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Mobile application for distributing information to students at the Sciences and Humanities University

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ABSTRACT

Currently, educational institutions around the world have implemented many standards and rules to ensure teaching quality. Many of these standards and rules are related to the use of technologies that provide students with services and facilities to learn. However, in Peru, a Latin American country, these standards and rules have been recently implemented, and as a result, information systems are required to guarantee teaching quality. This research exposes the implementation of a mobile application for distributing and managing information for students and teachers who require data about courses, grades, absences, and receive news about important university announcements. This work applied both research methods and Scrum methodologies together to demonstrate how the education process benefits from the use of technologies. As a result of these implementations, processes like finding academic information improved by an average of 50%. These results support that the implementation of mobile application technologies in educational environments is beneficial for guaranteeing process improvement and teaching quality.

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1. INTRODUCTION

Nowadays, different mobile applications allow access to information sources. Some of these applications support higher education [1], and have only one requirement: a mobile phone that supports the use of mobile applications. The use of mobile applications transcends different areas and has a great power of influence on various topics. For example, as mentioned in [2], the research shows how mobile application developers combine political content into one app, uniting different sources like Facebook, Twitter, news, and statistics, making it easier for sympathizers to find information related to their political parties.

Another use of mobile applications is mentioned in [3]. This research analyzes the implementation of apps in banking to improve the customer service process. The use of these types of apps frees users from the pressure and tension they feel when going to the bank. In this case, mobile applications help to improve a process and bring great benefits to the bank. The benefits include customer satisfaction through process automation. These key benefits motivate the implementation of mobile apps. In research from Vacas *et al.* [4], a survey was conducted to determine the level of acceptance of apps in process automation and increased satisfaction among university students. The result was that students agreed that the use of technologies to manage information on campus is positive.

Consequently, the attendance process, which in many cases was a manual process requiring students to sign on a sheet of paper, is improved with the use of technologies like mobile applications. The research from Fatah *et al.* [5] analyzes the implementation of a mobile app for the automation of the attendance process. The scope of this app included a user-friendly interface and data processing. This mobile application concluded with an improved process (in time and resources) and an increase in student satisfaction. The research from Chuang [6] shows another use of mobile apps, focusing on a learning process that encourages student participation using the Delphi method. Mobile applications improve not only administrative processes but also learning processes, providing students with tools to increase their academic performance.

The use of mobile applications is widespread in different areas and topics, as demonstrated in the preceding researches. In Peru, the application of this technology in educational processes is recent, due to new regulations requiring universities to undergo an accreditation process, as mentioned in [7]. The research explains how fifteen digital platforms provide guidance to meet the requirements of the new regulation. The trend is that universities are incorporating technology into their processes to improve them and comply with regulations and laws. The motivation to incorporate technologies in educational processes also includes contextual reasons like the COVID-19 pandemic [8]. This prompted a significant effort to implement mobile applications to provide quality education in indigenous communities. These mobile applications provide services for data collection and their consumption through virtual apps, ensuring that education continues despite obstacles in remote communities.

The impact of using mobile applications in university learning was measured in [9] through a survey in five universities, applied to students and teachers. The results show that the majority of students (70%) have a mobile device, but only 15% use them as a complement to their education. It is inferred that this is due to the lack of specialized applications that incorporate university processes. Even so, the highest score for the question related to incorporating mobile applications in the educational process was 3.8 (out of 5), indicating a high level of acceptance. The high level of acceptance, the contextual environment, and the new regulations in Peru make the mobile application development market attractive. It incentivizes not only universities to invest in this technology but also brings new providers with different solutions to improve processes, providing good results [10]. The different solutions included many processes identified in [11]. To identify these, a survey was conducted with students and teachers. The processes included: access to academic information, collaboration and communication, course and homework management, tests and feedback, laboratory activities, and the development of skills and competences. Applied mobile technology entails process improvement and time reduction. The development of this mobile application included methodologies like Scrum, focusing on overcoming uncertain conditions and tight deadlines. This ensures the final app has a real and relevant integration with university processes, increasing business value. For these reasons, Scrum is used as a guide for mobile application development, as mentioned in [12]-[15].

