Mobile App Prototype for Course Management in Secondary Education

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Abstract—In the last decade, mobile applications have proven to be constantly evolving where it has played an important role since the development of technology. Children and adolescents are very interested in these new technologies, and it is easier for them to use them, which also helps them to learn any subject of their interest. That is why in this research a mobile application prototype is designed for the management of courses in secondary education. The Scrum methodology was used to develop its phases. As a result, a proposal arose to develop a prototype of a mobile application to improve student learning. The survey result shows that most of the questions have a high rating scale, with the highest average being 4.91 with a standard deviation of 0.302, and only a low rating scale of 1.45, on average, with a standard deviation of 0.52. The study is scalable, where it can be applied to university education. The beneficiaries are the educational communities.

Keywords—Balsamiq, education, learning, mobile app, Scrum methodology

1 Introduction

Due to covid 19, the education system had to change its strategies and teaching methods, which affected both teachers and students, for this reason, the mobile app was proposed as a complementary tool, which will be implemented to improve the course management system in the private school, Monte Carmelo. According to the author [1], not only smartphones but also apps play an important role in learning and management, which makes it easier for students to organize their time. Furthermore, mobile edge computing can create a carrier-class service with high performance, and accelerate the download of content, services, and apps on the network [2]. Which gives an update to the educational administration system [3]. The article analyzes modern textbooks and teaching materials as part of pedagogy, the solution to the found problems is called management in educational systems.

The periodical use of the cluster analysis method allowed the investigation of a potential market for consulting services, to identify the modern management needs of educational organizations [4]. In addition, the use of assignment management based on information technology with an analytical approach can help to efficiently solve the problems in educational organizations [5]. The study is about teachers' experience and practice teaching new programmers, having students with a specialty in smartdevice technology, as well as research activities [6]. Emerging technologies in academic and administrative management are based on the use of robotic process automation (RPA), enterprise resource processes (ERP) and Learning Management Systems (LMS). In this sense, teachers and employees must be trained in the use of said tools.

This research was carried out because some schools do not have an established system to help students manage their free time to complete their academic tasks or homework. The objective of this study is to implement a mobile app for course management to help high school students. This research was made as follows: section 2, explains the review of the literature, and analysis of different investigations. section 3 defines the Scrum methodology and its phases, that will be used in this investigation. section 4 presents the results, section 5 discussions, and section 6, the conclusions.

2 Review the literature

This study is based on the development of a mobile app to support the administrative and educational management of Monte Carmelo Private School with the help of information Communication Technology (ICT) tools, as the school does not have the necessary technology to do a successful performance. In this section, the analysis of the different investigations was focused on finding their results and conclusions, to compile and contrast information for the development of the course management app.

The authors [7] mention that m-learning has the potential to take education beyond the classroom. These new technological tools create a demand to restructure pedagogy and the school system. For that reason, the use of mobile apps regarding education has been made in correlation with technology. In the study, the author [8] expresses that although many have investigated about the importance of mobile learning, other aspects like how to adopt mobile learning have not been sufficiently addressed yet. Having as a context that each year the use of mobile devices such as tablets and smartphones increases. Therefore, more apps are being developed to meet the demand.

According to the author [9], the research is based on one question: How does the development of mobile learning, based on Android Honeycomb, improves the education quality and the accessibility to basic professional courses, especially regarding curriculum and instruction courses? In Universities, the transformation and development of modern information technologies (IT) have affected the educational process of many educational organizations. The transformation and development of modern information technologies in the educational process justify many educational innovations that promote the professional training of future teachers [10]. This is very important for future teachers, to understand complex intelligence as the component of the information educational environment; teachers must understand their own minds and other components

they interact with, in order to develop intelligence. According to the author [11], without having time and place as limitations, eLearning offers a great learning environment. Blackboard offers simplified teaching and assessment systems. The purpose of this study is to examine how administrators, faculty members, and students use Blackboard Ally for Learning Management Systems (LMS) in online classes to analyze the learning process and success of the user/student.

