Evaluation of MoblrN m-learning system: Participants' attitudes and opinions

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Abstract

The advance of pervasive technologies such as mobile technologies and various mobile devices has brought opportunities for educators to design and perform interactive learning activities and has also enabled educationalists to access the virtual learning environment anytime and anywhere without restrictions of time or place and without too much additional effort. The m-learning system, MobLrN*,* has been developed by the researcher. Different from the m-learning systems developed by other researchers, the MobLrN m-learning system contains all teaching/learning components for m-learning, such as access control, user profile, learning materials, assignments, self-tests, quizzes, performance measurement, announcements, and report generation. Thus, instead of using different systems for different activities, the instructors can use the developed mobile system for all of their teaching activities. The main porpuse of the study was to identify whether the developed m-learning system is acceptable or not as a mobile learning environment. Data were collected through a questionnaire. Descriptive statistical analysis technique and the percentage method were used. The obtained results confirm that the MobLrN m-learning system was deemed to be useful for instructors and students for the future. The system is oriented to anyone who may have an interest in mobile technologies, and all higher education institutes.

Keywords*:* m-learning system; m-learning environment; m-learning; evaluation; distance learning

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1. Introduction

As the developments in mobile technologies have positively affected the development of new mobile devices, it has also increased the interest of educational technologists and educators in the use of mobile devices in education. The use of mobile devices in education has created effective environments, thus allowing teachers to design and perform (Jahnke & Liebscher, 2020) interactive educational activities. As a result, this has given opportunities to both educators and learners to access the virtual learning environments easily whenever they want and from their own places of study, and also to organize or participate in their interactive educational activities out of the class. Therefore, the integration of ubiquitous technology into today's classrooms has become inevitable (Uzunboylu, 2019). This has motivated many researchers to investigate different aspects (attitudes and self-efficacy, interactive whiteboard) of such integration (e.g. Gulbahar, 2007; Unal & Uzun, 2019; Wood & Ashfield, 2008). This helps learners to learn quickly and at the same time allows educational institutions to focus their attention on global learning environments (Gunes, 2019). Moreover, mobile technologies offer multimedia-based content for m-learning and deliver course materials efficiently for learners (Kalolo, 2019). As a result of mobility requirements, mobile learning has become increasingly available (Clough et al., 2008; Crompton, 2019). Consequently, m-learning allows educators to utilize mobile platforms to bring effective applications to the virtual learning environment (Montiel et al., 2020). Hence, m-learning continues to be a hot topic among teachers. However, very few educational organisations around the world and in Cyprus have adopted it.

Elaish et al. (2019) and Nikolopoulou (2020) stressed that mobile learning and the effects of the digital age on higher education are interesting topics for academic research. At the same time, because mobile learning is adaptive (Tsatsou et al., 2019), it can offer the required knowledge when and anywhere they need it (Cavus & Ibrahim, 2017). However, there is little research result indicating that this is currently happening. The current status of m-learning pointed out the urgent need to develop cheap, and useful m-learning systems (Cavus, 2010) that are correspond to the needs of students "in culturally appropriate ways" (Rajasingham, 2011: p. 6). On the other hand, in recent decades, the focus of scientific research into higher education has been on m-learning. However, the resulting empirical evidence also advises that those educational institutes that prefer mobile learning have found that their numerous expectations are not fully met. As a result, the author has developed an m-learning system called MobLrN to fill this gap in the field of m-learning.

Prior study into the acceptance of m-learning platforms has confirmed that the usability of the developed system is a central factor (Brata & Brata, 2020) that is indeed a significant predictor of users' (students and/or instructors) acceptance of such systems (Ennouamani, Mahani & Akharraz, 2020; Ishaq et al., 2020). Thus, in order to determine whether or not the developed mobile system can be accepted as a learning tool, the opinions of students and instructors were sought. The power of the developed system is that it can be easily accessed on mobile devices such as PDAs, mobile phones, cell phones, cellular phones, tablet computers, and laptops. The main goal of the MobLrN m-learning system is to help instructors and students to learn/teach through mobile technologies and the Internet with no restrictions on space and time. The interesting features of the MobLrN m-learning system is that it contains all teaching/learning components for distance learning such as access control, user profile, learning materials, assignments, self-tests, quizzes, performance, announcements, and report generation. Additionally, no additional software needs to be installed on the mobile devices of instructors/students. Moreover, the paper has theoretical significance. From a theoretical standpoint, the developed m-learning system may be used to meet the expectations of instructors and students involved in teaching/learning activities.