For all the above reasons, there is evidence that mobile application technologies provide multiple benefits to universities worldwide, and their implementation in Peruvian universities is crucial for both improving processes and complying with regulations. In this research, the main objective is to demonstrate how mobile applications improve processes related to distributing information to students and teachers. For that, specific processes were analyzed to create a mobile application using the Scrum methodology, and process time measures were performed before and after mobile implementation to demonstrate the improvement in the processes.

2. METHOD

2.1. Scrum methodology

The methodology used for developing the mobile application was Scrum. This methodology implements an agile process that delivers software incrementally. In this agile process, many instruments, artifacts, and techniques are involved [16], [17]. Figure 1 shows the full process and techniques used. Throughout the process, agile techniques were used:

- In the project envision stage, an agile project charter was used to define the main objectives of the project. This document includes business opportunity, scope, goals, customer and stakeholder identification, metrics of success, risk, cost, and benefits [18].
- Also in the project envision stage, a story map technique was used to visually identify requirements [19].
- User personas is a technique used to describe user profiles and map them with requirements [20].

– Value stream map, using in Scrum to eliminate waste, on the project was used for make measurements of the process and calculate their efficiency before and after the implementation of the app [21].
– Collaborative techniques improve communication, involvement, and creativity [22]. These characteristics are important when the Scrum team and stakeholders are involved in requirements identification. The collaborative techniques used to collect requirements and risks were "prune the product tree" and "the speedboat".
– Agile projects reduce risk through the implementation of all their processes, reducing the risk implicit in the sprints. However, it is important to incorporate actions in the process to reduce the risk [23]. In this research, a risk-adjusted backlog technique is used, incorporating risk responses into the backlog activities.
– After determinate the backlog the next step is prioritize the user stories, planning poker was the technique used in this research [24].
– The product roadmap is a technique that represents the vision and direction of the project [25]. In this implementation, this graphic tool was helpful in keeping stakeholders committed and informed about the activities and the product.
– Techniques used in this project for developing the product were pair programming and continuous integration. The first one requires one programmer to write the code and the other to review the code [26], while continuous integration frequently incorporates code into the main repository [27]. Both techniques are useful for identifying errors in the early stages of development.

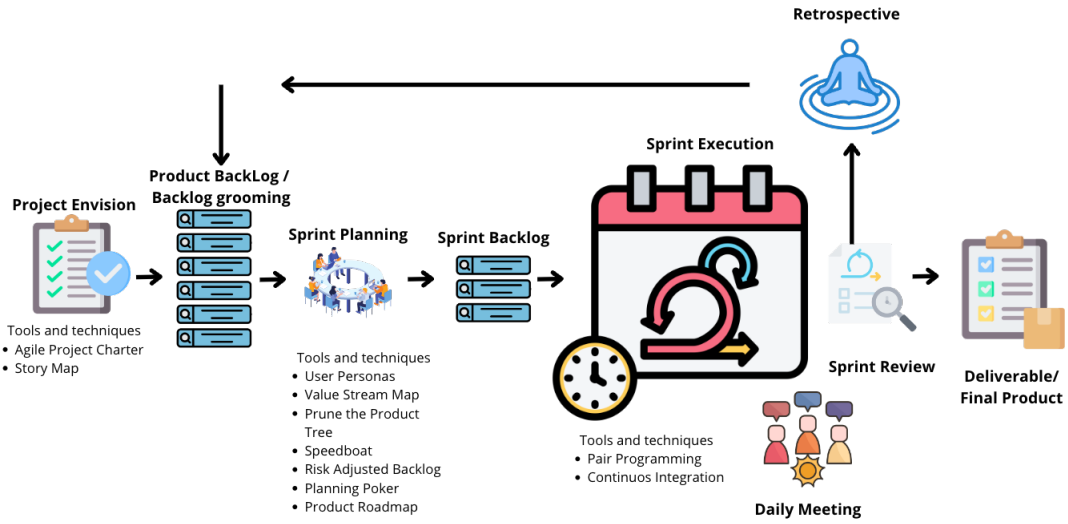


Figure 1. Scrum methodology, tools and techniques

2.2. Case study

2.2.1. Planning stage

Using the techniques explained in the above sections, the planning stage resulted in 33 user stories divided into seven epics, defined as:

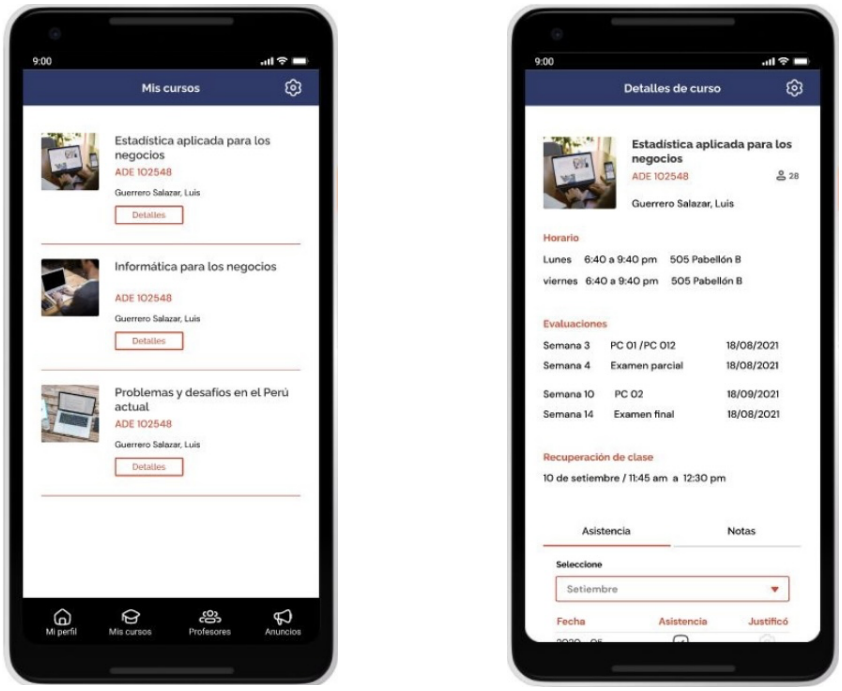
– As a student, I want to manage the information of my courses to know about my academic performance.
– As a student, I want to know the information related to the available laboratories, to allocate the resources for studying.
– As a teacher, I want to reserve classrooms and laboratories to plan classes and make-up sessions.
– As a teacher, I want to send announcements to my students to inform them about news or changes in classes.
– As an administrator, I want to schedule teachers, classes, and timetables to inform both teachers and students.
– As a student, I want to have general information in my profile to remember details about my registration.
– As a student, I want to manage app configuration to set general settings.

These epics were later divided into 33 user stories. The defined user stories cover three main processes: process of searching academic information (courses, grades, attendance, schedules), initially with

18% efficiency; process of reserving areas (classrooms, laboratories, auditoriums), initially with 5% efficiency; process of information request (academic procedures), initially with 20% efficiency. These metrics were calculated with value stream mapping and measurements made to the processes. To develop the mobile application, the 33 user stories were prioritized, estimated, and finally divided into three sprints, each with a duration of four weeks, as explained in the following sections.

2.2.2. First sprint

In the first sprint, the most important user stories were developed (12 user stories). On the story map, these stories are located in the backbone section and some in the walking skeleton section. The main objective of this sprint was to provide students and teachers with a tool to visualize detailed information about courses. Figure 2 shows the most important interface developed, Figure 2(a) the list of courses that students are enroll or teachers teach that depend of the user role, Figure 2(b) the detail of the course showing important information like schedule, and important dates.



