

Using Mobile Moodle to Enhance Moodle LMS Accessibility and Usage at the University of Dar es Salaam

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Abstract: Over the last decade, there has been a remarkable increase in the adoption and use of learning management systems (LMS) in sub-Saharan Africa in a bid to improve the quality of on-campus delivery as well as increasing access to education through blended and distance learning. Despite the increased adoption of LMS in the region, their potential has not been fully exploited as relatively few users tend to use them, thereby not justifying the high infrastructure investment costs. The continued penetration and adoption of mobile phones amongst users in the region presents an opportunity to find ways of making LMS accessible to users via mobile phones. However, there are relatively few attempts to enhance accessibility and usage of LMS into users' mobile phones especially in sub-Saharan Africa. This article aims at sharing experiences of configuring and using Mobile Moodle to enhance Moodle LMS usage and accessibility via mobile phones at the University of Dar es Salaam. Through analyzing log of two selected courses, it was revealed that the majority of students used *Course View* and *User List* features to read course notes and to check for their fellow students respectively. In addition, students indicated that the Mobile Moodle was easy to use and enable them to accomplish learning activities more quickly through a questionnaire that was distributed to elicit their opinions about the Mobile Moodle. The findings from this study will enable those who are involved in LMS implementation especially in sub-Saharan Africa to widen access of LMS via mobile phones and therefore increase LMS usage.

Keywords: Mobile, e-Learning, m-Learning, Moodle, LMS

1. Introduction

Over the last decade, there has been a remarkable increase in the adoption of learning management systems (LMS) in sub-Saharan Africa in a bid to improve the quality of on-campus delivery as well as increasing access to education through distance learning. The most popular LMS to be adopted by the majority of institutions in the region include Moodle, Blackboard, and Sakai [1], [2]. These systems have features that allow instructors to share learning resources with their students via the Internet. They have also some features that allow both synchronous and asynchronous communication between instructors and students or between students themselves [3].

Nowadays, the adoption of LMS in institutions of higher education in the region is increasing, specifically Moodle. This is evident from the number of active Moodle sites from several countries that can be extracted from the Moodle site. As of December 2015, Moodle site indicated that there are 109 sites in Kenya, 49 sites in Tanzania, 17 sites in Zimbabwe, 390 sites in South Africa, and 36 sites in Uganda [4]. These statistics are further supported by various studies in the literature. For instance, 55% of 11 surveyed institutions in Tanzania [5], 25% of institutions in Sudan [6], and four institutions in Zimbabwe [7] have adopted Moodle.

According to Wainwright [10], the “old adage of *if you build it, they will come* is not necessarily true when it comes to a LMS” (p.267). Actually, the number of users accessing these systems on daily basis is relatively low across many institutions. For instance, there were only 60 active users in LMS installed at Makerere University in Uganda [8], less than 10 users at University of Nairobi in Kenya [2], 103 users at University of Dodoma, 81 users at Open University of Tanzania, and 49 users at Institute of Finance Management in Tanzania [9]. These findings are representative of several other studies showing the low trend of LMS usage in various institutions in sub-Saharan Africa.

Therefore, institutions should find strategies that will increase LMS usage. There are already few studies that have proposed strategies that can be used to increase LMS usage. Mtebe (2015) described seven strategies namely improving usability, uploading quality learning materials, enhancing support services, reviewing relevant policies, increase awareness, complementing LMS with social media, and making use of mobile applications. Similarly, Unwin and colleagues indicated that reducing the cost of bandwidth, providing reliable support services, and making use of Open Educational Resources (OER) into the LMS will likely increase the number of LMS users.

Despite these strategies, institutions have not seriously considered the use of mobile phones to enhance LMS accessibility and usage in sub-Saharan Africa. In fact, the use mobile phones to access the LMS is quite low [12]–[15] despite many students having access to mobile phones connected to the Internet. For example, results of a survey given to more than 800 students in four universities in Tanzania showed that 93.4% of the students had access to Internet via mobile phones [16]. The finding was consistent with another study conducted in two universities in Uganda and South Africa which found that over 70% students had mobile phones with Internet connection [3].

Therefore, this proliferation of mobile phones among students presents an opportunity to think of alternative ways of making LMS services effectively available to them via mobile phones [3]. This article aims at sharing the experience of configuring Mobile Moodle at the University of Dar-es-Salaam in order to enhance the usage and accessibility of Moodle LMS via mobile phones. In addition, the article presents findings on the opinions of students towards using Mobile Moodle in order to achieve their learning objectives.

