Marsden (2013) and Mtebe and Kondoro (2016) developed interface that enabled users to access Moodle system using mobile devices at the University of Cape Town and the University of Dar es Salaam respectively. Other studies include those in (Koole, Mcquilkiln and Ally, 2010; Xhafa *et al.*, 2010; Zamfirache *et al.*, 2013).

These studies have been expanding the accessibility of eLearning systems to enable learners with mobile devices to have access of learning resources that are already available into the systems. Nonetheless, few studies have developed mobile applications to enable instructors provide timely support services to students taking blended distance courses. This study developed a mobile application (app) as a tool to help instructors provide timely and effective support services to distant students during learning process. The use of the mobile app was aimed to create an environment where instructors will be able to access the system and respond to queries promptly via mobile devices and to conduct formative assessment through students posts.

LITERATURE REVIEW

Sub-Saharan Africa has fastest mobile phone subscriptions in the world with almost 444 million mobile subscribers, equivalent to 9% of world subscriptions (GSMA, 2018). The penetration rate is expected to reach more than 50% by end of 2025. Similarly, mobile phone penetration has increased from 61% in 2013 to 80% of the total population by 2017 in Tanzania (TCRA, 2018). The Internet users have also increased from 29% in 2014 to 45% in 2017 (TCRA, 2018). with the majority of them accessing via mobile devices (Mwakisole, Kissaka and Mtebe, 2018). Increased penetration of mobile phone in sub-Sharan Africa can potentially leapfrog the ICT infrastructural challenges facing the majority of countries in the region. This is because the current generation of mobile devices have powerful computing capability as good as mini-computers and they have a myriad of features such as Internet connectivity, video camera, telephone, GPS, film player, and games player (Sharples et al., 2009).

With these increased mobile subscriptions and widespread of mobile devices, many students have been able to own at least one device. In a study conducted in 10 institutions in Tanzania, it was found that nearly 93% of students had access to Internet via mobile devices (Mtebe and Raisamo, 2014b). Therefore, universities have been taking advantages of mobile phone penetration to enhance teaching and learning. For instance, a number of mobile applications have been developed to enable students and instructors access various features of eLearning systems (e.g. Koole, Mcquilkin and Ally, 2010; Ssekakubo, Suleman and Marsden, 2013; Network ICT for Education, 2014; Mtebe and Kondoro, 2016). Using these mobile applications, students can view their course materials, and contribute discussions in the discussion forums anytime anywhere (Vázquez-Cano, 2014). With increased challenges of managing and supporting distant students, some mobile applications have enabled instructors to provide support services more effectively and efficiently.

For instance, Makerere University developed Mobile Research Supervision system to support blended distance students in completing research projects (Muyinda, Lubega and Lynch, 2010). The mobile application aimed at enhancing student–student and student–supervisor collaboration as part of guiding students to carry out research projects. Harley et al. (2007) developed mobile application for sending text messages from computers to mobile phones of students providing peer support and facilitate informal learning amongst students. Similarly, the Open University Malaysia implemented mobile learning initiative for providing support services to students learning various courses offered via the eLearning system (Lim, Fadzil and Mansor, 2011). The text messages were sent to individual and group students from administrators and instructors as part of proving pedagogical and technical support to students. Other efforts to adopt and use mobile applications to enhance support services in various universities include those of (Inshuk et al., 2003; Huang, Jeng and Huang, 2009; Priya and Juvanna, 2014; Vázquez-Cano, 2014; Sanga et al., 2016).

Despite these efforts, relatively few attempts have been made to adopt and use mobile applications in enhancing blended distance courses in institutions in sub-Saharan Africa. This study was conducted to demonstrate the applicability of mobile applications for enhancing teaching and learning process in sub-Saharan Africa taking Mzumbe University as a case study.

THE DEVELOPMENT OF MOBILE SYSTEM

The development of a mobile application followed eXtreme Programming (XP) agile software development methodology. The XP development methodology is characterized by short iterations with small releases of the working product to the customers at the very early of the project in order to receive feedback and improve from there (Beck, 1999). The development of the mobile

application started by developing user requirements using user stories whereby interviews and group discussion were conducted to 4 instructors who were teaching blended courses and 12 students respectively.

After the interviews, developers and teachers set together to generate user stories of every detail of the proposed application. User stories were broken into three small increments so that they could easily be developed. For each user story, the time and effort required to accomplish it was estimated and scheduled. The completion of the first user story was planned to be released in 8 weeks followed by the second user story and third user story in 10 and 13 weeks respectively.

Two developers were involved with developing the application with one developer being the main developer and the second developer reviewing and testing the system throughout the developing process. The first working prototype was released after 9 weeks, whereby selected instructors were allowed to test before collecting new requirements for continuing improving the prototype. The collected requirements were used to develop the second version of the system which was released after 4 weeks. The process of improving the system, demonstrating to instructors and students, and collecting new requirements for improving the next release continued until the final version was released. At this stage, no new requirements were found. The development of the mobile system took four iterations before releasing the fourth and final version. Figure 1 shows the process involved in the development of mobile system.

