



ENHANCED MOBILE APPLICATION FOR EFFECTIVE TEACHING AND LEARNING IN HIGHER EDUCATION

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Abstract

Due to emerging technologies in the area of information and communication such as telephony and computer technology, there is need for Nigerian's higher institutions to upgrade their curricula and mode of teaching in order to meet up with the fast evolving academic and industry demands. In Nigeria, the mobile technology is one of these emerging technologies that has not been fully utilized to its fullest just as e-learning has paved way for educational breakthrough. In the tertiary institutions, research indicates that lecturers struggle to cover the allotted course contents within a semester because of inadequate hours, which affects both the students and the lecturers. In order to mitigate this anomaly, ubiquitous learning or what is rightly referred to as mobile learning could be applied, where lectures are made available through a mobile application. Therefore, this study aims to develop an android-based application which supports mobile learning (m-learning) for higher institutions. Primarily, the m-learning app offers direct communication between students and lecturers, provides mini-computer based test (CBT), and supports sharing of files and creation of course contents. The app is developed with Android Studio and Mysql database. The analysis and design were performed with the Object-Oriented Analysis and Design Model. The development method adopted is waterfall and Java, an object-oriented programming language was used for programming of the application.

Keywords: mobile learning; ubiquitous learning; Performance indicator; software development; android, mobile technology.

Introduction

Mobile learning is schooling or training carried out utilizing movable computing devices such as smartphones or tablet computers. Mobile technologies are an intimate part of the lives of nearly all educators and students in the western world today (Naismith et al., 2004). It should not be taken for granted that we now can talk to one another at anytime and anywhere. It should not be seen as typical that one can access the Internet for information, snap pictures, record one's thought with a single device and these can be shared amongst our friends, family situated at near or far off places. Recent developments in mobile phone technologies are also providing support for rich-multimedia experiences and location-specific resources. It is obvious that technological equipment is becoming more and more compact as they can be. This accounts for the main reason why our phones, computers and other media devices can now be carried around in our pockets and can connect us to diversified sources of information and enable communication almost everywhere we go. According to Adepetun, (2016), the use of mobile phones in Nigeria remained at a remarkable rise with about 94 percent and still rising. Adepetun, (2016) also revealed that a statistics portal once reported that 15.5 million new phone users may be recorded in Nigeria in the year 2016. It goes without argument to say that students and lecturers formed a part of these numbers reported by statistics. Consequently, an enabling ground has been provided for developing additional engaging mobile applications that will aid in promoting mobile learning. A mobile application that provides support for learning over a distance, which includes enabling a student to participate in a poll, a lecturer/instructor to publish announcements, distribute his course files with his students and quickly retrieve their reflections from polls, is fit to be the start of a mobile learning promotion hence, one of the goals of this study.

Existing System Overview

The administration of courses in Nigerian institutions is strictly class-based. This means that the instructor and students must converge at a point before a class can hold. This approach is widely obtainable anywhere in the world but it is accompanied with a common problem; not being able to cover the scheme of work. This is usually a problem of inadequate time being allocated for the said courses. To mitigate against this problem, Semertzidis, (2013) used mobile learning to improve on this class-based setbacks by developing a Mobile Application that enhances higher education learning. However, Semertzidis'(2013) had some areas that was suggested for further improvement. This study's goal is to create an enhanced version of the Semertzidis work by incorporating functionalities that were marked missing in the previous work.

Mobile Learning

Evaluation of Similar Systems

1. Nearpod

Nearpod offers teachers an easy-to-use application for creating interactive lesson plans, presentations, assessments, and digital content. Nearpod allows teachers to create digital lesson plans, share it with students during class, and track individual progress. Lessons are comprised of teacher-created slides that can include text, video, images, websites, questions, quizzes, polls, and assignments. Students are able to follow the lesson on their own devices at their own pace or teachers can lead a synchronized session where students can follow the lesson in real-time. Nearpod's strength is in the area of being able to track individual progress. Also, for the fact that it supports slide which can contain multimedia is an enormous strength. However, its weakness is the inability for the application to provide support for students to download any of these multimedia contents. There is need for one to be able to still access the learning content with or without the Internet. This weakness is improved upon in the current study. Nearpod is available on iPhone, iPad and Android devices.

2. Remind

Remind is a safe, classroom-friendly communication tool that helps teachers send messages, en masse or targeted, to students and parents. Its strength is that it allows teachers to schedule reminders about meetings, assignment deadlines, send students messages such as daily homework assignments, reminders of upcoming tests, photos of class activities or notes, links to outside resources like articles, videos and more. However, it lacks the ability to message individual students, an entire class of students, or multiple classes at the same time. Available on iPhone, iPad and Android.

3. Quizlet

Teachers can discover content for their classes amongst the millions of study-sets on Quizlet. Save time by finding study sets created by other teachers that cover exactly what students need. With the Quizlet application, you can easily find resources for any subject at any level. Revise for any subject with fun and interactive flashcards, games and diagrams. Its strength is that it makes it easy to discover and create study materials for languages, history, science and more. However, Quizlet is not devoid of drawbacks. Users complain that it does not let them save their work, PDF files cannot be opened in order for one to print. These series of problems make it difficult for one to access his study guide and is due to the fact that proper testing for non-functional requirements was not conducted.

The current study contains non-functional testing which validates the non-functional requirements of the New System. Quizlet is available on iPhone, iPad and Android

Proposed System

As stated in the existing system overview section, the proposed system is basically an enhanced version of the Edulife mobile application whose enhanced version is now termed edulive. The proposed system improved on the existing system by providing improvements in the following listed functional and non-functional requirements areas; the navigation in the application needs to be improved on, Improvements in the file manager, use the android device's primary email, Course creation and management workflow should be simplified, polling participation workflow should be simplified, include privileges option, and add more chart types. The system provides a means for lecturers to create courses, notify students about the new course, grant students request to be part of the course and more importantly, allows for the course contents to be prepared and uploaded in Word doc file format or PDF.

To be part of a created course, the student will have to place a request to join first, the administrator who is the lecturer will have to grant the students' request to join. Upon granting of the request, the student is privileged to download the file to his/her device and also participate in a poll. The poll is a medium through which the lecturer ascertains in descriptive form, the number of students that quite understand the course content. The structure of the poll is basically, questions regarding the subject discussed with possible answers to the questions placed in options (a to d).