Mobile Moodle was downloaded and configured to provide access of Moodle LMS via students’ mobile phones at University of Dar es Salaam. Students were required to download the application from Google Play and use same credentials as those used in the Moodle LMS. In order to determine the effectiveness of the Mobile Moodle, we assessed some basic data generated in the system log to find out how students accessed LMS features using a sample of two courses with a total of 300 students. In addition, the questionnaire was distributed to students who used the application in order to elicit their opinions about the Mobile Moodle. The findings from this study will enable those who are involved in LMS implementation especially in sub-Saharan Africa to widen access of LMS via mobile phones and therefore increase LMS usage.

2. Customization and Configuration of Mobile Moodle

According to Zamfirache and colleagues [13], there are two methods which can be used by users to access Moodle from mobile phones. The first method is through browsers installed into mobile phones. This method provides immediate access to the Moodle without any additional changes to the system or making any configuration into the mobile phone. However, this method can cause interface-related issues such as slow in loading some pages, poor interface optimization, and some features may not fully accessible on mobile phones as they require adjustment to make it usable on mobile phones [17]. Additionally, to be able to access Moodle using this method, users need to be connected to the Internet all the time.

The second method that can be used to access Moodle via mobile phones is using a native developed mobile application. The method requires redesigning and development of a mobile application that meet users' preferences. The main limitation of this method is that it is device specific and requires high development costs [17].

Our work is based on the second type of Moodle access with a focus of Mobile Moodle accessible via mobile phones. The Mobile Moodle was customized and configured from open-source mobile application that is HTML5 based, and built using the Ionic hybrid apps framework. The Ionic framework is an open and free technology stack that offers mobile-optimized HTML, CSS and JavaScript components for easily building interactive mobile applications. This framework allows a single codebase for the app to be used to build across multiple platforms. i.e. the same source code is used to create the app for both iOS and Android platforms. In addition, since the application is open source, anyone can fetch the source code, modify it, and build a mobile app with a custom look and features for their own purpose.

For this study, there was a need for a custom mobile application that would automatically connect to the UDSM Moodle. The source code for the Mobile Moodle was modified and configured in order to seamlessly connect to UDSM Moodle. The code was then compiled and built for the Android platform. The choice of the Android platform was based on the fact that the majority of students and instructors at UDSM are using Android smartphones. The following were steps taken to customize and configure the Mobile Moodle.

First, the source code for the official Moodle Mobile app was accessed and forked from its official repository. The code was downloaded and stored locally. All the modifications and customization was done locally. To start with, a few key configuration parameters were modified. These included (i) the ID of the app package which would uniquely identify the app when made available on the Play Store, (ii) the name of app that will appear on the Play Store or installed on a user's mobile phone, and (iii) the short description of the app that will appear on the Play Store.

In addition, the parameter for the URL of UDSM Moodle was also fixed and pre-configured in the source code. The user interface was then modified so that this parameter could not be accidentally or intentionally changed by the user.

Second, the Mobile Moodle interface was customized in order to conform with UDSM colors, look and feel. This included the app icon, background images, and the overall theme of the application. It should be noted that the interface for Mobile Moodle is literally a Moodle interface, with the visuals stripped down and some of the formatting reworked to allow the pages to be displayed on almost all mobile devices [18]. In other words, the Moodle LMS images were removed while buttons and external links were formatted to acceptable mobile standards.

The third step was to configure the UDSM Moodle server in order to allow the third party client i.e. the Mobile Moodle to connect the the server. By default, Moodle prevents this because of security. Therefore, the "allow web services" setting was enabled, and the changes were applied on the server. Moreover, all user permissions were reviewed to make sure that users would be able to login through the mobile app, and be able to access all their resources.

After all modifications were done, the fourth step was to compile and build the app, ready to be deployed to the Play Store. The application was first built it locally by installing all the necessary tools and libraries before using the Adobe PhoneGap to upload custom code and build the appropriate application. The Adobe PhoneGap is a free and open source framework that allows developers to create mobile apps using standardized web APIs for various platforms.

The developed app was then uploaded from the local repository together with a

signature key needed to create the final Android binary. The final release APK (Android Application Package) file was then generated.