2. Literature review

Researchers have identified various benefits of m-learning, such as collaborative interaction, the ability to access resources anytime and anywhere, and through multiple channels (Crompton et al. 2019; Uzunboylu, Cavus & Ercag, 2009). Therefore, more m-learning applications are being developed for teachers and students to learn foreign languages (Cavus & Ibrahim, 2009; Georgieva, Smrikarov &

Georgiev, 2011; Kukulska-Hulme & Shield, 2008; Sadiq, Cavus & Ibrahim, 2019), to take assessments (Huang, Lin & Cheng, 2009; Ng'ambi & Brown, 2009; Wexler, 2019), to deliver course content (Che et al., 2009; Jahnke, 2015; Lan & Sie, 2010) and for collaborative learning platforms (Jagušt & Botički, 2019; Tai & Ting, 2020). On the other hand, SMS is used as a communication method in higher education such as one-way (Cavus & Ibrahim, 2009; Ghaemi & Golshan, 2018) or two-way (Stone, Briggs & Smith, 2002). Also, Song (2008) developed a system that sends SMSs to students with examination dates and places, students' marks, etc. Wang et al. (2009) even used SMS in a classroom to supplement a regular lecture. Also, some researchers have developed mobile learning systems for different purposes and specialties. For example, Brata and Brata (2020) developed the m-learning app with the mental model to improve end-user experience and they used A/B testing for the system. An anatomy m-learning application (eMed-App) was developed by Golenhofen et al. (2020) to support medical students' to learn the skeletal system by themself. Their results showed that students whose academic performance is high had been more motivated to use the developed application than other students in the anatomy course. Also, El-Bishouty, Ogata and Yano (2007) generated a ubiquitous computing environment PERKAM (PERsonalized Knowledge Awareness Map) in order to allow the students to "share knowledge, interact, collaborate, and exchange individual experiences". Rani and Krishnanunni (2020) developed an educational app, titled EA-ASU, for self-learning and delivery digital real-life learning scenarios. The developed app allowed the learners to upload their own material to the central repository of the app and also allows learners to modify them. However, in the literature, there is limited research available on the development of m-learning systems that are capable of supporting most of the learning activities, such as learning materials, exercises, test, announcements, and others on the same platform. Consequently, there is a need to develop a well-defined and well-structured m-learning platform. These reasons have motivated the author to carry out this study. This paper describes the developed m-learning system, MobLrN, and evaluates whether or not it is acceptable.

3. The aim of the study

The main aim of the study is to identify whether the developed m-learning system is acceptable or not as a mobile learning environment. Hence, an experimental research has been investigated to find out the opinions of end-user (students and instructors) about the acceptability of the MobLrN m-learning system.

In this context, the researcher searched for reply to these questions:

1- What are the opinions of instructors and students about the MobLrN m-learning system qualification?
2- What are the opinions of instructors and students about the usefulness of the MobLrN m-learning system?
3- What are the opinions of instructors and students about the quality attributes of the MobLrN m-learning system?
4- How satisfied are the instructors and students with using the MobLrN m-learning system?

4. Method

4.1. Research design

An experimental research approach was used in the study. Since the system was developed in two different ways for students and instructors, the survey was carried out for both types of users. The experimental study was carried out at Near East University in the north of Cyprus. An m-learning system *(MobLrN)* that has been developed by the researcher was used in the study.