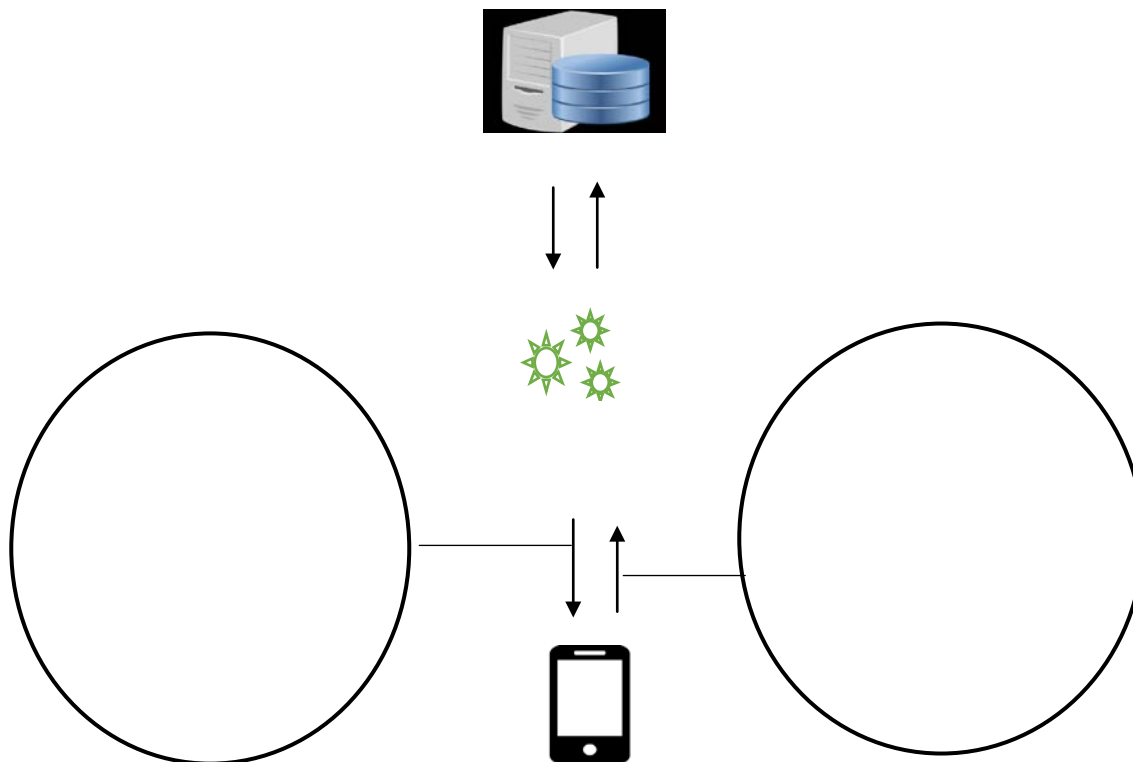


Figure 1.0: The study paradigm illustrating the developer's conceptual framework

The concept is based on a client-server architecture. Figure 1 describes the HTTP request/response model of the mobile application. The mobile phone or any other portable device enables the user to initiate a request to the server. The server-side is coded using PHP and responds in a JSON format. Although the server needs to communicate with the database, this is dependent on the user's request. The application programming interface (API) component is the library upon which most of the Read/Write calls are reconciled.

The features of this system are:

1. It allows users to upload course materials prepared in portable document format or word document format.
2. The administrator which is the Lecturer has the sole right of enabling any user to be part of any created course.
3. Users are notified when they are granted request to be part of a created course.
4. Uses a combination of email and password to provide security.
5. It can function 24 hours a day, 7 days a week as long as there is Internet signal.

Design and Implementation

The system was developed using JAVA an object-oriented programming language and MYSQL an Open Source Database Management System. The software development methodology adopted for the study is the Waterfall model. The system analysis and design technique employed is the Object-oriented and Analysis Design technique.

To use this system as an independent mobile learning service, the university students must provide the necessary hardware and software requirement, which primarily are:

- An android-driven mobile phone and a supported SIM card.
- An Internet connection which is required for the database server communication.