Finally, the customized Mobile Moodle was uploaded to the Google Play Store in order to be accessible to users. To upload the Mobile Moodle an Android Developer Account (which costs \$25) was needed. This was created and activated. The information describing the Mobile Moodle as well as its features was created and added. At this stage, the Mobile Moodle was made available into the Google Play ready for students and instructors to download and install into their mobile phones. A user would simply download the application enter their credentials and automatically connect to the LMS without the need to configure anything else. Figure 1 shows the interface of Mobile Moodle in the Google Play.

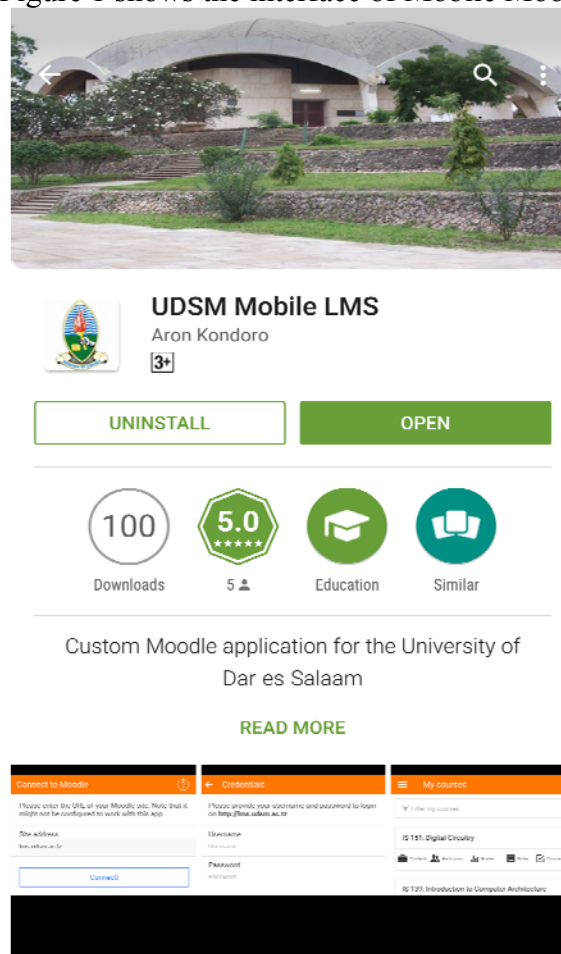


Figure 1: The interface of a customized Mobile Moodle

Once users download it, they can access academic information such as course notes, announcement, and discussion threads. Figure 2 show the interface of UDSM Mobile Moodle once the user has managed to login.

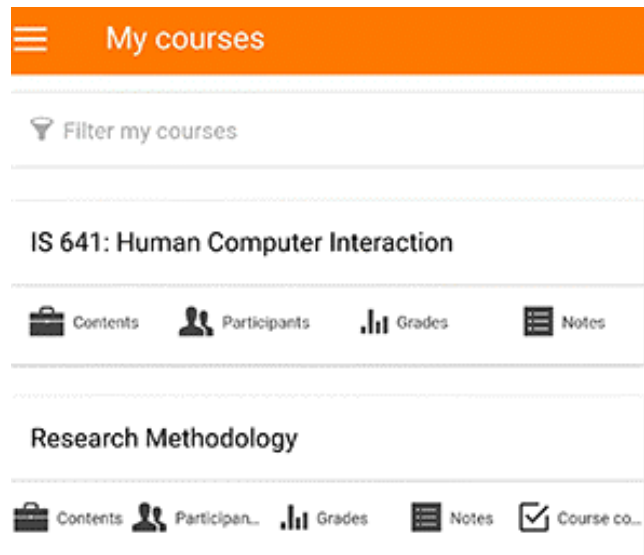


Figure 2: The interface of a UDSM Mobile Moodle showing its features

3. Related Works

There are some studies in literature that have customized Moodle to be accessible into mobile phones. Makerere University in Uganda, for instance, developed the MobiClass application to enable instructors to interact with their students via mobile phones [19]. The project was funded by Spider organization of Sweden. However, there is no data available in the literature how the application was used.

Casany and colleagues developed a mobile extension of Moodle to be accessible in the mobile devices. The extension enables users to access Moodle features such as forum, calendar, wiki, glossary and internal mail both online as well as offline. Although the initial specification was meant for Moodle, the authors have been working to extent this extension to other LMS specifically Sakai and Olat.