4.2. Participants

The researcher invited 25 instructors and 49 students from different departments such as education, engineering, law, language etc. to trial the developed m-learning system in order to verify the acceptability of the system as an educational learning platform. Fraenkel, Wallen and Hyun (2012)

proposed that "there are no rules for determining the size of groups (p. 267)" in an experimental research. Students' ages ranged between 17 and 22, whereas the instructors' ages ranged between 24 and 50. 42% and 58% of the students were female and male, respectively, while 48% of the instructors were female and 52% of them were male.

4.3. Developed system

The m-learning system was developed by the researcher by considering collaborative learning. The system is called the *Mobile Learning System (MobLrN)* and provides a platform for the m-learning environment by enabling access control, user profile, learning materials, assignments, self-test, announcements, performance, and report generation (Fig. 1). Each student and instructor must first register to get a username and a password to access the m-learning system. This allows the developed system to collect information about the students' profile, results of self-tests, and assignments. Then, all this information is kept in the developed system's database for further analysis by students and instructors. Mobile devices such as PDAs, cell phones, tablet computers, cellular phones, or laptops can be used to access the system easily. The main properties of the MobLrN m-learning system are:

- Easy implementation without any technical knowledge,
- Integration of rich content into lessons,
- Collaboration and communication of students-to-students and instructor-to students,
- Monitoring of students' performance and if they need help, the instructor can help them immediately,
- Students are able to study at a distance using own mobile device,
- Students can manage their own learning,
- Enables students to communicate regardless of their location,
- Students can call on information and knowledge when needed,
- Students can receive immediate feedback about their activities,
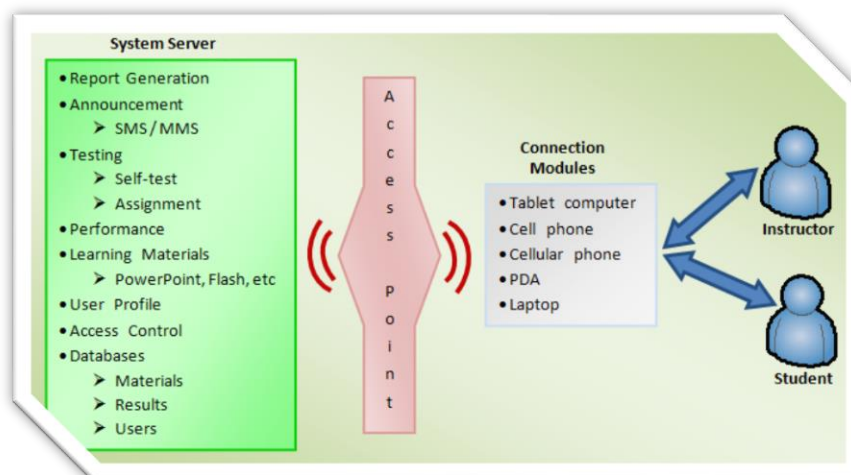- Students are able to receive personalized information in the given course materials.

Figure 1: Structural design of the MobLrN m-learning system

The PHP and JAVA programming languages were used to develop the MobLrN mobile learning system. MySQL was used to build the system's database. All of these software programmes are open-source meaning that the researcher incurred no costs when developing the system. The MobLrN m-learning system works as a standard client-server application, requiring an internet connection all the time. The system supports two types of users depending on the functions they perform: Instructors and learners. Users do not have to install any third-party applications in their devices in order to access the

developed system. In all processes of the MobLrN system, English was used as the interaction language. Figure 2 illustrates some sample screenshots from the MobLrN m-learning system.

  (a) Upload new announcement   (b) Uploaded all announcements   (c) Student registration to the course

Figure 2: Sample snapshots from the MobLrN m-learning system

4.4. Data collection tools

In the literature, Magal-Royo et al. (2007) indicated that "there is not a specific and suitable criterion to evaluate developed m-learning platforms (p. 1)". Consequently, most researchers have used specially designed questionnaires on a 5-point Likert scale format to determine the value of their developed m-learning environments (Luo et al., 2010; Yang & Chien, 2008). This is because the developed m-learning platforms have different properties. For example, while the system developed by Motiwalla (2007) used course discussion forms to enable students to interact with each other, the studies carried out and the system developed by Corlett et al. (2005) analyzed the use of their system in terms of "hardware and software". However, the system developed by the author has been designed by considering aspects such as system interface, design, performance, usefulness of each module and so on. The survey used in the study has been taken from the survey developed by Luo et al. (2010).