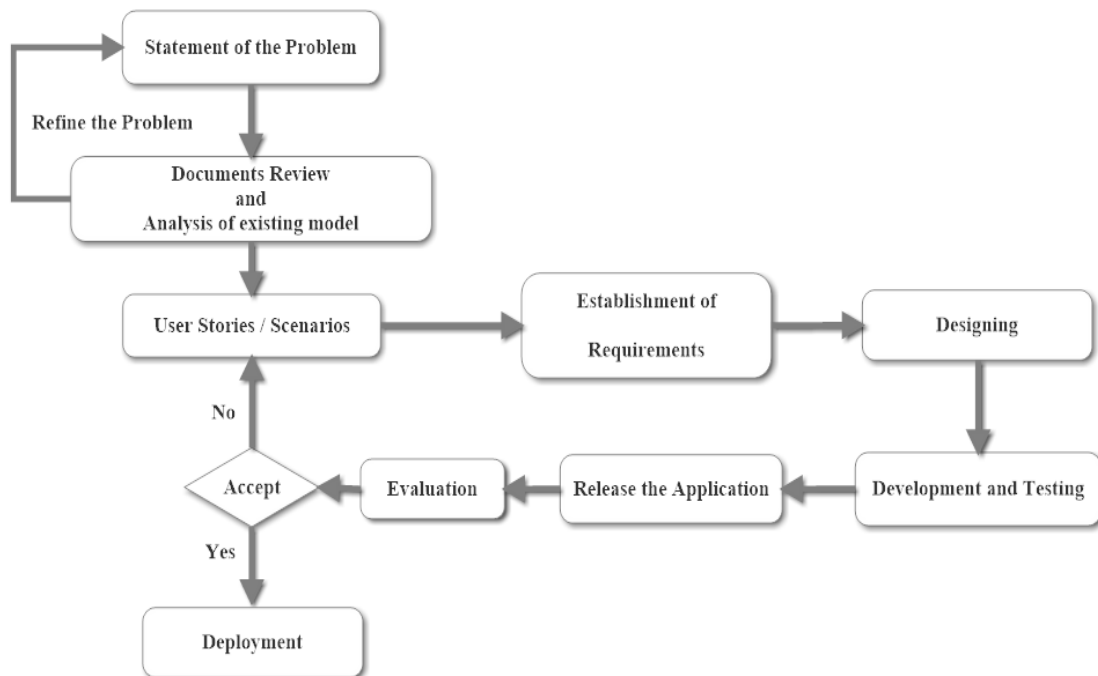


Figure 1: The development process of the mobile system

The final version of the application was uploaded into the Google Play Store for students and instructors to download. The information describing the system and few screenshots were uploaded. Students and instructors were told to download the application after searching “Mobile portfolio” into the Google Store. Users were required to enter their credentials and automatically could login into the system as shown in Figure 2.

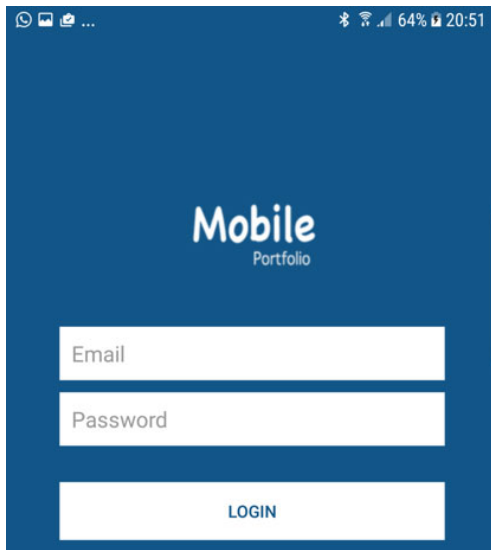


Figure 2: The screenshot of a login page of the mobile system once it is downloaded

Once student login into the system, the first page shows subscribed courses and in each course a list of topics is shown (see Figure 3).