Zamfirache and colleagues [13] developed of a mobile application as an extension to Moodle that enables users to access mobile-specific functionality namely the offline mode, notifications, and attendance based on location. The application was tested for its features but no data was collected from users to determine the effectiveness of the application.

There are many other initiatives that have tried to develop a mobile client that enable users to access Moodle vi mobile phones. MDroid (Moodle for Android), is a good example of such initiatives. MDroid offers support for authentication, course and file listing, forum access, parallel file download and offline mode. However, many users have complained problems related to courses and course content visualization [13]. It also connects to a limited number of Moodle servers.

Similarly, mTouch is a native Moodle application that runs in iOS mobile platform. This application provides the various features to users such as course visualization, forum usage, calendar events, chat, grade viewing, wiki access, and quiz solving. According Zamfirache and colleagues [13], this application only addressed to student access and does not offer any management capabilities. In addition, the application is only available on the iOS platform.

Finally, mBot is another application developed to allow users to access Moodle functionalities via mobile phones. With this application, user can instantly access its course and activities organized by their usage relevance, unlike the previous applications. According to Zamfirache and colleagues [13], resources and activities are opened in a separate browser which is a major limitation of this application.

Our work is based on Mobile Moodle application which is an extension to the Moodle

that enables users to connect to their mobile phones using their mobile phones. The Mobile Moodle is a minimalist Moodle interface that provide mobile interface for Moodle. Given the fact that the majority of university students today have some sort of internet-enabled mobile phones, the application provides them with quick, easy access to learning content and other academic information from anywhere via their mobile phones [18].

4. Methodology

The study was conducted at the end of semester 1 of 2015/2016 at University of Dar es Salaam. Students used Mobile Moodle across the whole semester consisted of 15 weeks. During that time period, a total of 631 students downloaded the application. Students were required to download the application from Google Play and use same credentials as those used when accessing Moodle using their computers. The Mobile Moodle also enabled students to access learning resources in offline environment when network coverage was not available as the content could be downloaded and stored in their devices. The content was then synchronized with Moodle data when the network was available.

In order to determine how students used various LMS features using Mobile Moodle, we extracted data from two courses: IS 605 Research Methodology and IS 151 Database Systems. The courses were selected on convenience basis. Firstly, LMS logs of the two courses were analyzed to find out which LMS features were mostly used by students.

Secondly, it was also necessary to elicit students' opinion on the use Mobile Moodle. To achieve this, the questionnaire was distributed to 300 students who used Mobile Moodle access the two selected courses. Each student was given the questionnaire at the beginning of the lecture, and their responses were then collected at the end of the lecture. Out of the 300 students, 291 students completed the questionnaire. This is equivalent to 97% response rate.

The questionnaire consisted questions in which the respondents were asked to rate each question using a 5-Point Likert scale that ranged from Strongly Agree to Strongly Disagree. The responses were then analyzed and categorized using the Statistical Package for the Social Sciences (SPSS).

5. Findings

5.1 Mobile Moodle Accessibility and Usage

In order to determine the effectiveness of the Mobile Moodle, we assessed some basic data generated by the system log and found that the majority of students who installed the application used it to read the course notes with 22.73% for IS 605 and 38.89% for IS 151 (see Figure 3 and Figure 4).

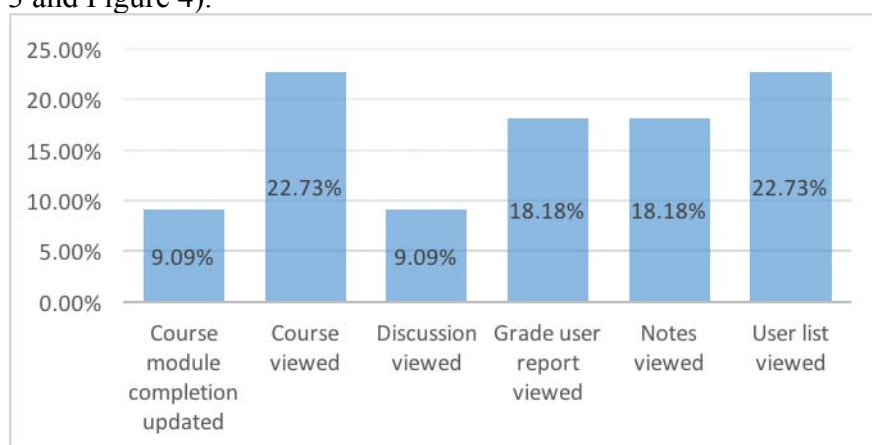


Figure 3: LMS access and usage by students in IS 605

However, there was a variation in terms of other LMS features for each course. For instance, discussion forum and course module completion were the least accessed LMS features in IS 605 while course module completion was the least accessed feature in IS 151 as shown in Figure 3 and Figure 4.