According to the author [12], this article aims to outline different pedagogical strategies with apps used in the classroom. At the same time, apps are being developed to meet this demand. Also, these apps can be used as a source of information and as a tool to share class material. While there are specific features that separate this from traditional software development, there was a lack of guidance on issues that arise during the mobile software development process [13], having as goal developing a mobile app framework. It started by conducting a systematic mapping study of the mobile app software development process, then conducting a survey and completing a qualitative study in the industry. The authors [14] mentioned that the use of embedded apps has been concerning not only to software vendors but also to hardware manufacturers. The academic community voluntarily joined the discussion in terms of theory and empirical measurement, having experience and knowledge in desktop environments. According to the authors [15], the purpose of the study is to discuss the students' perception regarding the use of a mobile app having as a tool to help learn new vocabulary and phrases in English, the author aims to identify strengths and weaknesses according to the student's feedback. On the other hand, the authors [16], share the findings of some scientific publications that specifically identify the key features and explain the differences between mobile apps and traditional software. For this purpose, an online survey regarding research and community development was conducted.

The algorithms and techniques that are treated in the course are complex and difficult to assimilate. Therefore, a mobile app was considered the new way to reach students, to teach Flight Training Learning Platform (FLA). The application is developed for Android mobile phones and tablets. According to the authors [17], they mean to indicate that electronic textbooks, testing systems, and other software are being developed. Most of them are intended to be run on personal computers. Also, mentions that smart education is sophisticated. The study emphasized increasing the effectiveness of a mobile-oriented learning environment using augmented reality, which allows the integration of real and virtual learning tools through mobile devices [18]. According to the authors [19], they focused on the students' motivation factors and determine how crucial the role of teachers is to motivate English learners in ESP classes at the University of Dhofar. Also, highlighted the importance of motivation when learning through a mobile app.

The experience of applying the project-based blended learning approach using visualization technology in teaching mobile app development for IT students [20]. This technology is based on a project-based method, pair programming, teamwork, and the use of digital educational resources such as visual learning content. According to the author [21], the mobile internet is a product of the integration of the traditional internet and mobile communication industries. This research mainly analyzes the use of Internet-based mobile information systems in education. The authors [22], shared the results

of the study which shows that the students in the third group outperformed the students in the other two groups. The results can be attributed to their enjoyment, motivation, and positive attitude towards the use of tablets, as well as the teaching method. The author [23], mentioned that the study highlights the impact of different backgrounds regarding the use of mobile apps for the learning process. Also, the result shows that the price has insignificant influence on how likely the students are to use the app. The author [24] showed how relevant the educational system is for society. Also, mentioned that the integration of mobile devices in education, as a bridge between internal and external educational activities, is not fully exploited.

In conclusion, after analyzing the information from the authors mentioned above, software was developed to help students manage their free time in order to improve their academic learning. Although many have investigated the importance of mobile learning, the impact of the educational process in educational organizations has not been sufficiently addressed. While there are specific features that separate this from traditional software development, there is a lack of guidance on the issues that arise during the mobile software development process, specifically identifying the key features and what will set this app apart from others.

3 Methodology

In this investigation, Scrum methodology was used (see Figure 1), the phases of the methodology are described as well as the tools used for the prototype, and some recommendations for the development of the app [25]. Each phase is explained in detail.
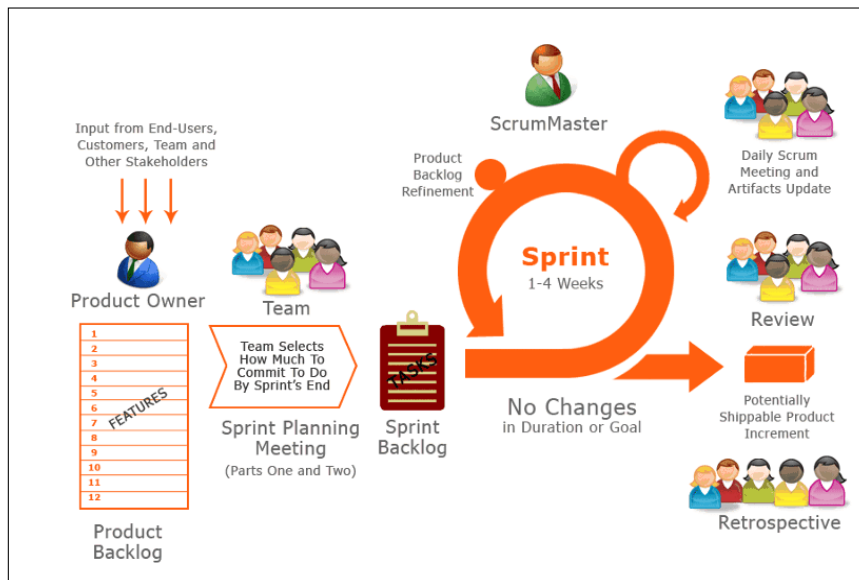