The investigation of the usability methods of any developed system or tool should be validated against potential users (Guney, 2019; Karoulis & Pombortsis, 2003). Additionally, usability inspection is important for finding any run time problems, although such methods could also be applied during the design and building phase (Magal-Royo et al., 2007). For this purpose, the most widely used methods are Heuristic evaluation (Nielsen & Molich, 1990), and Cognitive Walkthroughs evaluation (Lewis et al., 1990). These evaluation methods are introduced with regard to each development phase of the system. Then instructors' and students' opinions were taken. At the end of all these evaluations, the author improved the system accordingly based on evaluation results.

For this purpose, the study employed quantitative data, which were collected through the questionnaire entitled *"Instructors' and Students' Opinions about the Developed M-Learning System Acceptance"* that was developed by the researcher. But some of the items adopted from Alepis and Virvou (2014). The content and validity of the prepared questionnaire were considered by 13 experts, including 2 assessment and measurement experts, 5 experts on software testing and 2 mobile user interface design, and 4 experts in the field of educational technologies and was decided that it can be used in the study. The internal consistency of the data collection tool was calculated .96 using Cronbach's alpha. Finstad (2010) stated that if "a coefficient is higher than the absolute value of 0.70, it indicates a high degree of internal reliability". The developed questionnaire consists of 4 sections. The first section was used to evaluate the system's qualification and it formed 10 questions. The second section was used to verify the usefulness of the system's modules (11 questions) based on the opinions of the instructors and students. The questionnaire consist of 5-point Likert scale type questions which *Very Useful* was representing score 5 and *Very Useless* was representing score 1. *Very Useful* interpreted a positive opinion of the participants to the MobLrN m-learning system. The third section of the developed questionnaire contains 6 items to test the system usability of the developed system. In general, usability is described as the usage quality of a system from the perspective of users (instructors/students). Finally, the last section of the questionnaire contains 10 items about the

satisfaction of instructors and students with regard to using the MobLrN m-learning system. The opinions of the instructors and students were collected from 5-point Likert scale type items in the third and fourth section of the questionnaire ("*Strongly Agree*=5" and "*Strongly Disagree*=1"). "*Strongly Agree*" was interpreted as a positive opinion to the the MobLrN m-learning system.

4.5. Data analysis

The data obtained by the questionnaire were interpreted by descriptive statistics methods. SPSS statistical pacage was used during the analysis process.

5. Procedure

Firstly, e-mail addresses of potential participant instructors from different departments were obtained from the Near East University web page. In order to determine the students who would participate in the study, students from different departments who are taking the "Introduction to Computers" courses were informed about research procedure. Separate meetings were held and detailed information was given to the volunteer participants regarding the experimental study, about m-learning, and about mobile technologies in general. After the meeting, the MobLrN m-learning system was introduced. An explanation of the mobile system manipulation was presented in detail for the participants and each user was wanted to use their own mobile device with this system in a computer laboratory of the Department of Computer Information Systems.

After this procedure, the participants were asked to use the system on their own for three weeks (five hours a week) with their mobile devices that supported the Android operating system in their own places of study (home, dormitory, office, café, bus etc.). After three weeks of usage, the researcher gave them the questionnaire and requested them to complete it. All the participants who attended the study for three weeks completed all that was required from them. The completed questionnaires were collected by the researcher. 20 instructors out of 25 and 42 students out of 49 completed and returned the survey. However, 2 students did not complete all parts of the questionnaire and were therefore excluded from the study.

6. Application Evaluation Results

Magal-Royo et al. (2007) stated that there are no specific and suitable criteria for evaluating created m-learning platforms. Thus, researchers have used different criteria when evaluating system quality. In this study, the author identified the following criteria:

6.1. Qualification of the MobLrN m-learning system

The means of the opinions scores and the standard deviations of the participants about the qualification of the MobLrN m-learning system are given in Table 1.