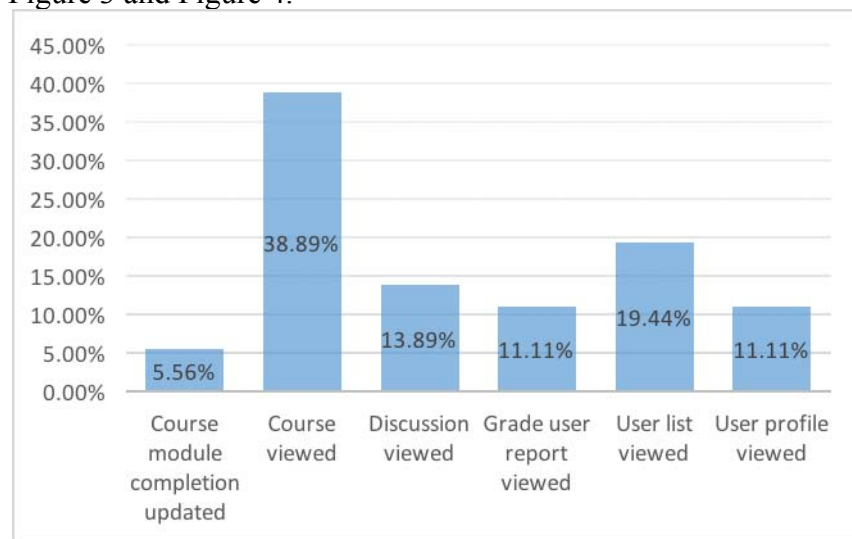


Figure 4: LMS access and usage by students in IS 151

5.2 Level of difficulty of the Mobile Moodle

Studies show that if the technology is not easy to use, users will spend more time learning how to use it rather than learning the content [20]. Therefore, it was necessary to gather feedback from students how they perceived the application in terms of level of difficulty.

Therefore, students were asked to describe the level of ease of use of the Mobile Moodle on 5-point Likert Scale [1=Very Difficult: 2=Difficult: 3=No Opinion: 4=Easy: 5=Very Easy]. The overall response to this question was very positive. The majority of students (95%) indicated that the application was easy to use with 63% indicating that it was Very Easy to use (Figure 5).

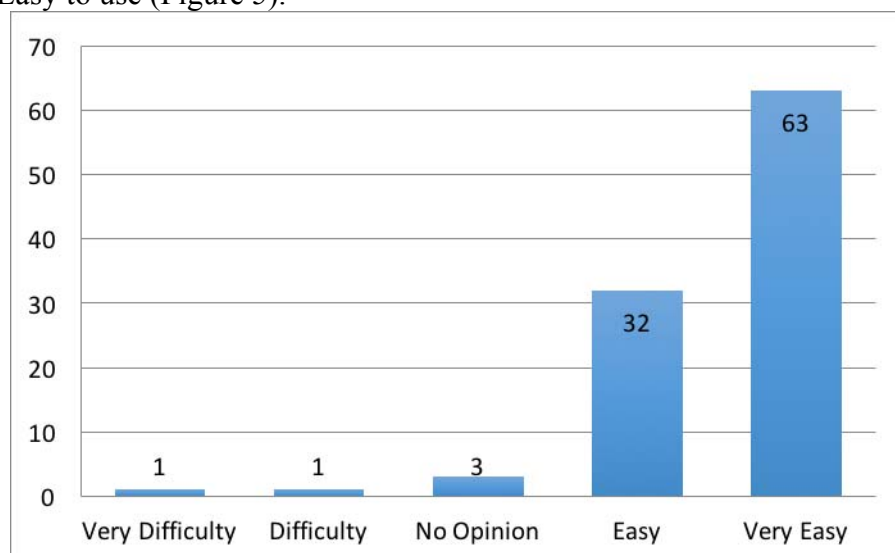


Figure 5: Level of Ease of Use of the Mobile Moodle

5.3 Accomplish learning activities more quickly

If students find the application useful and enables them to accomplish learning activities more quickly they will definitely be going to use it. Therefore, students were asked to rate on 5-point Likert Scale [1=Strongly Disagree: 2=Disagree: 3=No Opinion: 4=Agree:

5=Strong Agree] if they believed that using Mobile Moodle enabled them to accomplish learning activities more quickly. More than two third (86%) of students agreed that using Mobile Moodle helped them to accomplish learning activities more quickly. On the other hand, minority of students (5%) indicated that the application did not help them to accomplish learning activities more quickly as shown in Figure 6.

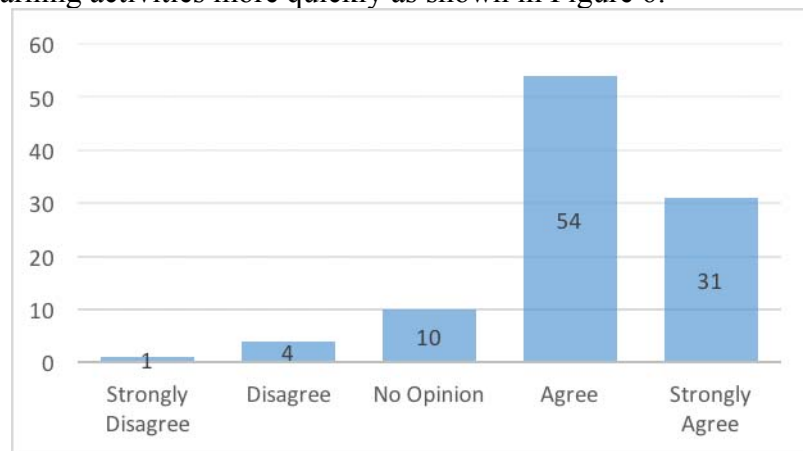


Figure 6: Students' opinions on if the application helped to accomplish learning activities more quickly

5.4 Availability of resources to access Mobile Moodle

Finally, we wanted to elicit students' opinions on the availability of resources and support to access and use Mobile Moodle. These resources include ownership of smart phones, reliable Internet connection to access the Mobile Moodle, and other related resources. This is because many studies indicate that users' decision to accept and to continue using Mobile Moodle will be influenced by their perception on the availability of these resources.

Nearly two third of students (61.7%) indicated that they had resources to be able to access and use Mobile Moodle while the minority of students (26.1%) indicated that they did not have resources. In addition, 12.2% of students were neutral (See Figure 7).

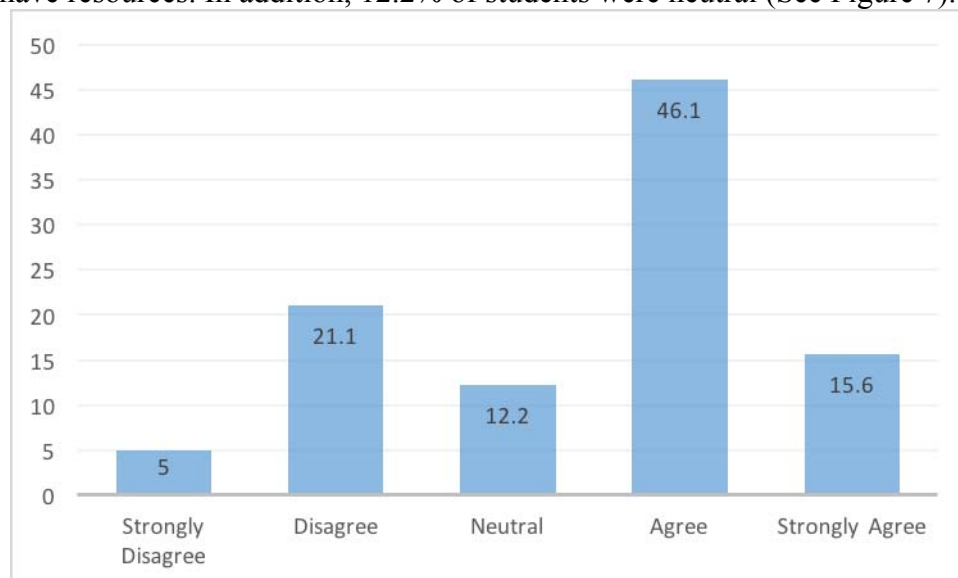


Figure 7: Students' opinions on the availability of resources and support to access and use Mobile Moodle.