Logical and Physical Design

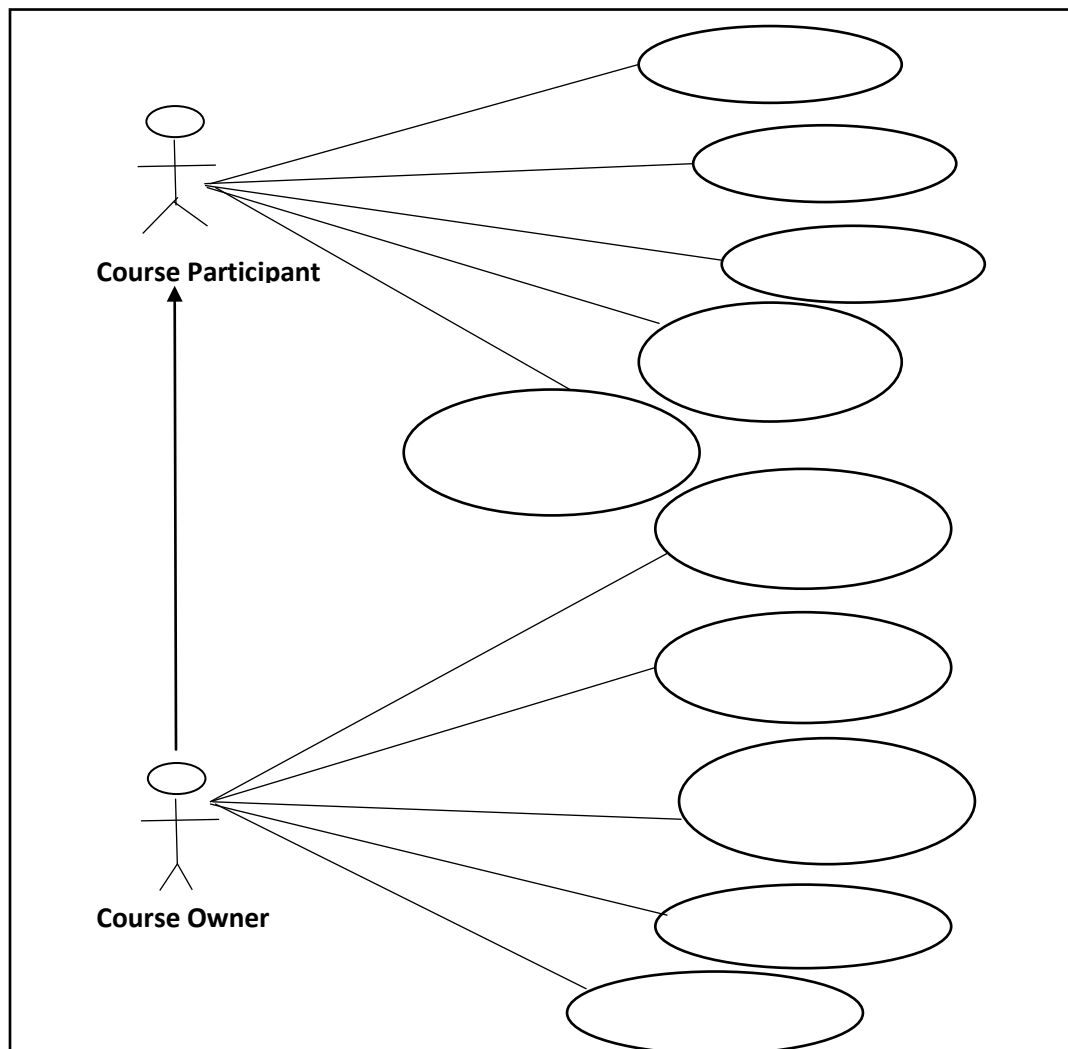


Figure 1.1 Use Case Diagram of the Proposed System

A use case is a list of steps which defines interactions between actors and a system, to achieve a goal. An actor is a person, organization or external system that plays a role in one or more interactions with the system (Alexander & Neil, 2004). This model shows the interaction between a system and its environment (users or systems) within a particular situation. The use case diagram developed for this study is shown in Figure 1.2. The diagram in Figure 1.2 shows that there are two actors; course participants and course owners, with the last to inherit the interactions of the first.

The oval shapes contain the activities or actions the actors (users) can initiate. The course participant can create course, edit profile, vote in a poll, download a file or request to join a course. The course owner can edit/delete course, add course user, upload a course file, create a poll or delete a poll.