Fig. 1. Scrum Methodology

3.1 Scrum

It is an agile development software that has spread to other industries. This is a process that is applied in a set of good practices in a collaborative way [26], as the team aims to achieve the best possible results in a project. Also, it immediately adapts to changes, obtaining a constant rhythm, both in terms of sprint length and effort. The stages of the methodology were described below. The roles are the scrum master who is responsible for applying the scrum correctly; the development team that fulfills the function of the development part and finally the product owner that is in charge of obtaining the requirements of the users.

Initiation: In this phase, the project is studied and analyzed to identify the basic needs of the sprint. The questions we ask ourselves when carrying out this phase are: What do I want? How do I get it? And how much do I want it? In addition, the teams were defined from 3 to 5 people to facilitate the proposals of ideas and creativity to the group. The processes that will be developed in Scrum are creating the project vision, identifying the Scrum Master and stakeholders, forming Scrum teams, developing epic or user story, creating lists of requirements prioritizing the product, and planning the launch.

Planning and Estimation: In this phase, the following steps were developed: create user stories, identify, estimate tasks, and finally the creation of task iterations. The planning allowed to organize appropriately.

Implementation: In this phase, meetings were held, and we discussed the sprint and options to optimize the workload per team in order to give shape to the project. In this phase, the following processes are fulfilled: create deliverables, perform daily stand-up, maintain the backlog prioritizing the product, and refine the elements of the backlog inside or outside the meetings [27].

Review and Retrospective: In this phase, as everything was implemented, the work performance of the team groups are reviewed, and feedback or solutions to problems that arose will be provided. There are two important steps in this phase, demonstrate and validate sprint, and sprint retrospective. Giving feedback is very important, since in this way you can obtain good practices.

Releasing: In this phase, the delivery of the product and the outcome of the project are carried out, which must comply with only one task, getting the project deliverables ready, and the project retrospective.

3.2 Design tool

The internet, smartphones, mobile apps, and new ways of communicating have changed the way we live around the world [28]. As an estimate, nine out of ten people with mobile phones can download apps that are connected to the Internet [29][30]. The design tool used for the project was Balsamiq, this is an application to create mobile applications without the need to know a programming language. It provides interactive components to build blocks, called components. These features can be customized and allow you to design the app interface more efficiently. Behind the scenes, offers the so-called dynamic react act, which brings to life the app.

The app integrates the pages we developed and adds features such as login, user account, permission management, viewing, and interaction with other devices, as well as integration with Zapier services and thousands of affiliates. Just like AppSheet, Balsamiq brings your app to life through the use social media. These store the interactions between the various app components, manage userdata, and connect multiple related apps. The marketplace within Balsamiq offers a variety of urban offerings, allowing you to add new services.

3.3 Development tool

In this project, we used Star UML as this software uses classical model notations and semantics associated with the Unified Modeling Language (UML), which allows to identify use cases. Also, we used Balsamiq which works with a graphical interface that designs the app by dragging the functions we are requesting. It is recommended to use a development tool like Jira, which is an online tool for project task management, bug and issue tracking, and operational project management.

3.4 Development of the methodology

According to the methodology mentioned above, we developed the app based on the phases of initiation, planning and estimation, implementation, review and retrospective, finally the releasing phase.