(a) (b)

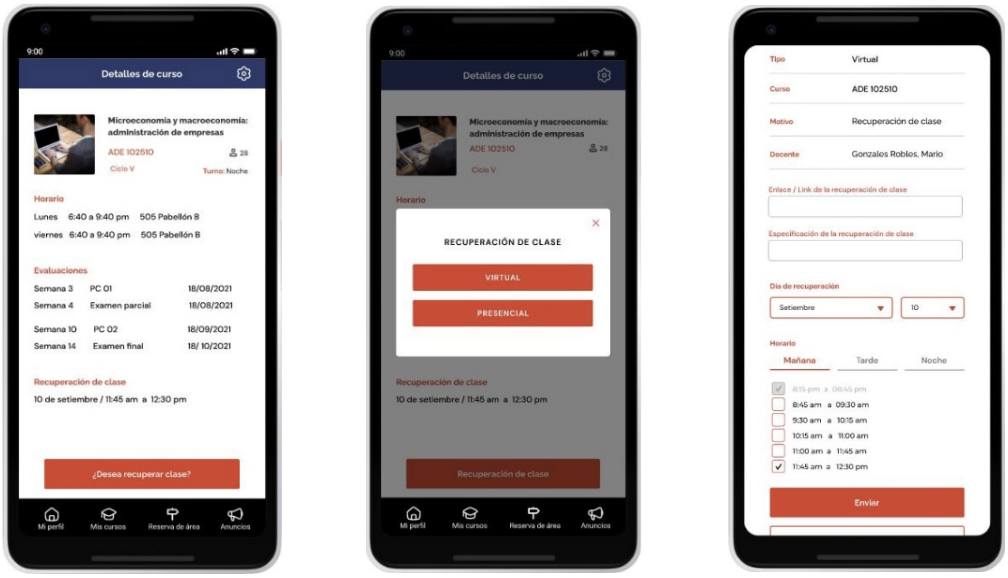
Figure 2. Sprint 1. Main interfaces; (a) the list of courses and (b) the detail of the course

2.2.3. Second sprint

In the second sprint, 11 user stories were developed in four weeks. The main objective was to provide teachers with the tools to make reservations of areas and schedule class recoveries. Figure 3 illustrates the primary interfaces for this sprint. Figure 3(a) the course detail interface is designed to schedule a recuperation for a missed class. Figure 3(b) the recuperation can be virtual through video conference or in-person in a physical classroom. Figure 3(c) the recuperation class details include the motivation for the recuperation, the specific schedule, and other relevant information.

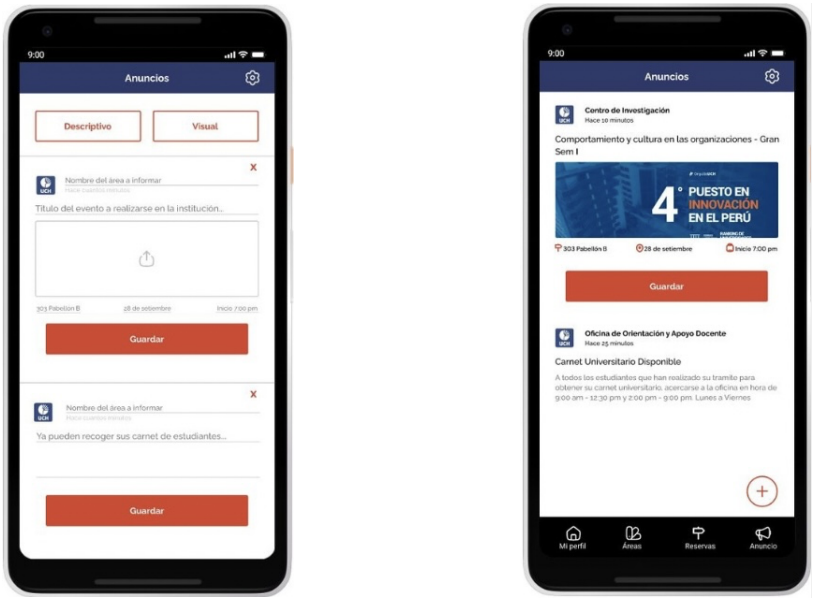
2.2.4. Third sprint

In the third sprint, 10 user stories were developed in four weeks. The main objective was to provide administrative employees with tools to manage reservations and distribute academic news to students and teachers. Figure 4 illustrates the primary interfaces, including Figure 4(a) the interface for publishing academic advertisements and providing information on benefits for students and teachers, and Figure 4(b) the list of advertisements published.