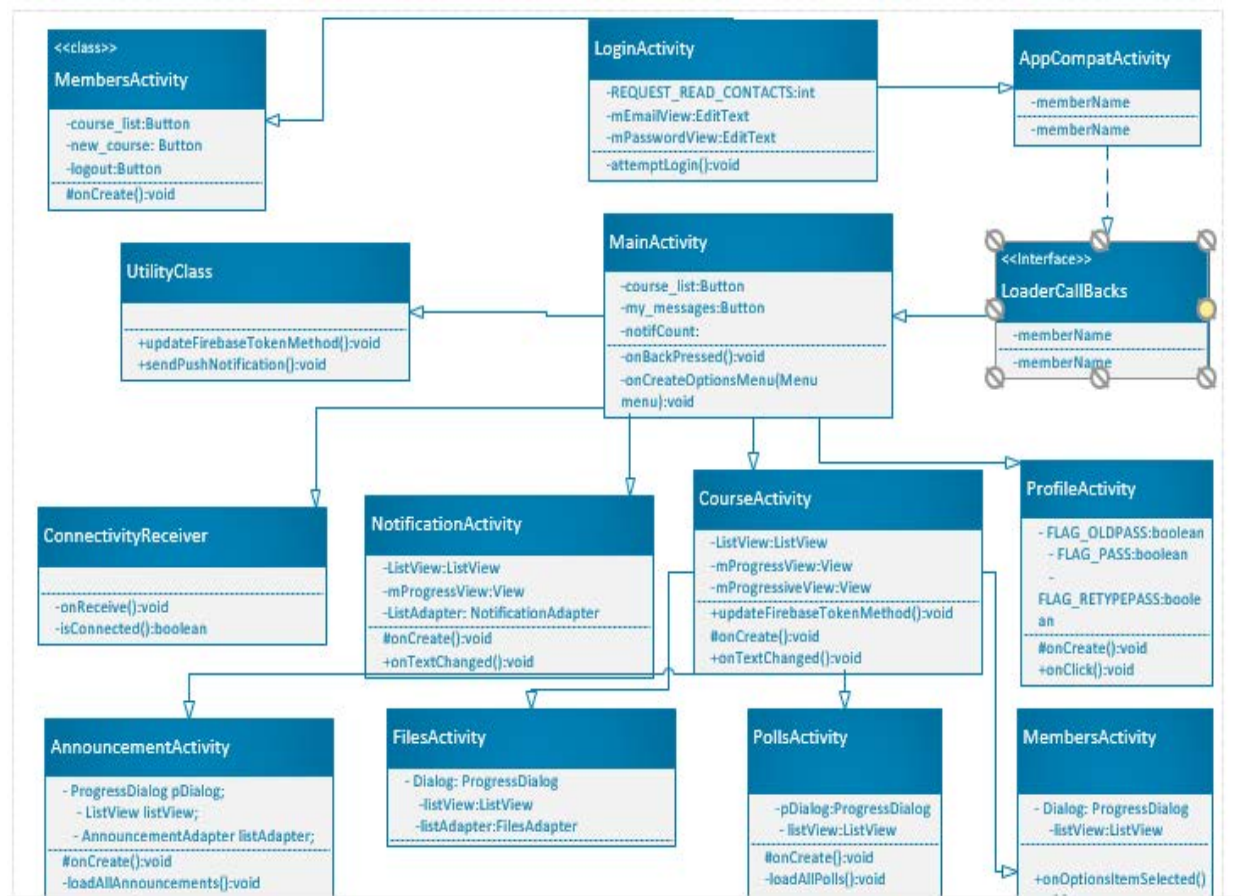


Figure 1.2 Simplified Class Diagram of the Proposed System

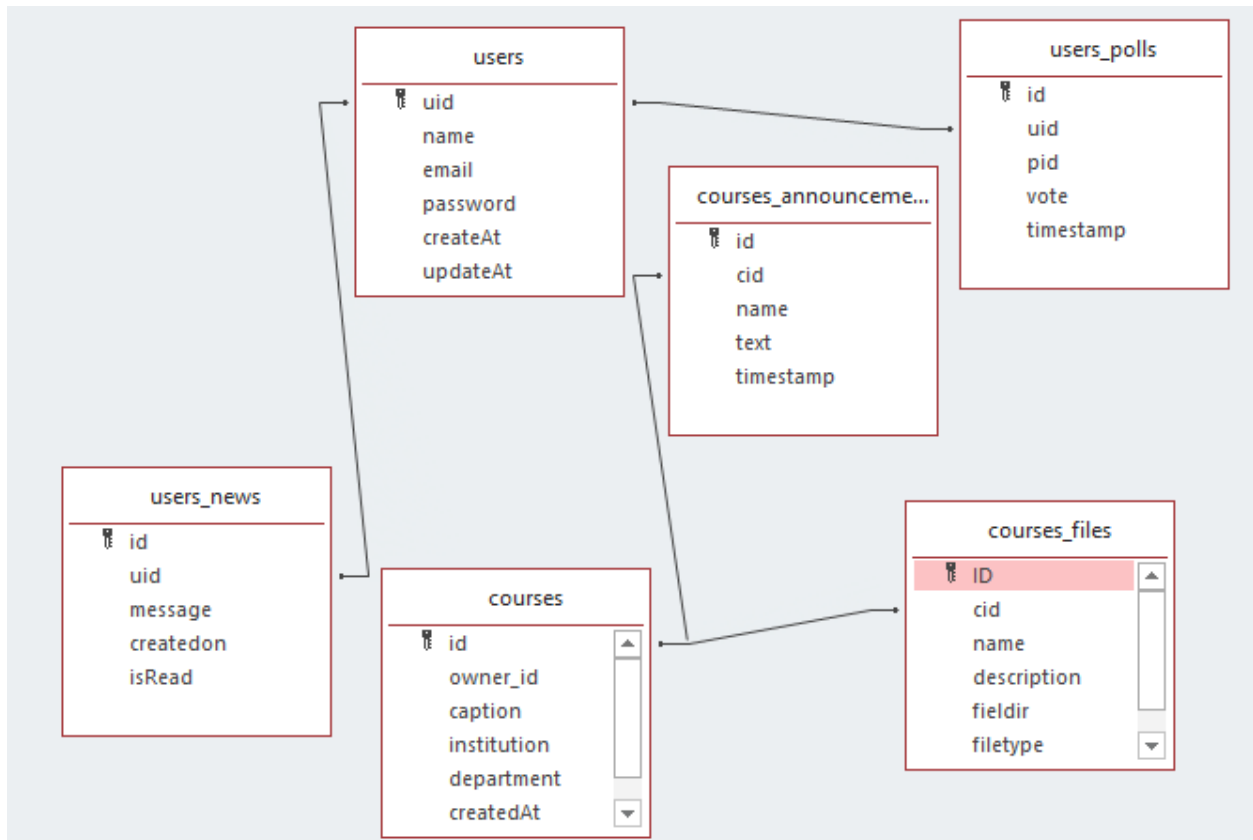


Figure 1.3: Entity Relationship Diagram of the Proposed System

Figure 1.4 shows the entity relationship diagram of the web server's database. The table "users" is used to store the details of the users of the system. The table "courses" is used to store all the courses that have been created by the users. The table users_news is used to store all the users' news. The courses_polls, courses_announcements and courses_files tables are used for keeping the announcements data, files data, and polls data of each course. The users_courses table is used to match users to courses. Similarly, users_polls table is used to match users to polls.

In all tables, except users, users_courses and users_polls, there is a primary key, which means that it should have a unique value. The tables users, users_courses and users_polls have two primary keys, which means that they do not accept a row with the same primary keys.

Code Module Snippets

```

public void onItemClick(AdapterView<? > arg0, View view, int position, long id) {
    // When clicked, show a toast with the TextView text
    if(position == 0){//manage polls
        Intent i = new Intent(CourseMapActivity.this, PollsActivity.class);
        i.putExtra("courseid", courseid);
        i.putExtra("viewtype", "owner");
        startActivity(i);
    } else if (position == 1){//manage announcements
    
```



```
        Intent i = new Intent(CourseMapActivity.this, AnnouncementActivity.class);
        i.putExtra("courseid", courseid);
        i.putExtra("viewtype", "owner");
        startActivity(i);
    } else if (position == 2){//picture update
        Intent i = new Intent(CourseMapActivity.this, FilesActivity.class);
        i.putExtra("courseid", courseid);
        i.putExtra("viewtype", "owner");
        startActivity(i);
    } else if (position == 3){//manage active members
        Intent i = new Intent(CourseMapActivity.this, MembersActivity.class);
        i.putExtra("courseid", courseid);
        i.putExtra("viewtype", "active");
        i.putExtra("usertype", "owner");
        startActivity(i);
    } else if (position == 4){//Manage pending member requests
        Intent i = new Intent(CourseMapActivity.this, MembersActivity.class);
        i.putExtra("courseid", courseid);
        i.putExtra("coursename", coursename);
        i.putExtra("viewtype", "pending");
        i.putExtra("usertype", "owner");
        startActivity(i);
    }
}
});
}
```

The module above is responsible for listing all created courses when the ListView object is clicked on.

System Verification

To verify the operation of the system invariably means checking to see if the functional and non-functional requirements were met. The system testing illustrated using a lecturer “Mr Opara Camillus” with email “oparac@gmail.com” and a student “Joy Iroegbu” with email address “joyiroegbu@gmail.com”.

Figure 1.2 is the Home screen. It contains the Login section and a link to the registration screen. Unregistered users will have to click on the Register link. The figure reveals the details of the Test lecturer.

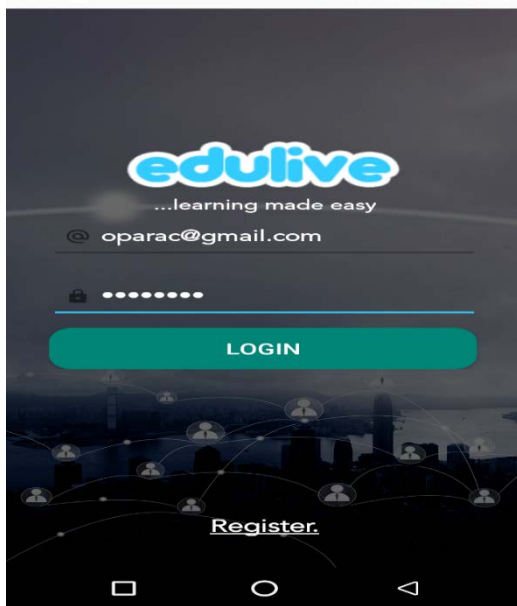


Figure 1.4 Home screen

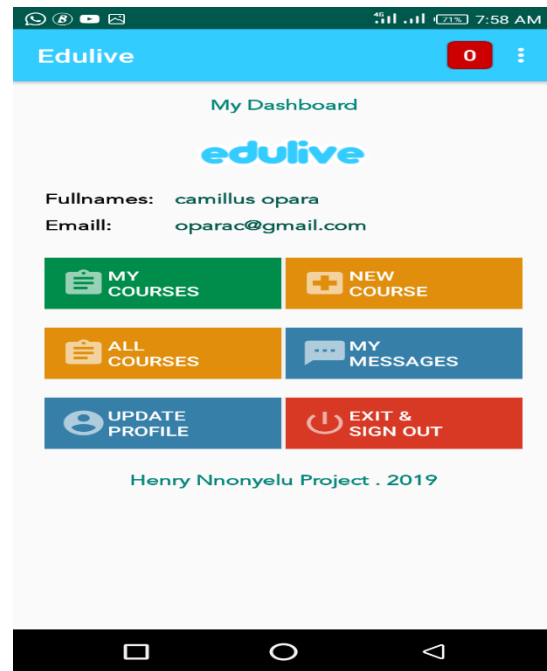


Figure 1.5: User Dashboard

Upon successful login, the user is welcomed in the dashboard as reveal in figure 1.5. The Lecturer then creates a new course by tapping on the NEW COURSE button.