Start: In this stage, we made three questions. What do I want? The answer is to design and develop an educational management mobile app for secondary-level students. Following the question, how do I get it? Using tools such as Balsamiq and Star UML. Final question, how much do I want it? It is highly required for private schools to help students in the learning process and management.

Planning and estimation: In this stage, the dimensions to create the questionnaire are established. In addition, functional and non-functional requirements are put in place. The functional requirements will describe the behavior of the system regarding its functionality. Table 1 shows the functional requirements used in this project.

Table 1. Functional requirements

Nº	Functional requirements
1	User Registration
2	User Login
3	Access to enrolled courses
4	Access to class assignments and material
5	Access to virtual class

The non-functional requirements define the characteristics of the system and its performance, which generally include attributes such as security; reliability; portability; quality; compliance; accessibility; efficiency (see Table 2).

Table 2. Non-Functional Requirements

N°	Non-Functional Requirements
1	Security: Show security for users in its usability
2	Reliability: the reliability that must be had in the use.
3	Portability: Portability from one place to another
4	Quality: The quality in the use in an integral way
5	Compliance: Accurately determining compliance
6	Accessibility: Access intuitively by end users
7	Efficiency: must be efficient in decisive stages

Implementation: Scrum has three fundamental roles, product owner, scrum specialist, and team members. Product Owner: the product owner is responsible for communicating the product vision to the development team. In this project, the product owner is the school that will give the vision for the app and the company that will create the app, as they develop the software. Scrum specialist, the scrum master acts as a liaison between the product owner and the team. The team members are responsible for completing the work. The business actors identified, refers to the user which in this case is the student staff, then the teachers who will record how to review tasks, and finally the administrative staff that will follow up and monitors the progress of the students. It defines the interaction between the user and the app, the user selects a course from a list following a pre-requisite requirement. First, the user needs logged in and once the course is selected, it will show up in the dashboard; the mobile app is developed. using Balsamiq. Figure 2 shows the use case and the relationships that the user has with the system and their respective methods.
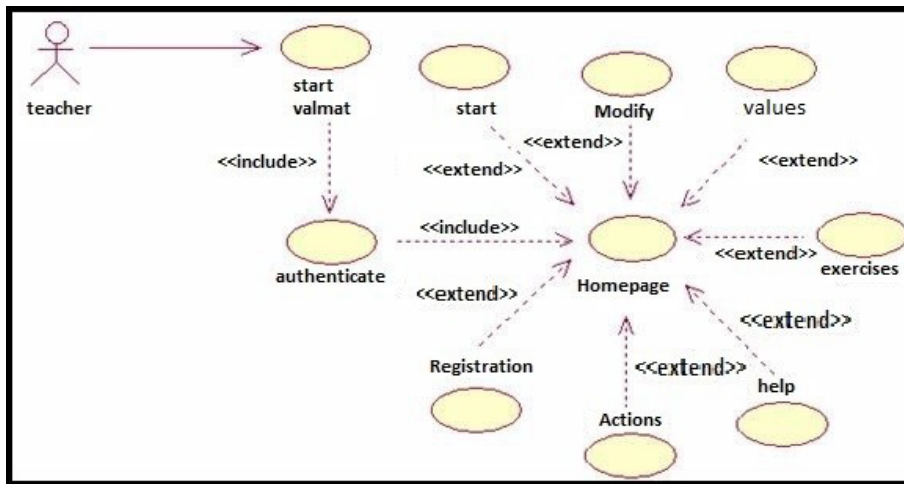