As shown in Table 1, the means of all answered questions in the questionnaire were over 4.50. The results suggest that instructors and students had positive opinions in terms of the qualification of the MobLrN m-learning system.

According to Table 1, question 2 "*How do you rate the usefulness of the system? (M=4.84, SD=0.37)*", it can be seen that the instructors expressed the opinion that the developed system is useful. Answers to question 5, "*How do you rate the m-learning system usage?*" and question 8 "*How do you rate the efficiency of the system? (M=4.80, SD=0.58)*" and question 5 "*How do you rate the m-learning system usage?*" and question 8 "*How do you rate the efficiency of the system? (M=4.80, SD=0.58)*" indicate that the MobLrN m-learning system is useful and efficient.

Table 1: The evaluation results of instructors' and students' opinions about the developed m-learning system's qualification

	Instructors (n=20)		Students (n=42)	
	Mean	**SD**	**Mean**	**SD**
System's Qualification				
1. How do you rate the manipulation of the teacher/student side program?	4.64	.57	4.63	.49
2. How do you rate the usefulness of the m-learning system?	4.84	.37	4.81	.56
3. How do you rate the interface of the m-learning system?	4.68	.48	4.67	.55
4. How do you rate the accuracy of the m-learning system design?	4.72	.54	4.74	.45
5. How do you rate the m-learning system usage?	4.80	.58	4.78	.42
6. How do you rate the information access of the m-learning system?	4.72	.54	4.85	.36
7. How do you rate the performance of the m-learning system?	4.76	.44	4.89	.32
8. How do you rate the efficiency of the system?	4.80	.58	4.89	.32

Scoring: 5 = Very Useful, 1 = Very Useless

Answers to question 7 "*How do you rate the performance of the m-learning system? and* question 8 "*How do you rate the efficiency of the system? (M=4.89, SD=0.32)*" indicate that the students were happy with the performance and the efficiency of the system. In addition, the responses to question 6, "*How do you rate the information access of the m-learning system? (M=4.85, SD=0.36)*" and question 2 "*How do you rate the usefulness of the system? (M=4.81, SD=0.56)*" show that the students were positive about these questions and they had no difficulties in accessing and using the system.

In addition, according to these results, the instructors and students generally expressed highly positive opinions.

6.2. The usefulness of the MobLrN m-learning system's modules

The evaluation results of instructors' and students' opinions about the usefulness of the MobLrN m-learning system's modules are given in Table 2.

Table 2: The evaluation results of instructors' and students' opinions about the usefulness of the developed m-learning system's modules

	Instructors (n=20)		Students (n=42)	
	Mean	SD	Mean	SD
The Usefulness of the System's Modules				
1. How do you rate the usefulness of the announcement module?	4.80	.65	4.93	.27
2. How do you rate the usefulness of the self-test module?	4.76	.72	4.67	.68
3. How do you rate the usefulness of the learning materials module?	4.84	.62	4.89	.32
4. How do you rate the usefulness of the assignment module?	4.60	.65	4.81	.40
5. How do you rate the usefulness of the profile module?	4.52	.65	4.85	.36
6. How do you rate the usefulness of the assignment feedback module?	4.84	.62	4.81	.40
7. How do you rate the usefulness of the quiz module?	4.72	.54	4.74	.66
8. How do you rate the usefulness of the self-test feedback module?	4.64	.57	4.70	.67
9. How do you rate the usefulness of student's personal records module such as assignment achievement?	4.68	.56	4.78	.64
10. How do you rate the usefulness of student's personal records module such as quiz achievement (academic performance)?	4.68	.56	4.78	.64
11. How do you rate the usefulness of student's personal records module such as self-test achievement?	4.68	.56	4.78	.64