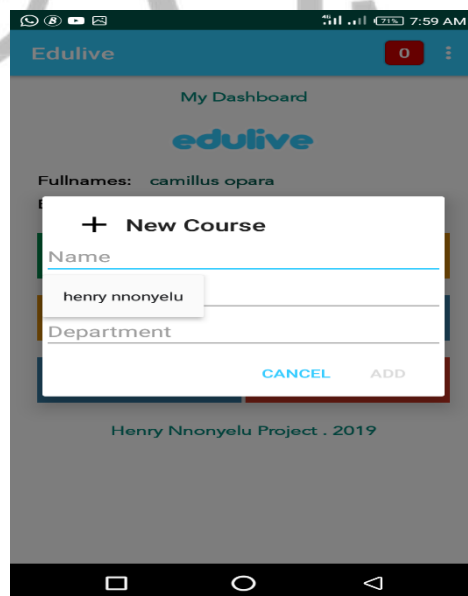


Figure 1.6: New Course form

The user will have to enter details of the new course in the form as shown in figure 1.6. The fields name, Institution and department are all required.

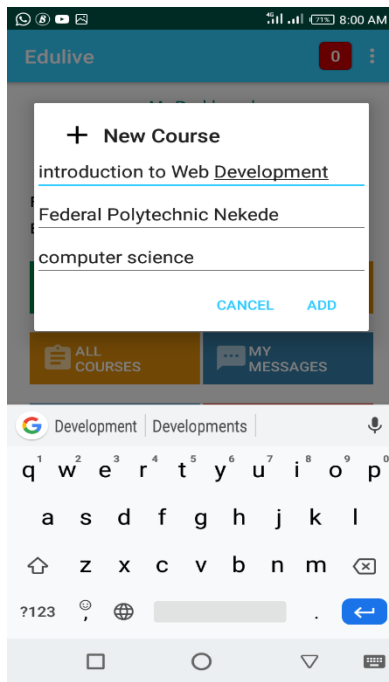


Figure 1.7: Filled New Course form

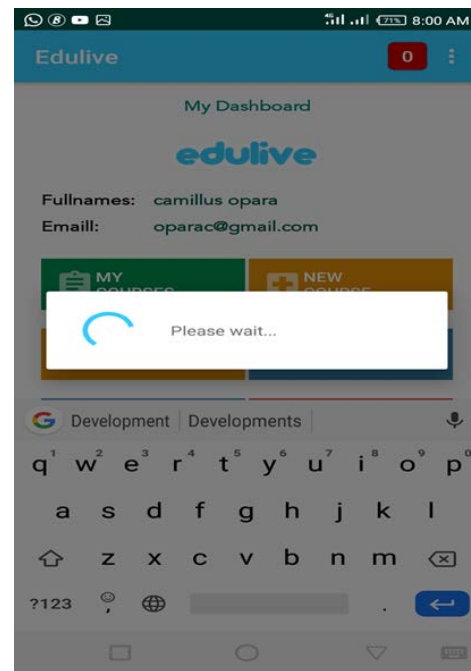


Figure 1.8: Processing NEW COURSE request

After filling the form as revealed in figure 1.7, the user clicks on the ADD button and waits for the system to process the request as shown in figure 1.8.

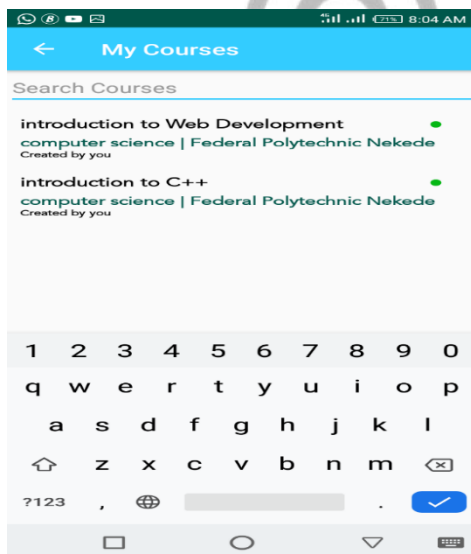


Figure 1.9: My Courses screen

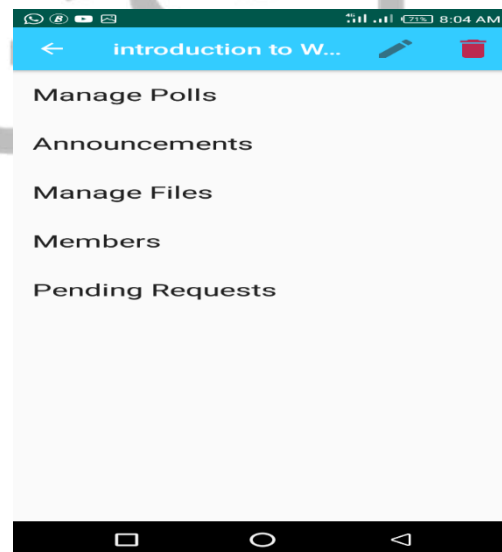


Figure 1.10: Course options

My Courses screen is a screen that reveals a list of all created courses. This is shown in figure 1.9. Each course listed in My Courses section has options for setting it up properly. Figure 1.10 reveals the course option for introduction to Web Development created by the Test Lecturer. To create poll for the course, click on MANAGE POLLS, to create announcements for the course, click on

ANNOUNCEMENTS. To upload files for the course, click on **MANAGE FILE**. The **MEMBER** option reveals students that has been granted rights to be part of the created course. To see a list of the request for a particular course, you tap on **PENDING REQUESTS**.