Fig. 2. Use Cases

Figure 3 shows the flowchart of the registration process for this mobile app. The initial prototype of the mobile app, the graphic user interfaces and actions that will need

to be designed and configured. The development of the prototype took 15 days, including the design of the app and the logo.
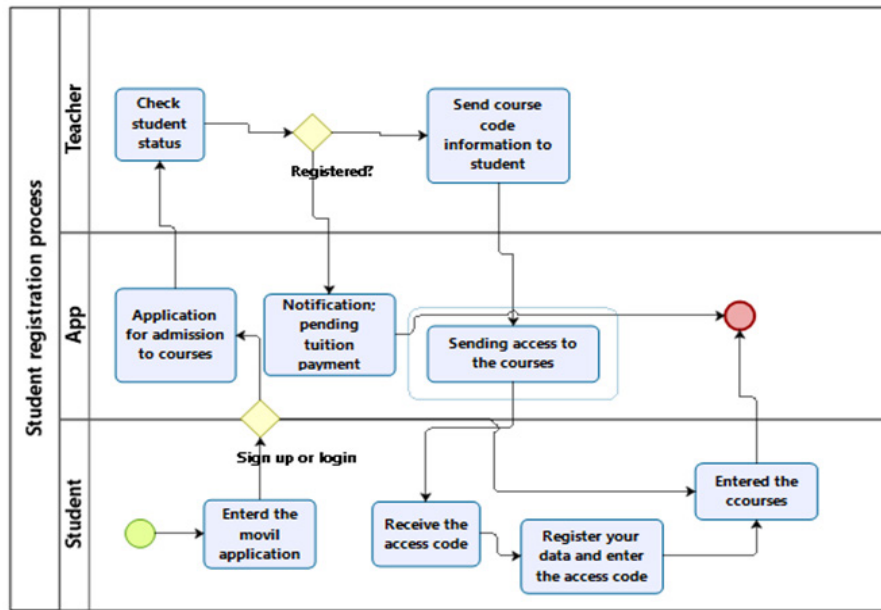

Fig. 3. Student Registration Process

Review and retrospective: During the review of the sprint, we will run the app and verify that works efficiently, meeting the expectations of the school.

Release: The product will be delivered. The mobile app is called AMGAES, and the outcome of the project is discussed. Next, we will share screenshots of the mobile app in loading sequence.

Figure 4 shows the prototype of the app, the registration and login interfaces. Figure 4 (a) shows all required fields that must be completed in order to create an account and Figure 4(b) shows the login interface where the login credentials must be entered to have access to the app.

Fig. 4. Interfaces: (a) Register and (b) Login

In Figure 5, the prototype designs for the welcome screen and the courses main menu are processed. Figure 5 (a) shows the welcome screen that is the first screen the users see once they logged into their account. Figure 5 (b) shows all the courses they are taking. The completion of the welcome allows the user to start. After entering you can select the different courses according to the established schedule, this helps to have an order and you can quickly locate the courses thanks to the mobile application.

(a)   (b)

Fig. 5. Mobile app: (a) Welcome and (b) Courses

In Figure 6, shows the designs of the art course and the documents that will be up-loaded to the app. Figure 6 (a) shows one of the courses as a sample, as well as the modules and documents such as class material per class. Figure 6 (b) shows the classes, and the option to upload files. In both cases it allows you to have an order in your classes where you will do it with the mobile application as a complement.

Fig. 6. Designs: (a) Art course and (b) Upload files

4 Results

This section shows the results of the study, based on Scrum methodology used in this investigation.

4.1 About the survey

In this project, in order to have a better understanding regarding the functional and non-functional requirements that were used for the development of the course management mobile app, a survey was conducted.

A survey was carried out and the data was entered, this is saved to do an analysis of the answers. In the survey, dimensions such as design, privacy and security, functionality and performance were identified, which were implemented and distributed through Google Forms with the questions shown in Table 3. The questions of the survey

were developed based on the established dimensions, having a total of 16 questions which were answered by the experts. The first design dimension focuses on being able to obtain information about the interface, and the colors among others, in this way to be able to carry out the design correctly. In Privacy and Security, questions are asked that allow you to know how safe and private you are when using the mobile application. Regarding the questions of the functionality dimension, it allows us to know if its functionality is adequate. Finally, the performance focuses on mobile optimization.