Scoring: 5 = Very Useful, 1 = Very Useless

As shown in Table 2, when the instructors examined the developed system from the perspective of an educator, they focused their positive opinions on learning materials and the highest score was given to the 3rd question, which was "*How do you rate the usefulness of the learning materials?*". Additionally, with regard to question 6, "*How do you rate the usefulness of the assessment feedback? (M=4.84, SD=0.62)*", the instructors who were aware that students learn by doing homework showed positive views. Question 1, "*How do you rate the usefulness of the announcement? (M=4.80, SD=0.65)*". Any news uploaded to the system by the instructor (assignments, quiz, etc.) was sent to the students' mobile phones immediately as a message (SMS/MMS). As this helped students get information instantly, it shows the effectiveness of the system, as indicated by the survey results for question 1. Question 3 "*How do you rate the usefulness of the learning materials? (M=4.89, SD=0.32)*" received high scores since the students were happy about the interactive learning materials prepared for them.

Question 5, "*How do you rate the usefulness of the profile? (M=4.85, SD=0.36)*" also scored highly, which is likely because to the students wanted to know more about their class mates and instructors.

In addition, according to these results, the opinions of students and instructors were highly positive towards the usefulness of the MobLrN m-learning system's modules. Therefore, it is clear that instructors and students were pleased and would use the developed system as a learning platform in their own courses in the future.

6.3. Satisfaction about the use of the MobLrN m-learning system

The following opinions were used to measure students' and instructors' satisfaction about the use of the MobLrN m-learning system:

1. I communicated easily with my students/instructor/ classmates with the MobLrN m-learning system. *(Communication)*
2. I completed all my quizzes easily with the MobLrN m-learning system. *(Testing)*
3. I uploaded/downloaded the homework to/from the MobLrN m-learning system easily. *(Assignment)*
4. The MobLrN m-learning system helped me reach my teaching/learning goals. *(Learning Goals)*
5. Interaction with the tutor is easy in the course. *(Interaction)*
6. I discussed my ideas with my instructor and classmates. *(Discussion)*
7. I can say that the MobLrN m-learning system satisfied all of my educational needs. *(Educational Needs)*
8. I recommend the use of the MobLrN m-learning system to other instructors/students. *(Recommendation)*
9. I want to use the MobLrN m-learning system again. *(Satisfaction)*
10. The use of the MobLrN m-learning system was very interesting and attractive. *(Interesting)*

The percentages of opinions are given in Figure 3. According to Figure 3, the students and instructors who used the MobLrN m-learning system were generally satisfied. Apart from Item 2, "*I have done all my quizzes easily with the MobLrN m-learning system* (instructors M=92.62%, students M=89.75%)" and item 3 "*I upload/download the homework to/from the MobLrN m-learning system easily* (instructors M=93.13%, students M=90.01%)", it was observed that the students were more satisfied than the instructors in all other items. Some instructors wasted too much time using classical methods to prepare quizzes and also to check the answers. However, we can say that since the evaluation is performed automatically in the developed system, the instructors save valuable time and thus are more satisfied. Since the students can access the system from anywhere and at any time, we can say that they can spend more time completing their assignments, and consequently, the instructors became more satisfied as a result of the success of their students.