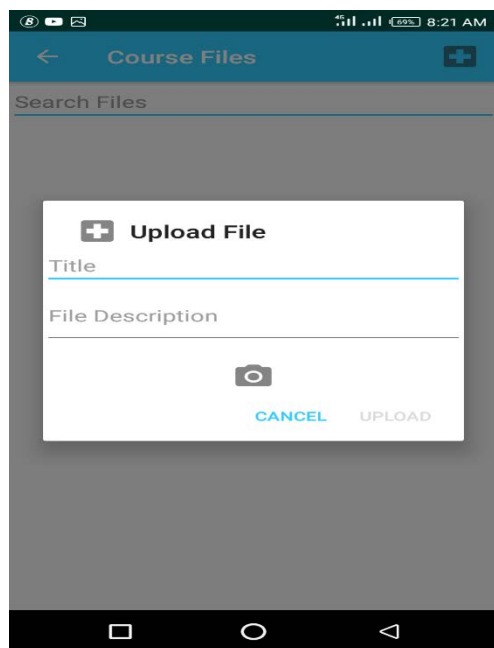


Figure 1.11: upload file dialog box

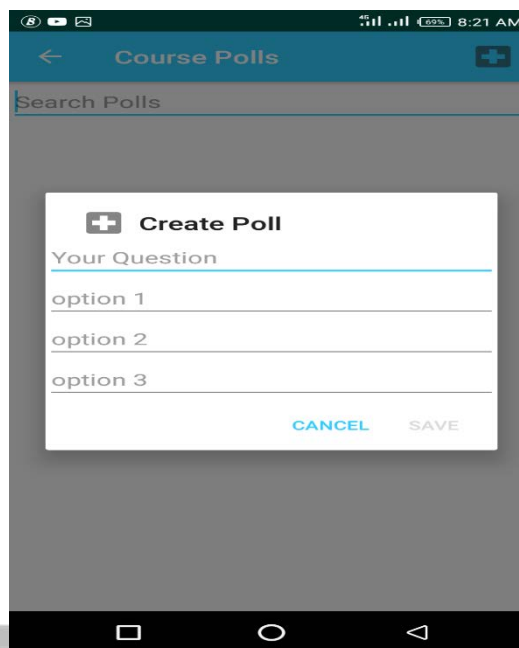


Figure 1.12: create poll dialog box

For the purpose of the system verification, user taps on **MANAGE FILES** in order to upload course material for the new course. The screen in figure 1.11 is revealed. It is a dialog box that will enable the Lecturer select the file for the course. The Lecturer can also create a Poll for the newly created course as shown in figure 1.12 and 1.13.

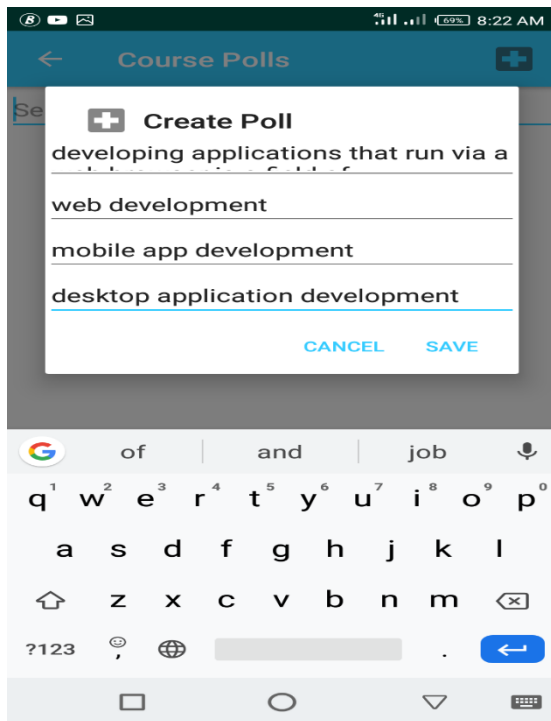


Figure 1.13: Create Poll dialog box

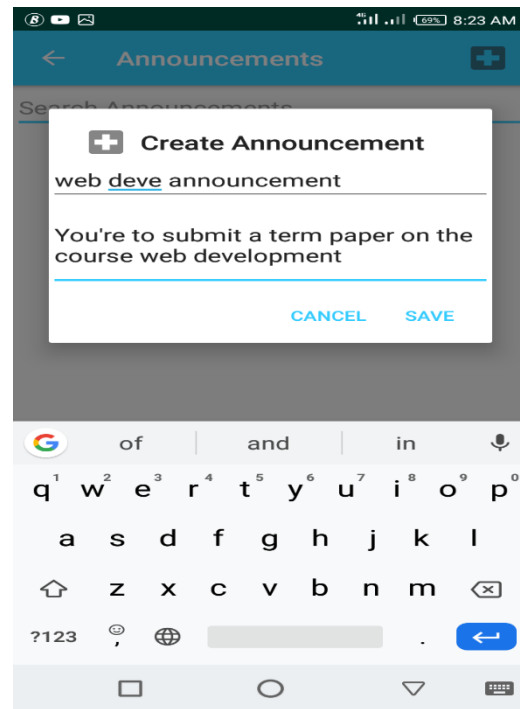


Figure 1.14: Create Announcement dialog box

Optionally, the Lecturer can create announcement as shown in figure 1.14. Upon successful upload of the course material, the screen contained in figure 1.15 is revealed.

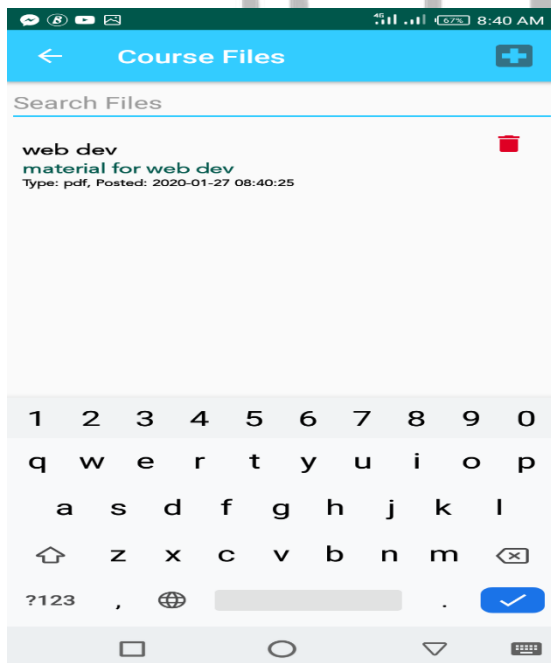


Figure 1.15: Course files screen



Figure 1.16: Dashboard for Student

The lecturer is done creating a new course and the test student logs in with her device as shown in figure 1.16. Test student taps on ALL COURSES to view the list of available courses as shown in figure 1.17.