Table 3. Dimensions of the survey

Dimensions	Questions
Design	1. Is it important to choose colors to represent the course management app? 2. Is it important to have an interface that is easy to manage? 3. Is the interface user-friendly? 4. Is the bottom navigation bar appropriate for the app? 5. Is the app designed for secondary school students?
Privacy and Security	6. Would it be necessary to do user verification by sending a code via email or text message? 7. Are you pleased with the security system of the app? 8. Does the app need an option to remember input data? 9. Does the app allow you to upload files?
Functionality	10. Do errors occurred when accessing the app? 11. Is there an option to request technical support? 12. Are we requesting the enough information when a user signs up?
Performance	13. Does the app run slow? 14. Does the app slow down your cell phone? 15. Does the app run your battery low? 16. Describe the satisfaction level regarding this questionnaire.

Table 4 shows the criteria such as: design, privacy and security, functionality, and satisfaction, with the 16 questions, with their averages showing that the highest average is 4.55 for the design criterion, and the lowest average 1.45 found in the functionality criterion; regarding question 10, it was the lowest score obtained where they support the answer that errors do not occur when interacting with the mobile application. This is positive, since it shows that the people surveyed are satisfied with the access to the application.

This survey had a population of 11 people. The results shows that most of the questions have a high scale, with the highest average of 4.91 with a standard deviation of 0.302 and a single low scale, this was the lowest mean of 1.45 with a standard deviation of 0.522. To summarize, most of the questions obtained a high rating scale and only one low rating scale was obtained. The analysis of the results showed that there is a great acceptance on the part of the experts towards the course management app.

Table 4. Expert evaluation

Criterion	Questions	Medium	Standard Deviation	Scale
Design	RQ1	4.18	0.751	High
	RQ2	4.55	0.522	High
	RQ3	3.91	0.539	High
	RQ4	3.55	0.522	High
	RQ5	4.09	0.302	High
Privacy and Security	RQ6	3.55	0.688	High
	RQ7	3.64	0.505	High
	RQ8	3.82	0.405	High
	RQ9	4.91	0.302	High
Functionality	RQ10	1.45	0.522	Low
	RQ11	4.18	0.603	High
	RQ12	3.82	0.405	High
Performance	RQ13	4.09	0.302	High
	RQ14	3.64	1.120	High
	RQ15	3.64	0.674	High
	RQ16	3.64	0.674	High

Table 5 shows the criteria of the dimensions: Design, Functionality, Security and Satisfaction, these dimensions had 17 questions in total, that were addressed to verify the effectiveness of this project.

Table 5. User survey dimensions

Dimensions	Questions
Design	1. Do you think the prototype of the mobile app is easy to understand? 2. Do you think the prototype meets all phases for the course management process? 3. Do you think the app complies with the required speed? 4. Do you think the design of the app is optimal and according to the colors of the school? 5. Do you think the prototype of the mobile app will be accepted?
Functionality	6. Do you agree that the phases are easy to find in the mobile app? 7. Do you think the images fit the subject? 8. Do you think the functions of the app are easy to understand? 9. Do you think the app will allow to upload files?
Security	10. Do you think our security measures are adequate? 11. Do you think that everything related to the security system should be in the instructions? 12. Do you think the course management app is reliable? 13. Do you consider that creating the password is easy and efficient?
Satisfaction	14. Do you think that the app meets the user's expectations? 15. Would you recommend the app to another institution? 16. Does the educational management app have a good methodology? 17. Do you think the instructions meet the user's expectations?

Table 6 shows the questions with the different dimensions such as design, functionality, security, and satisfaction, to obtain information regarding the prototype. Having a total of 17 questions, with a lower value of 3.82 and the highest of 5.00, which demonstrates the user's acceptance. The highest score that was obtained with the value of 5 is

with respect to the images of the mobile application that fits optimally and with quality; in this way, the functionality will be the correct way for the end users.