6. Discussion

Many students in sub-Saharan Africa do not have access to computers connected to the Internet. As a result, it is difficult for them to easily access course materials and other learning resources shared by their lecturers through eLearning systems. Therefore, finding

new ways of enhancing accessibility and usage of LMS becomes important. This study was set out to share experiences of configuring and using Mobile Moodle at the University of Dar es Salaam in order to enhance accessibility and usage. Lessons learned from this study can be used as input in future similar attempts to leverage mobile technology to widen access of LMS in sub-Saharan Africa.

The main advantage of Mobile Moodle is that it enabled students to access various LMS features both in online and offline situations. In other words, students were able to access course notes and other learning resources even when they were not connected to the Internet.

The most interesting finding emerged from this study is that majority of students accessed various Mobile Moodle features in the two selected courses. Through accessing and analyzing application log of the two courses, it was noted that the most LMS feature that was mostly accessed was Course View followed by User List in both courses. The finding was consistent with a study conducted at Makerere University and University of Cape Town to determine the most desired and most accessed features in Mobile Moodle. In this study, authors found that course content and course outline were the most desired mobile features of Mobile Moodle [3].

The study also found that User's List Viewed was the second highly accessed Mobile Moodle feature in both courses. The result implies that students were interested to know their fellow students who were accessing the application. According to Mödritscher, Neumann, and Brauer (2012), mobile users tend to quickly look up required or interesting information compared to web users who normally have longer and deeper browsing sessions which include more course-specific functionality.

When students were asked to rate the level of difficulty of the Mobile Moodle, it was found that the majority of students rated it as very easy to use. This is inline with the fact that when a technology is perceived to be easy to use, users are likely to use or continue using it [22]. Therefore, this finding implies that students are likely going to continue using the Mobile Moodle.

Another interesting finding from this study is that students indicated that using Mobile Moodle will enable them to accomplish learning activities more quickly and flexibly and therefore their learning effectiveness will improve. The finding corroborates with similar studies such as those in [23] conducted elsewhere.

Finally, students were asked to provide their opinions on whether they had resources to access Mobile Moodle. These resources include ownership of smart phones, reliable Internet connection and other related resources. As expected, many students indicated that they had resources to be able to access and use Mobile Moodle. This result seems to be consistent with other studies (e.g. [16], [3]) which found that the majority of students own mobile phones and tend to access Internet via mobile phones.

7. Recommendations for Future Research

Despite findings from this study, there were some constraints that were reported by students. The main limitation described by the majority of students was related to the cost of mobile Internet especially for courses where students were required to download large PDF files as well as watching video clips. Future studies should take this issue into consideration if they want all students to be able to access learning resources via mobile phones. One solution could be to enter into an agreement with mobile operators to exempt or charge students Internet prices at a discounted price. At the University of Dar es Salaam, some operators already offer discounted data packages to students who are at the University campuses. This could be leveraged further to facilitate accessibility and usage of course materials.

The Mobile Moodle application mirrors the main web-based application by containing

all the modules and features such as Course Modules, Discussion Forums, Assignments, Grades, Chats and Notification. This can get overwhelming and confusing a novice smartphone user. Therefore, in this study some of these features such as Chats and Notifications were disabled, and only core features were used. This kept the application simple and led to the majority of students (95%) who used it, feeling that it was easy to use. Similar future attempts should also consider simplicity as an important core feature in order to increase usage and obtain positive feedback from students.

8. Conclusion

The purpose of the current study was to present the findings of the use Mobile Moodle to increase usage and accessibility of Moodle via mobile phones at the University of Dar es Salaam. The Mobile Moodle was downloaded, customized, and configured to meet the need of UDSM context and was made available in the Google Play for students to download. Through analyzing log of two selected courses, it was revealed that the majority of students used the *course view* and *user list* features to read course notes and to check for their fellow students respectively. In addition, students indicated that Mobile Moodle was easy to use and enable them to accomplish learning activities more quickly through a questionnaire which was distributed to elicit their opinions about the Mobile Moodle.

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