The reason that the students were more satisfied in all other items could be because they are younger and thus more inclined to learn and use the new technologies. It is a reality that modern mobile devices are significantly changing young people's lifestyles. They have grown up in a world that is different from that of most adults. Nicklin, Velikova and Boele (2020) reported that higher value is placed on technology by younger people.
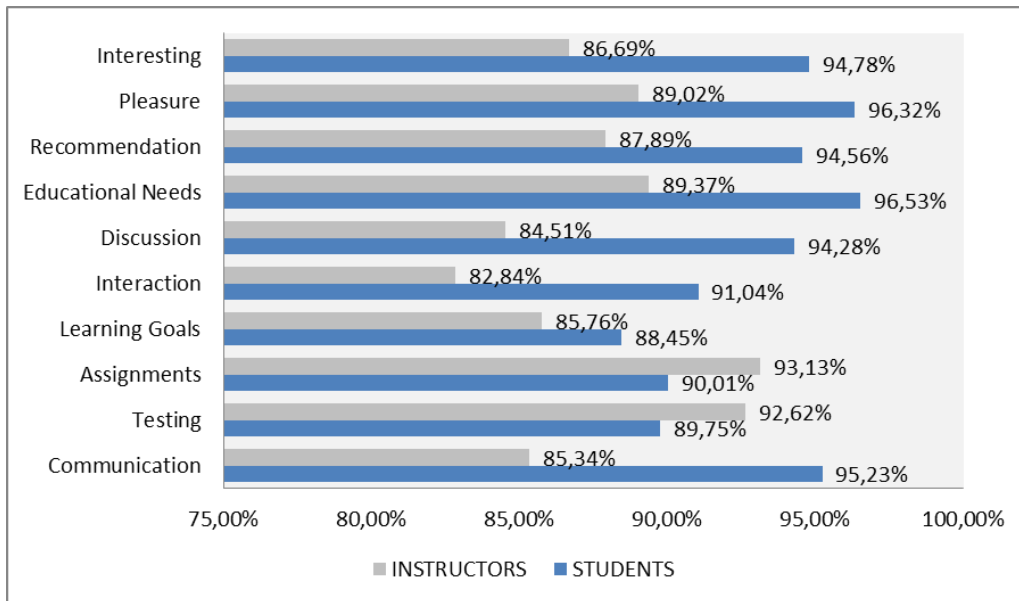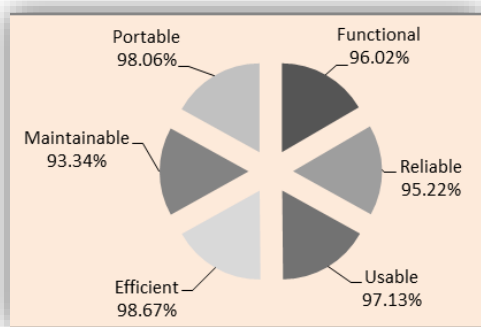
Figure 3: Instructors' and students' opinions about the satisfaction of using of the MobLrN m-learning system
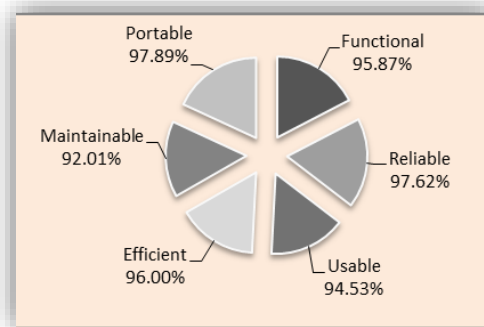
6.4. MobLrN m-learning system quality attributes

In order to obtain the opinions of participants on the quality attributes of the developed m-learning system, the survey consisted of the following topics:

- The MobLrN m-learning system is functional.
- The MobLrN m-learning system is reliable.
- The MobLrN m-learning system is usable.
- The usability of the MobLrN m-learning system is efficient.
- The MobLrN m-learning system is maintainable.
- The MobLrN m-learning system is portable.

(a) Instructors' opinions   (b) Students' opinions

Figure 4: Instructors' and students' opinions about quality attributes of the MobLrN m-learning system

The International Organization for Standardization (ISO) is one of the organizations responsible for developing and publishing International Standards. The ISO/IEC 9126-1 quality standard model was chosen as the framework in this paper, which is known as the software quality standard, covering

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technical and non-technical features of mobile device applications. In particular, the ISO/IEC 9126-1 standard separates software quality attributes into six guidelines where they are used for the creation of any kind of mobile device-based software application. These guidelines are the functionality, reliability, usability, efficiency, maintainability, and lastly, the portability. The functionality is about the expected behaviour of a system. All systems should behave as described in their functional design documents. The reliability refers to the robustness of a system. In particular, a reliable system is one where the operation can be trusted at all times and under all circumstances. The usability is about how easy it is to use a system. The efficiency is about the performance of a system. An efficient system requires less energy and performs its tasks in the most efficient way. Maintainability is about how easy it is to keep a system running and upgrade it where necessary. Portability is about the ability to use a system (e.g. a program) in a different environment to what it is designed for. During the development and testing processes, these attributes can be measured. As a result, the users' perspective of system quality can be determined by measuring the quality of the attributes in use.