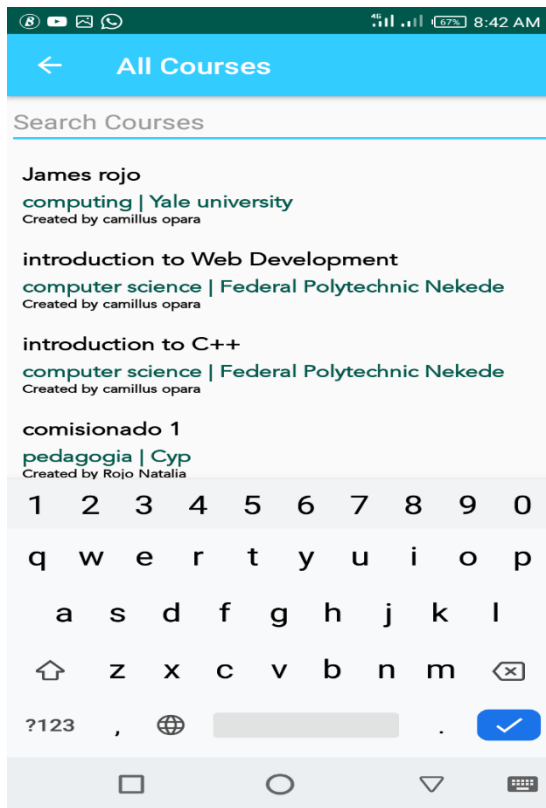


Figure 1.17: All Courses screen

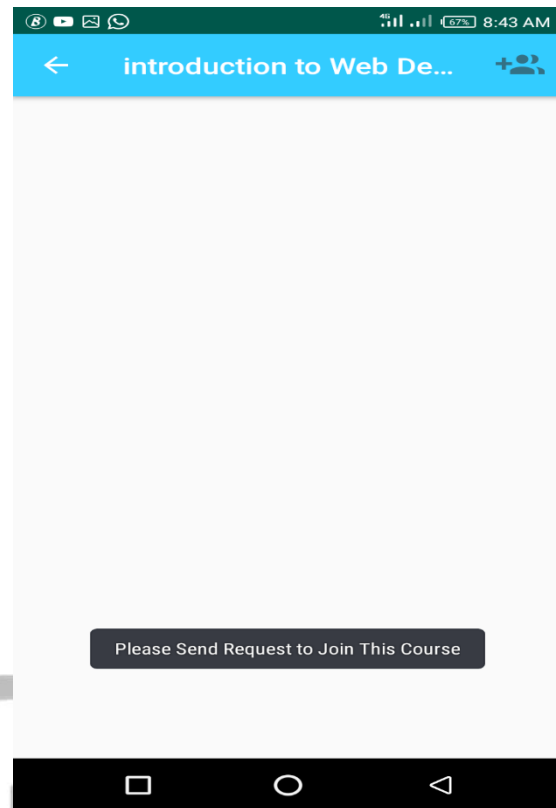


Figure 1.18: Request to join screen(a)

The student taps on “introduction to web development” the screen contained in figure 1.18 is revealed. The Lecturer will have to approve of the request before the student can become part of the learning forum. Student affirms of the request as shown in figure 1.19 by tapping YES.

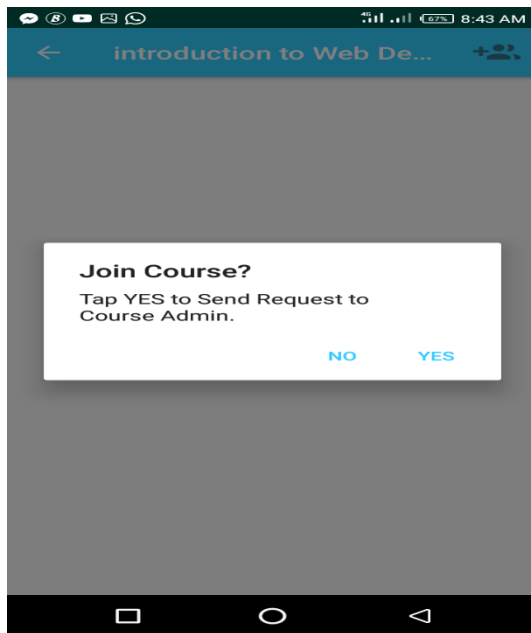


Figure 1.19: Request to Join(b)

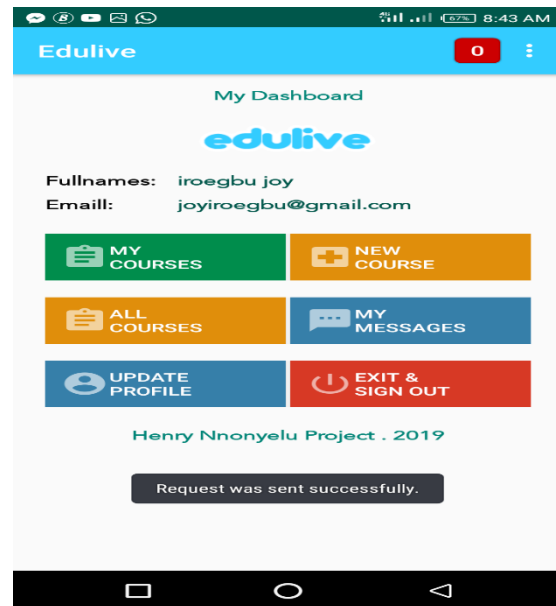


Figure 1.20: Request sent awareness message

Figure 1.20 is returned after the student requests to be part of the course and the awareness message is implemented as shown in figure 1.20.