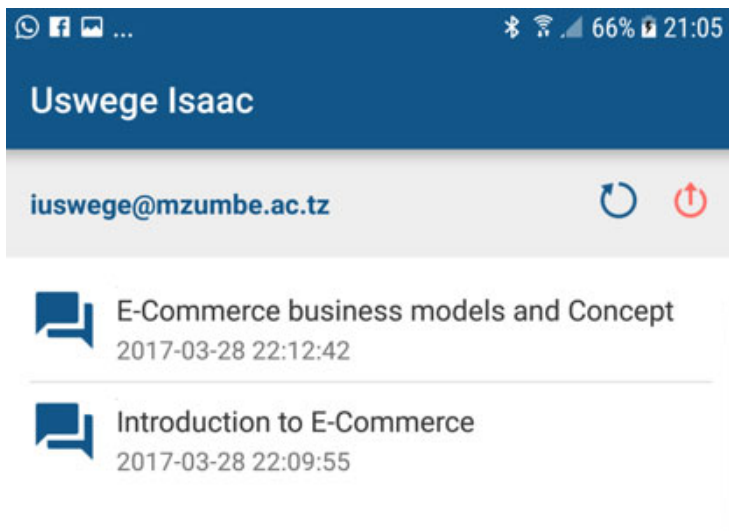


Figure 3: An example of a list of courses when user login the system

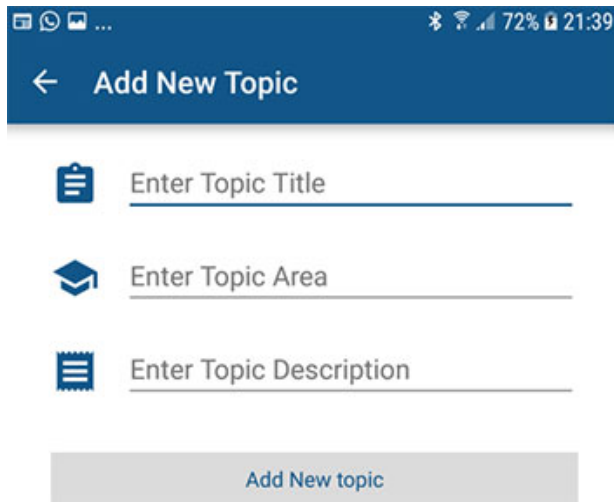
The application enables students to subscribe to various topics created by instructors and post reflections in the form of conversation. Instructors can create topics, follow up about students' reflections and track students' progress. Table 1 shows the privileges of students and instructors in the system.

Table 1: Privileges of instructors and students in the mobile system

User Status	User Privileges
Student	<ul style="list-style-type: none"> • View All Topics Available in the system • Subscribe to the topic • Posting reflection on the subscribed topic • View fellow students' reflections
Instructor	<ul style="list-style-type: none"> • View all topics available in the system • Subscribe to the topic • Replying students' reflection through topic conversation window • Adding new topic • Editing the existing topic • Deleting the existing topic

Instructors were asked to create two topics for each module. The first topic required students to post the reflection of what they have learnt after reading each module before proceeding to the next module. This topic was graded and the grades contributed towards the final score.

The second type of topic was a general topic where students were asked to discuss various issues related to the module. They were free to ask any question related to the module for instructors and other students to respond. There was no deadline for this topic and these contributions were not graded. Figure 4 shows a screenshot of the page that instructors could use to create topics for each module.

**Figure 4:** Screenshot of a page where instructors created topics

METHODOLOGY

The group discussions and questionnaire were adopted as data collection instruments to determine the effectiveness and usefulness of the developed mobile application. An email request was sent to Mzumbe staff mailing list asking instructors to participate in the study. Eight instructors agreed to participate, however, only 5 of them had Android smartphones which was a requirement to participate in the study. Moreover, an email was sent to 187 students who were enrolled into various blended distance courses asking them to participate in the study. A total of 76 students agreed to participate with 22 students being students taking Production and Operation Management, 13 students taking Electronic Commerce, 19 students taking Managing Partnership in Public Service, 11 students taking Social Sciences Research Methods, and 10 students taking Customer Services Management courses.

To facilitate group discussions, students were grouped into 15 groups with five students in each group. These groups were numbered from 1 to 15, with each student in the group identified with the unique number i.e. student 1 to student 5 in each group. At the same time, a questionnaire was given to students to elicit their perceptions about the developed mobile application. Data was analysed qualitatively by identifying principal themes and then examining the patterns that emerged from the data. Finally, the summarized data were categorized based on the topics and themes that emerged from the collected data. The findings are explained next.

FINDINGS

Usage of mobile system

We monitored the use of the developed mobile system using the data from Google Play and by the end of semester I, 316 users had downloaded the application. Through analysis of the questionnaire, of 76 usable responses, it was found that 39% of students indicated that they use the system many times per day while 31% of students indicated that they use it once per day. However, only 5% of students indicated that they did not use the system for the entire semester (See Figure 5).