As shown in Figure 4, instructors and students were very happy about the quality attributes of the system. The average percentage marks (Strongly Agree) indicate that the users were happy with the general structure of the system. As the obtained values were between 92.01% and 97.89% for students, and between 93.34% and 98.67% for the instructors, the general results were positive and this indicates that the MobLrN m-learning system can be used as an educational learning platform.

7. Discussion

The growth in the usage of mobile technologies and the effect of mobile devices have led to the development of new mobile systems, especially in education. These technological developments have also affected the realization and spread of mobile learning. The results of many studies have shown the benefits of mobile learning for both students and teachers (Clough et al., 2008; Uzunboylu, Cavus & Ercag, 2009). From the positive and encouraging opinions obtained in the study, it is shown that students and faculty members (instructors) do not have any difficulty in accessing the required course materials on the developed system whenever they need it without more effort. Cavus and Ibrahim (2009), Kalolo (2019), and Tsatsou, Vretos and Daras (2019) stressed that mobile learning is suitable for existing mobile devices to help learners to reach course materials and conduct learning activities at anytime and anywhere.

The main requirements of mobile systems are quality, usefulness, usability, and satisfaction. Therefore, the evaluation of the mobile systems is especially relevant; however, few researchers have addressed these criteria using field studies with instructors and students in real areas. Therefore, the most important aspect of the paper is that the developed mobile learning system, MobLrN, has been tested by real users, namely students and instructors. Finstad (2010) used the usability metric for user experience. However, many researchers have used the 5-point Likert scale format questionnaire for the evaluation of the mobile learning systems designed in their studies (Georgieva, Smrikarov & Georgiev, 2011; Luo et al., 2010). Also, Luo et al. (2010) underlined that this type of questionnaire is commonly used for these purposes. Pensabe-Rodrigueza et al. (2020) used a usability assessment in their study. Meanwhile, Kumar, Goundar and Chand (2020) proposed a Heuristics evaluation to test their developed mobile system. All of these studies have demonstrated that various methods can be used to evaluate mobile systems.

8. Conclusions and Future Research

After the formative evaluation, the questionnaire was used to investigate the opinions of instructors and students and the investigation results showed that the participants were satisfied with the MobLrN m-learning system's operations, usefulness, and interface. Both instructors and students seem to have positive opinions about the developed m-learning system. The reason why the instructors expressed positive opinions could be because they were able to carry out their traditional teaching activities within the system developed by the author, and at the same time, these activities could be implemented independent of time and location. Moreover, the experimental results of this research

confirm that, since the means of the instructors' and students' opinions were high, the MobLrN m-learning system is well developed by technically. Also, the interface of the MobLrN m-learning can be easily understood. Ultimately, the features of the developed m-learning system create a flexible and fertile learning context to students that can accommodate different kind of learning activities. Another pleasant result indicates that the MobLrN m-learning system was deemed to be useful for instructors and students for the future. The system is oriented to anyone who may have an interest in mobile technologies, and all higher education institutes.

In the future, as a result of the successful implementation of the MobLrN m-learning system, the author is planning to realize a much wider experimental study to investigate various parameters such as student performance, students' learning abilities, and behaviour by using the developed m-learning system. Unavoidably, there are several limitations related to this experimental study. The first limitation pertains to the sample size used in this research. However, as a result of the limited finances available for this research study, it was necessary to limit the number of participants. The cost of mobile services (SMS, MMS, GPRS, 3G etc.) can be rather high and as a result, the researcher was limited in her studies. In further studies, it is hoped that a solution can be found to the financial problems and that another study can be performed with more participants over a longer period of time. This is because in a longer study, it is expected that the participants will have better knowledge and more experience of the system, meaning that the results of the research study could be different.

Acknowledgements

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