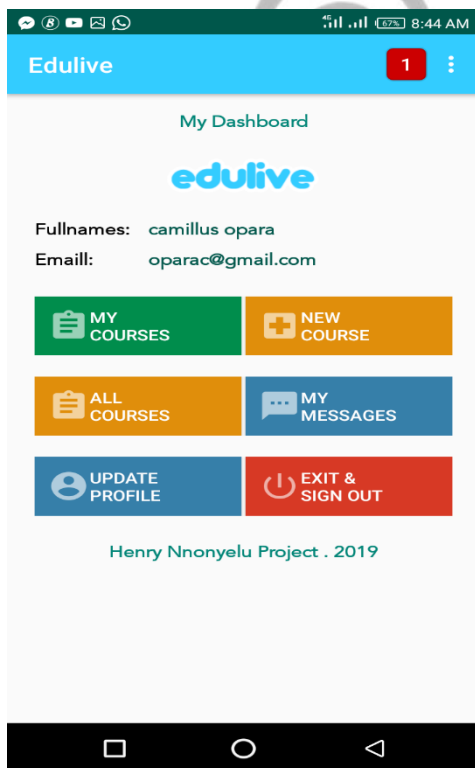


Figure 1.21 Lecturer Dashboard

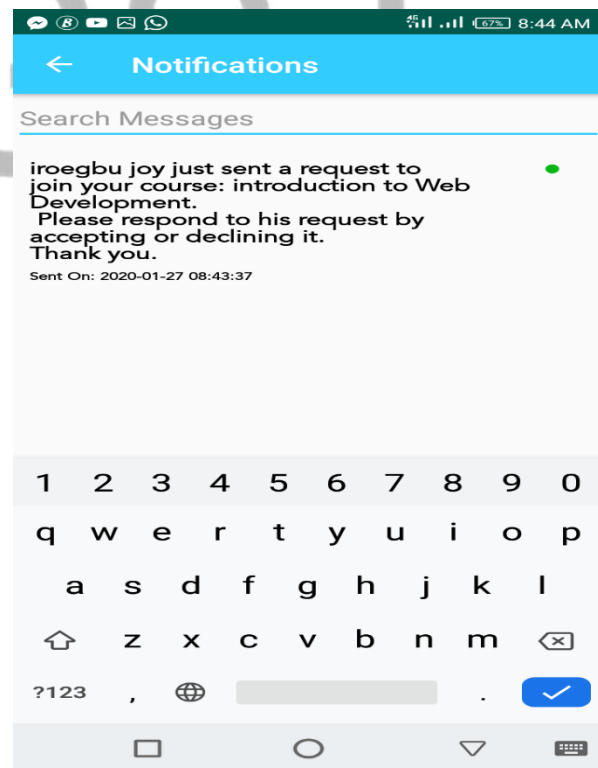


Figure 1.22 Notifications area

The Lecturer will have to grant the request so he logs in as shown in figure 1.21 and at the top right corner of the screen the red button reveals the total number of requests to join a course. Tapping on the notification icon revealed the screen contained in figure 1.22.

The student can then log in and download the course file, access the poll, or read the announcements specified for the course.

Comparison Report

In order to make comparison between the existing system and two out of the reviewed mobile learning application described in the Evaluation of Similar Systems section, there is need to identify the performance indicators that will be used as a basis for making comparisons.

Performance Indicators

1. **Reliability:** refers to the ability of the software to provide desired functionality under the given conditions.
2. **Functionality:** refers to the degree of performance of the software against its intended purpose.
3. **Usability:** refers to the extent to which the software can be used with ease.

Comparison Report of the Existing and New System

A senior lecturer in Computer Science Department, Federal Polytechnic Nekede made this comparison. The developer only assisted in the process. The table below shows the basis for this comparison. This table is a prove that there is actually an improvement of the existing system. It is compared using the identified performance indicators.

Table 1.0 Proof of Enhancement

Basis of comparison	Description of the basis for comparison	Existing System	New System
Reliability	Refers to the ability of the application to provide desired functionality under the given conditions.	The file manager does not operate fairly well when trying to upload a file. The back button exits the app instead of the app taking the user a step backward.	Does operate as expected. The File Manager responds to the back button by taking the user a step backward.
Usability	Refers to the extent to which the application can be used with ease.	User interface is fairly good but the course creation workflow and	User interface looks good with options placed on open

		management is not smooth. User sometimes needs guidance when creating a new course. This is not user-friendly.	boards. No form of navigation like in the old system. This is definition of user-friendliness.
Functionality	Refers to the degree of performance of the app against its intended purpose.	For functions such as upload a file, user is left frustrated if there is need for the user to go back in order to select another file for upload. The functionality that involves the use of the file manager is not responsive. The create course functionality sometimes makes the app to hang. This is possibly due to a bug, not quite sure.	Purpose of its use is always achieved. File manager and create course functionalities are always responsive.

Advantages of mobile learning system

Mobile learning is gaining swift popularity because:

1. **It offers flexibility to learners.** Learners are no longer limited to learning at one particular spot and one particular method. Learners have the flexibility to either learn using Podcast, video, Audio or pictures while on the move with their mobile devices.
2. **Better completion rates and higher retention.** Contents provided in mobile learning platforms are concise.
3. **Multi-device support.** The same content is made available across all devices; laptops, Personal computers, tablet and smartphones.
4. **Learning path.** Phone organisers and reminders are integrated in the mobile learning platforms enabling learners to be notified promptly about updates in courses.
5. **Collaborative learning.** Engaging learners towards the establishment of online learning communities is more effective using mobile devices. This is one of the biggest mobile learning advantages, as learning as a process quite often suffers from lack of collaboration among eLearners.

Limitations of Mobile learning

1. **Connectivity:** if the user is situated at a place where is poor to no signal. The mobile learning system becomes useless.

2. **Cost:** A mobile device with limited functionality capabilities may not be suitable for m-learning. Hence, a student has no option but to get one with the required level of functionality so as to access the online courses. This mobile device may be relatively expensive.
3. **Size inconvenience:** The mobile device normally has a small screen size where the student is forced to strain their eyes as they access the online resources. The information provided may also be incomplete due to the limited size of the device.
4. **Limited storage:** Memory storage that is available in mobile devices may not be enough to store numerous offline content and other downloaded resources.
5. **Unexpected distractions:** These distractions may be in the form of a simple SMS, notification or call as someone accesses online content.

Recommendations and Further Work

The new system is significantly an improved version of the existing system. This application is therefore recommended to be used by higher institutions as it does not intend to eliminate classroom lectures but to bridge the communication gap after school hours. The new and improved application is fit to be used by schools and institutions but the following points should be noted as suggestions for future developers:

1. As course owner, the “manage poll” option should not reveal the poll questions because the course owner is assumed to be a lecturer and so should not be part of the poll. Course owner should only view show chart.
2. More chart options should be incorporated.
3. There should be an option to enable course participants upload a file back to course owner.
4. The “upload” button should be active by default instead of becoming active after user has selected file for upload.
5. This mobile application should also be built for IOS phones.

Conclusion

The waterfall model is always ideal for use in cases where the requirements never change. A comparison report was developed to evaluate the new and existing system in order to ascertain whether there is actually an enhancement. The report showed clearly that there is an enhancement based on the performance indicators identified in the study. In conclusion, the collective identified performance indicators (functionality, usability and reliability.) have a significant role to play in the determination of the need for the existing system to be improved on.

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