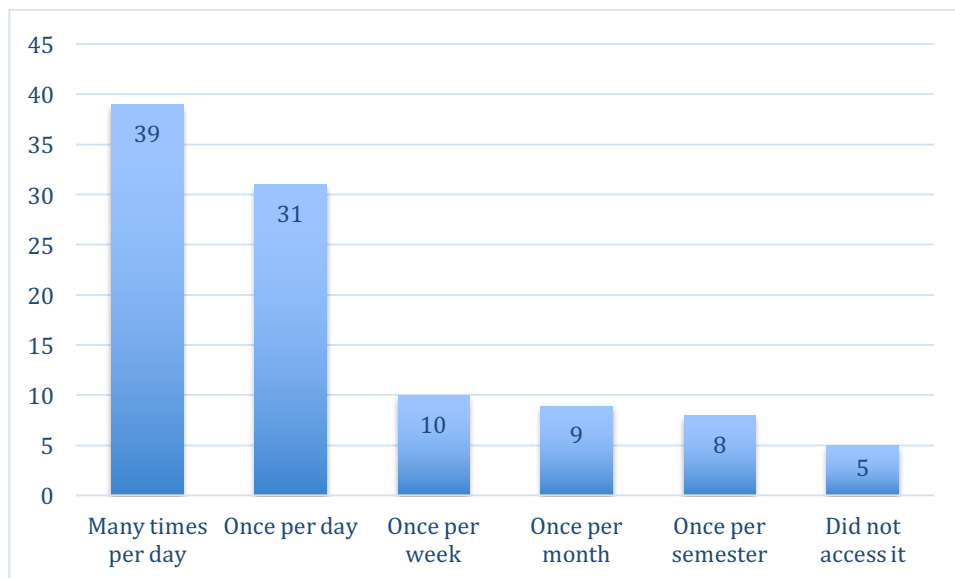


Figure 5: Students usage of the mobile system

Data from interviews and group discussions with students shows that those who did not use the system were those whose instructors were not responding to posted reflections in the forums. Data indicates that these students were previously using the system but at some points stopped due to lack of feedback from instructors.

“There was no any new topic created for BUS 210 for us to post reflections. The instructor stopped responding to our reflections posted on existing course topics. Therefore I did not see any reason to continue using the application.” (Student 2 from group 14)

“I stopped using the application because it did not facilitate my learning process. Although at first, the instructor was responding to our concerns, afterward there was no response, and that was when the application stopped to being useful.” (Student 5 from group 15)

We were also interested to explore instructors' usage trends of the eLearning system. Out of 5 interviewed instructors, 2 instructors indicated that they were using the system many times per day while 2 instructors indicated that they were using it once per day. However, one instructor used the system for the first 4 weeks before stopping. During the interview, the instructor said her smartphone encountered technical problems when she was upgrading to the latest Android version.

Ease of use of the mobile system

The ease of use of any system has direct effect on how users are going to use the system. In this study, we wanted to elicit students' perceptions about the ease of use of the system. Students were asked to rate the system on 5-point Likert Scale [1=Very Difficult: 2=Difficult: 3=No Opinion: 4=Easy: 5=Very Easy]. The majority of students (83%) indicated that the mobile system was Easy to Use with 55% indicating that it was Easy while 28% indicating that it was Very Easy (Figure 6).

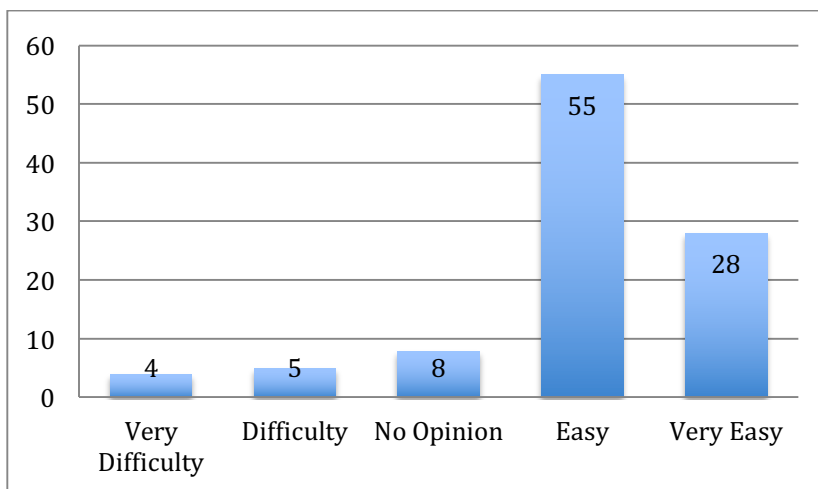


Figure 6: Level of difficulty of the mobile system

Similarly, an interview with instructors indicated that the system was easy to use. This is evident from some of comments from instructors. Some comments from instructors are hereunder:

“The mobile system is simple to use and took me 5 min to download and integrate it into my course.” (Instructor 3)

“It is easy to create a topic. I like the fact that I can also edit the topic I have created.” (Instructor 2)

“The mobile system is basic to use and took me only 5 min to download and learn how to use it.” (Instructor 3).

“The app interface is straightforward, it is easy to find and do what you want.” (Instructor 4)

Using mobile system to support learning process

Students were asked to rate on 5-point Likert Scale (Strongly disagree to Strongly agree) if the use of the system enabled them to sort out technical issues and enabled them to get feedback promptly from instructors. The majority of students agreed that they were able to get prompt feedback on technical problems they encountered during learning process. Data from the questionnaire indicated more than two third of students (80%) indicated that the mobile system was effective in supporting them during learning process (46% agreed and 34% strongly agreed). Only few students (5%) indicated that the mobile system was not effective in supporting them during learning process (See Figure 7).