Table 6. User evaluation

Dimensions	Questions	Medium	Standard Deviation	Scale
Design	Question 1	4.78	0.582	High
	Question 2	4.86	0.572	High
	Question 3	3.92	0.444	High
	Question 4	4.84	0.681	High
	Question 5	4.96	0.283	High
Functionality	Question 6	4.92	0.396	High
	Question 7	5.00	0.000	High
	Question 8	3.94	0.314	High
	Question 9	4.82	0.748	High
Security	Question 10	4,96	0.283	High
	Question 11	4.64	1.025	High
	Question 12	4.00	0.000	High
	Question 13	3.90	0.444	High
Satisfaction	Question 14	4.84	0.650	High
	Question 15	3.92	0.444	High
	Question 16	5.00	0.000	High
	Question 17	3.82	0.596	High

The result corroborated that in most of the 17 questions, separated in 4 dimensions (Design, Functionality, Security, and Satisfaction), all of them obtained a high scale score. As a conclusion, it can be confirmed that there is a great acceptance from the 50 users who were part of the survey regarding the course management app.

4.2 Case study

In this section of the case study, it deals with the development of the prototype of the educational management mobile application, to support learning in students at the secondary level, as well as help teachers in the indications when creating the conclusion that through these results, it can be confirmed that work for students, in a way that facilitates the remainder of these works [31][32]. A prototype of the application was developed on the Balsamiq platform where the screens loaded in the application are displayed. With the objective of the project, which is to improve student learning, through the use of this application, the student will be able to have at hand the classes, tasks or class work and documents that are shared [33].

5 Discussions

In this section, we will describe and analyze the findings from various articles that were cited in this research, such as the author [6] who mentions that m-learning has the potential to take education outside the classroom and how these new technological tools

make us rethink the pedagogy and the school system. In addition, the author [7] used emerging technological apps to make student learning in more effective and interactive way. The author [8] presented a conceptual model to examine the factors that influence how to adapt mobile learning for students pursuing higher education. Providing greater emphasis on the effectiveness of mobile apps in the learning process. However, this project is focused on secondary education, but we can learn from this research about educational innovation that aims to develop a mobile learning management system app. According to the author's findings [11], the mobile app helped students prepare for a final performance test. However, students reported that the app was not very supportive of communication performance. In addition, the author's findings [1] mention that the study contributes to existing knowledge about student perceptions and the use of mobile apps for learning purposes. Also, the author [18] mentions that smart education is relevant and crucial, the experiment proved the necessity and effectiveness of the mobile app in the field of education. With respect to these conclusions mentioned by the authors, we get to an agreement that mobile apps are a great tool that can improve students' learning. According to the author [14], research has been conducted that has shown that smartphones are increasingly used in learning, in this study it is proposed the use of a mobile app to learn new vocabularies and phrases in English. However, these apps are not always effective in supporting students' learning as mentioned before in other article, a mobile apps were used to help students to prepare for an English test, but the result did not come out as expected, as it showed negative results; for this reason, we can say that most mobile apps have several benefits for learning purposes, e.g., immediately get knowledge. We still need to make emphasis on the different methodology options to create an app, and how this connects the human being to technology. Mobile applications serve as a complement so that students can use these tools in an optimal way. However, the use of technologies in education has a limitation since in some sectors students do not have access to the internet and technology such as Mobile. In this sense, education would be unfair; For this, the state must promote inclusion policies in the use of educational technologies in a mandatory way where the state can provide students who cannot have it.

6 Conclusions

The survey results showed that this app has great acceptance. In addition, we detected the user's interest, this will support the student to continue the technological trend, have an easy way to learn with the help of technological tools, and overcome the barriers of digital literacy. Several limitations were identified while developing the course management mobile app, such as the lack of options for the programming language, as this could have improved the flexibility of the functions and access to a greater number of styles for the design, increasing the scope in the creativity for the designer and developer. For future investigations, it is suggested to implement the chatbot function to improve communication between users and customer support. When carrying out a project using this prototype, focus on create a space where teachers can share information, opinions, and results with the students. Finally, it is suggested to

implement a data that, through the course of the time of use, can save important information and make sure that it is not accessible to people outside the educational organization to avoid threats to the personal information of the staff. administrator, teacher, and student. Finally, it is recommended to use the cloud for the user database to have a backup that can be updated periodically.

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