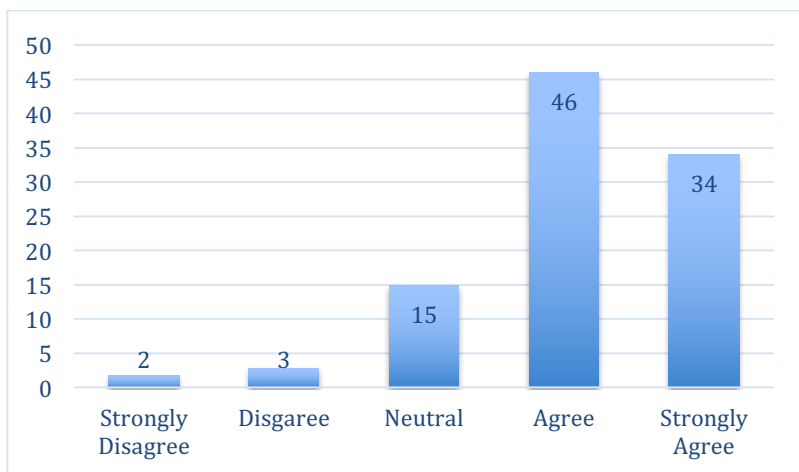


Figure 7: Students perception on effectiveness of mobile system to support learning process

Similarly, the majority of instructors indicated that the mobile system was useful in providing pedagogical support to students during course delivery. They pointed out that the system enabled them to track students' progress without necessarily being in the office. One of the interviewed instructors explained how he was able to follow up students' progress even when he was busy with other activities:

“Since all reflections are on my cell phone, I was able to make follow up on how my students are progressing from topic to topic wherever I was. One day I was able to guide them on the given assignment when I was on the bus. The good thing is that every

communication is grouped into a topic I have created and indicated topic objectives to make sure my students are always on required track". (Instructor 1)

"We use seminar sessions to discuss issues that were not clear during normal classes. Reflections help us to point out burning issues and discuss them during seminar sessions. This way saved a lot of time for only important issues. You know these reflections says a lot about students' achievement throughout the course." (Instructor 3)

Using mobile system to conduct formative assessment

The study investigated how useful the developed mobile application was in facilitating formative assessment. Students reflections were graded based on the number and quality of posts for each topic. During interviews, instructors indicated that these reflections helped them to track and follow up on students' progress. They further indicated that reflections enabled them to reflect on their delivery approach to meet students' needs and objectives. Some of their comments are:

"Posted reflections helped me to assess my students in real time. I don't have to set a test every time to evaluate their understanding of a particular topic." (Instructors 3)

"Posted reflections (Students reflections) on the topic help out to assess my teaching practice. Sometimes as a teacher you need to change your teaching approach depending on students understanding and the topic you are teaching." (Instructor 4)

"Mobile system is a simple and good way to assess students. Reflections posted in the app says a lot about their learning and I used their reflections to evaluate their understanding on a topic any time I wanted." (Instructor 2)

Proposed new features

Students were also asked to explain new feature(s) that could be added into the system after using the system for the whole semester. The majority of respondents suggested that the system should allow users to upload images when posting the reflections in the forums. Some of students comments are indicated below:

"Being able to post videos or pictures as learning reflections can give us more option to report our learning progress on a particular topic. Texting limits our reporting capability" (Students 1 from group 4)

"Most of the time you caught up in the situation where you want to take picture or video of a certain fact to portray a real picture of what has been done as the evidence of learning. You know learning took place anytime whenever you are, regardless of image and videos limitations, I was able to post all my reflections in text form." (Student 2 from group 7)

"It is not a problem for me to post a reflections by texting. But being able to post pictures and the document can be a plus to mobile system." (Students 5 from group 9)

Challenges faced in using mobile system

Finally, respondents were asked to explain any challenge they encountered when they were using the system. Students reported the cost of Internet as the main challenge. Although Mzumbe University has wireless Internet connectivity at the campus, it seems that this service is not accessible to students outside the main campus. Some of the challenges explained by students are indicted hereunder:

“Mobile data Services bundles may be cheap for University students because of these mobile services offers. However, the truth is sometimes some of us cannot afford to buy these bundles.” (Student 1 from group 3)

“One day I was required to post some reflections in the application but I could not because my data services bundle was expired and I did not have any money to renew my subscription. University provides free wireless Internet services, but it is not accessible at my hostel.” (Student 5 from group 5)

“There are some situations where u need to choose between buying food or mobile data bundle. I do not need to tell you what choice I will make; you already know that you cannot die because you do not have data service bundle on your mobile phone. For average students, even Tsh. 2000 is a big problem for sure. So, to tell the truth sometimes I failed to use mobile system for the entire week because I did have money to subscribe to data service bundle” (Student 4 from group 10)

DISCUSSION

This study set out to investigate whether mobile applications can be used for supporting learning process of students taking blended distance courses in higher education in sub-Saharan Africa. It was found that the developed mobile system enabled instructors to provide promptly and effective support services. Instructors used the system to create general forums where students were asked to post technical problems encountered when they were accessing the system. Since the forum was public, it was easier for instructors and technical staff to respond promptly to any reported technical problem. When students were asked to explain their perceptions on the effectiveness of the system to facilitate learning process, more than 80% of students indicated that the system was effective and helped them to receive constructive feedback.

This finding is in line with those of previous studies such as those in (Shroff, Trent and Ng, 2013; Chang, Chou and Liang, 2018). For instance, Shroff et al. (2013) found that the mobile system enabled learners to feel accountable during learning process while facilitating peer learning. Similarly, Chang et al. (2018) found that mobile system facilitated knowledge sharing and creation amongst students and instructors in a study conducted to 92 students. This therefore to say, the use of mobile applications can be used not only as a pedagogical tool but also to facilitate knowledge creation amongst learners. As students posting and responding to others, they create knowledge which can easily be shared in discussion forum such that other students with similar problems can learn from those posts.

Instructors also indicated that the mobile application was a useful tool for conducting formative assessment through reflections. They tracked students' progress through reading and responding to students' reflections while reminding those who were inactive through SMS or other means. The reflections were graded based on the quality and quantity of students' posts. The reflective practice incorporated in the assessment design helped students become active learners by encouraging them to take responsibility for their learning.

This finding corroborates with findings from other studies such as those in (Mason, Pegler and Weller, 2004; Harley et al., 2007; Muyinda, Lubega and Lynch, 2010). For instance, Mason, Pegler, and Weller (2004) used mobile system in a postgraduate online course at Institute of Educational Technology at the Open University. The study found that the system was effective as course assessment method. Therefore, well-designed mobile applications could be used as an effective tool for supporting students especially in blended distance programs currently offered by many universities in Africa. Finally, the developed mobile system was found to easy to use by the majority

of students. This was made possible due to adoption of XP agile method where students and instructors were involved in each stage of the system development. Instructors and students were involved from the onset of the project to the testing stage of the system to ensure that all requirements were captured.

CONCLUSION

The study investigated the effectiveness of mobile applications in supporting students' learning process in courses offered via blended distance learning in sub-Saharan Africa. The developed mobile system enabled instructors to reflect, and adjust their teaching approaches. Moreover, the mobile system enabled students to take responsibility of their learning while self-evaluating their work, and reflecting their findings about their learning process, experiences, and skills. Through testing the system with students and instructors, it has shown that the use of mobile system was an effective tool for providing pedagogical and technical support services timely and more efficiently. In fact, providing student-teacher with the opportunity to reflect critically upon their work during learning process, mobile applications become an invaluable resource for promoting effective ownership of learning. This research extends our knowledge on how ICT can be used to support students in a number of blended distance courses offered by several universities in sub-Saharan Africa.

REFERENCES

- Beck, K. (1999) *Extreme Programming Explained , Second Edition*. First Edit. Addison-Wesley Professional.
- Bezy, M. (2016) *Africa's Tertiary Education Deficit is Threatening its Economic Development, Africa Oye*. Available at: <http://brel54.blogspot.com/2016/05/africas-tertiary-education-deficit-is.html>.
- Bhalalusesa, E. P. (2005) 'Major achievements and important challenges: Expanding Tanzanian Higher Education opportunities', *Journal of Access, Policy and Practice: National Institute of Adult Continuing Education*, 2(2), pp. 121–139.
- Bhalalusesa, R., Lukwaro, E. E. and Clemence, M. (2013) 'Challenges of using E-learning Management Systems faced by the academic staff in distance based institutions from developing countries: A case study of the Open University of Tanzania', *Huria: Journal of the Open University of Tanzania*, 14, pp. 89–110. Available at: <https://www.ajol.info/index.php/huria/article/view/110783>.
- Bhih, A. A. et al. (2016) 'Diversity in Smartphone Usage', in *Proceedings of the 17th International Conference on Computer Systems and Technologies 2016 - CompSysTech '16*, pp. 81–88. doi: 10.1145/2983468.2983496.
- Chang, C., Chou, P.-N. and Liang, C. (2018) 'Using ePortfolio-based learning approach to facilitate knowledge sharing and creation among college students', *Australasian Journal of Educational Technology*, 34(1), pp. 30–41. doi: <https://doi.org/10.14742/ajet.2687>.
- Darvas, P. et al. (2017) *Sharing Higher Education's Promise beyond the Few in Sub-Saharan Africa*. Washington, D.C. Available at: <http://documents.worldbank.org/curated/en/862691509089826066/pdf/120693-PUB-PUBLIC-PUBDATE-10-25-17.pdf>.

- GSMA (2018) *The Mobile Economy Sub-Saharan Africa 2018*. Available at: <https://data.worldbank.org/region/sub-saharan-africa>.
- Harley, D. *et al.* (2007) 'Using texting to support students' transition to university', *Innovations in Education and Teaching International*, 44(3), pp. 229–241. doi: 10.1080/14703290701486506.
- Huang, Y. M., Jeng, Y. L. and Huang, T. C. (2009) 'An educational mobile blogging system for supporting collaborative learning', *Educational Technology and Society*, 12(2), pp. 163–175. doi: 10.1111/j.1365-2729.2011.00467.x.
- Inshuk, K. *et al.* (2003) 'Mobile technologies in support of distance learning', *Asian Journal of Distance Education*, 1(1), pp. 60–68. Available at: <http://www.asianjde.org/2003v1.1.Kinshuk.pdf>.
- Kaliisa, R. and Picard, M. (2017) 'A systematic review on mobile learning in higher education: The African perspective', *Turkish Online Journal of Educational Technology*, 16(1), pp. 1–18.
- Kasse, J. P. and Balunywa, W. (2013) 'An assessment of e-learning utilization by a section of Ugandan universities : challenges , success factors and way forward', in *International conference on ICT for Africa*. Harare. Available at: <https://pdfs.semanticscholar.org/df62/a1a15a982593b040af6866c95f17f6cab8de.pdf>.
- Kisanga, D. and Ireson, G. (2015) 'Barriers and strategies on adoption of e - learning in Tanzanian higher learning institutions : Lessons for adopters', *International Journal of Education and Development using Information and Communication Technology*, 11(2), pp. 126–137. Available at: <https://www.learntechlib.org/p/151845/>.
- Kokutsi, F. (2011) 'AFRICA: Expand university access, World Bank urges', *University World News, Africa Edition Issue 198*. Available at: <http://www.universityworldnews.com>.
- Koole, M., Mcquilkiln, J. L. and Ally, M. (2010) 'Mobile Learning in Distance Education : Utility or Futility ?', *Journal of Distance Education*, 24(2), pp. 59–82. Available at: http://tojde.anadolu.edu.tr/tojde28/pdf/article_9.pdf%5Cnfile:///C:/Users/jgilliam/AppData/Local/Mendeley Ltd./Mendeley Desktop/Downloaded/Koole, Mcquilkiln, Ally - 2010 - Mobile Learning in Distance Education Utility or Futility.pdf.
- Lim, T., Fadzil, M. and Mansor, N. (2011) 'Mobile Learning via SMS at Open University Malaysia: Equitable, Effective, and Sustainable', *International Review of Research in Open and Distance Learning*, 12(2), pp. 123–137.
- Mason, R., Pegler, C. and Weller, M. (2004) 'E-portfolios: An assessment tool for online courses', *British Journal of Educational Technology*, 35(6), pp. 717–727. doi: 10.1111/j.1467-8535.2004.00429.x.
- Mlitwa, N. and Belle, J.-P. Van (2011) 'Mediators For Lecturer Perspectives On Learning Management Systems At Universities In The Western Cape, South Africa', in *Pacific Asia Conference on Information Systems (PACIS 2011)*. Brisbane, Australia: AIS Electronic Library. Available at: <https://aisel.aisnet.org/pacis2011/135>.
- Mtebe, J. S. (2015) 'Learning Management System success: Increasing Learning Management System usage in higher education in sub-Saharan Africa', *International Journal of*

- Education and Development using Information and Communication Technology*, 11(2), pp. 51–64. Available at: <http://ijedict.dec.uwi.edu/viewarticle.php?id=2005>.
- Mtebe, J. S. and Kondoro, A. W. (2016) 'Using Mobile Moodle to enhance Moodle LMS accessibility and usage at the University of Dar es Salaam', in *2016 IST-Africa Conference, IST-Africa 2016*. Durban, South Africa: Paul Cunningham and Miriam Cunningham (Eds), pp. 1–11. doi: 10.1109/ISTAFRICA.2016.7530649.
- Mtebe, J. S. and Raisamo, R. (2014a) 'Investigating perceived barriers to the use of Open Educational Resources in higher education in Tanzania', *International Review of Research in Open and Distance Learning*, 15(2), pp. 43–65. doi: 10.19173/irrodl.v15i2.1803.
- Mtebe, J. S. and Raisamo, R. (2014b) 'Investigating students' behavioural intention to adopt and use mobile learning in higher education in East Africa', *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 10(3), pp. 4–20. Available at: <http://files.eric.ed.gov/fulltext/EJ1059061.pdf>.
- Mtebe, J. S. and Raphael, C. (2013) 'Students' experiences and challenges of blended learning at the University of Dar es Salaam, Tanzania', *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 9(3), pp. 124–136. Available at: <http://ijedict.dec.uwi.edu/viewarticle.php?id=1690>.
- Mtebe, J. S. and Raphael, C. (2017) 'A decade of technology enhanced learning at the University of Dar es Salaam, Tanzania: Challenges, achievements, and opportunities', *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 13(2), pp. 103–115. Available at: <http://repository.udsm.ac.tz:8080/xmlui/handle/20.500.11810/4571>.
- Mtebe, J. S. and Raphael, C. (2018a) 'A Critical Review of eLearning Research Trends in Tanzania', *Journal of Learning for Development - JL4D*, 5(2), pp. 163–178.
- Mtebe, J. S. and Raphael, C. (2018b) 'Key factors in learners' satisfaction with the e-learning system at the University of Dar es Salaam, Tanzania', *Australasian Journal of Educational Technology*, 34(4), pp. 107–122. doi: <https://doi.org/10.14742/ajet.2993>.
- Munguatosha, G. M., Muyinda, P. B. and Lubega, J. T. (2011) 'A social networked learning adoption model for higher education institutions in developing countries', *On the Horizon*, 19(4), pp. 307–320. doi: 10.1108/10748121111179439.
- Muyinda, P. B., Lubega, J. T. and Lynch, K. (2010) 'Unleashing mobile phones for research supervision support at Makerere University, Uganda: the lessons learned', *International Journal of Innovation and Learning*, 7(1), p. 14. doi: 10.1504/IJIL.2010.029471.
- Mwakisole, K. F. ., Kissaka, M. M. . and Mtebe, J. S. . (2018) 'Feasibility of cloud computing implementation for eLearning in secondary schools in Tanzania', *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 14(1), pp. 91–102. Available at: <http://ijedict.dec.uwi.edu/viewarticle.php?id=2396>.
- Network ICT for Education (2014) *The Makerere MobiClass Project | Network ICT for Education*. Available at: <http://networkict4edu.org/news/makerere-mobiclass-project> (Accessed: 5 January 2015).

- Nihuka, K. A. (2013) 'Student Support at The Open University Of Tanzania (OUT) for the Past 20 Years', *Huria Journal of OUT*, 14, pp. 37–47. Available at: http://www.out.ac.tz/images/huria_journal_vol_14_-_final_2013.pdf.
- Priya, N. B. and Juvanna, I. (2014) 'An Android Application for University Online Counseling', *International Journal of Computer Science and Mobile Computing*, 3(2), pp. 261–266.
- Raphael, C. and Mtebe, J. S. (2016) 'Instructor support services : An inevitable critical success factor in blended learning in higher education in Tanzania', *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 12(2), pp. 123–138. Available at: <http://files.eric.ed.gov/fulltext/EJ1111468.pdf>.
- Sanga, C. *et al.* (2016) 'Mobile learning bridging the gap in agricultural extension service delivery: Experiences from Sokoine University of Agriculture, Tanzania Camilius Sanga and Malongo Mlozi Sokoine University of Agriculture, Tanzania', *International Journal of Education and Development using Information and Communication Technology*, 12(3), pp. 108–127.
- Sharples, M. *et al.* (2009) 'Mobile Learning: Small Devices, Big Issues', in Balacheff, N. *et al.* (eds) *Technology-Enhanced Learning: Principles and Products*. Netherlands: Springer, pp. 233–249. doi: 10.1007/978-1-4020-9827-7.
- Shroff, R. H., Trent, J. and Ng, E. M. W. (2013) 'Using e-portfolios in a field experience placement : Examining student-teachers ' attitudes towards learning in relationship to personal value , control and responsibility', *Australasian Journal of Educational Technology*, 29(2), pp. 143–160. doi: <https://doi.org/10.14742/ajet.51>.
- Ssekakubo, G., Suleman, H. and Marsden, G. (2011) 'Issues of adoption : Have e-Learning Management Systems fulfilled their potential in developing countries ?', in *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment*. Cape Town, South Africa.: ACM New York, NY, USA ©2011, pp. 231–238. doi: 0.1145/2072221.2072248.
- Ssekakubo, G., Suleman, H. and Marsden, G. (2013) 'Designing mobile LMS interfaces: Learners' expectations and experiences', *Interactive Technology and Smart Education*. Emerald Group Publishing Limited, 10(2), pp. 147–167. doi: 10.1108/ITSE-12-2012-0031.
- Tarus, J. K., Gichoya, D. and Muumbo, A. (2015) 'Challenges of implementing E-learning in Kenya: A case of Kenyan public universities', *International Review of Research in Open and Distance Learning*, 16(1), pp. 120–141. Available at: <http://www.irrodl.org/index.php/irrodl/article/view/1816/3196>.
- TCRA (2018) *TCRA Quarterly Communications Statistics Report, April -June 2018, Online Access*. Dar es Salaam, Tanzania. Available at: <http://www.tcra.go.tz/images/documents/telecommunication/CommStatMarch16.pdf>.
- Unwin, T. *et al.* (2010) 'Digital learning management systems in Africa: myths and realities', *Open Learning: The Journal of Open and Distance Learning*, 25(1), pp. 5–23. doi: 10.1080/02680510903482033.

Vázquez-Cano, E. (2014) 'Mobile Distance Learning with Smartphones and Apps in Higher Education', *Educational Sciences: Theory & Practice*, 14(4), pp. 1505–1520. doi: 10.12738/estp.2014.4.2012.

World Bank (2010) *Financing Higher Education in Africa*. Washington, D.C. doi: 10.1596/978-0-8213-8334-6.

Xhafa, F. *et al.* (2010) 'Implementing a Mobile Campus Using MLE Moodle', in *2010 International Conference on P2P, Parallel, Grid, Cloud and Internet Computing*. Ieee, pp. 207–214. doi: 10.1109/3PGCIC.2010.35.

Zamfirache, V. *et al.* (2013) 'Extending the Moodle Course Management System for Mobile Devices', in *2nd International Conference on Systems and Computer Science (ICSCS)*. doi: 10.1109/lcConSCS.2013.6632031.

Copyright for articles published in this journal is retained by the authors, with first publication rights granted to the journal. By virtue of their appearance in this open access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

Original article at: <http://ijedict.dec.uwi.edu/viewarticle.php?id=2514>