(a) (b) (c)

Figure 3. Sprint 2. Main interfaces; (a) schedule setup, (b) virtual or in-person option, and (c) detailed recuperation info



(a) (b)

Figure 4. Sprint 3. Main interfaces; (a) advertisement publishing interface and (b) advertisements list

3. RESULTS AND DISCUSSION

3.1. Results

After the development of the project, the implementation was carried out in a test environment to measure the execution time of the processes using the app. The measurements were made by observing different test cases. Table 1 shows the measurements before and after the implementation of the app.

Table 1. As-Is To-Be measurements

Processes	As-Is		To-Be		Improvement
	Time	Efficiency	Time	Efficiency	
Searching academic information	16 min	18%	1 min	83%	65%
Reserving areas	611 min	5%	11.5 min	55%	50%
Information request	15.5 min	20%	1 min	75%	55%

Table 1 shows the results of the measurements of the process before and after the implementation. The process named "searching academic information" reduced the execution time from 15 minutes to 1 minute, representing 65% more efficiency. In the test, many non-value times were reduced, primarily the waiting time for attendance in the office. The process named "reserving areas" reduced the execution time from 611 minutes to 11.5 minutes. The reason for this significant time reduction is that, in the manual process, the administrative employees needed to compare information about the availability of resources. To do that, they had to communicate with other university departments and cross-check information, which sometimes took a long time. However, with the application, all the required information is in the database and available instantly. This improvement means 50% more efficiency in the process. Finally, the process named "information request" reduced the execution time from 15.5 minutes to 1 minute, meaning 55% more efficiency. The manual process included a step for publication and a step to send emails to students and teachers. These steps involved using two different systems: the web page for publication and the email system to send the messages. With the app, the process has only one step (publication) in one system (the mobile application).

3.2. Discussion

The primary findings of this research, presented in Table 1, demonstrate that processes enhance their efficiency by an average of 56%, encompassing information retrieval, requests, and area reservations. Additionally, there is a substantial reduction in time, averaging 95%. These findings hold significant relevance as they affirm the tangible impact of mobile applications on the education process, aligning with the primary objective of elevating educational quality.

The reduction in the process time and the increase in efficiency are directly correlated with the satisfaction of students and teachers. This leads to faster access to information, thereby reducing the waiting time for administrative tasks. This allows them to focus solely on their education, as evidenced by the researches [4]-[6] that yielded similar results using mobile applications. Specifically in Peru, the significance of this enhancement is particularly valuable because the actual context, where regulations mandate the implementation of novel tools to ensure quality education (as mentioned in [7]), provides universities with a proven solution that will enhance their educational processes.

Despite these advancements, substantial progress is still required. For instance, research [6] indicates that incorporating mobile applications directly into the learning process can enhance student participation and, consequently, academic performance. However, this approach is not widely adopted in Peru, where the primary focus remains on administrative and data management processes. With this aggregation in the educational processes, students could utilize their mobile devices as a robust tool for their education. This integration aligns with the recommendations mentioned in [9], yet there remains an opportunity for students to incorporate their mobile devices into their learning workflow.

4. CONCLUSION

In conclusion, this research developed a mobile application that addresses the primary concerns expressed by employees and students of the Sciences and Humanities University during the initial data collection phase. The application enhances academic information retrieval processes for students and teachers through a centralized database that provides the necessary course-related information directly to their devices. These improvements significantly reduce time, particularly waiting times. Additionally, the reduced reliance on academic departments for information requests frees up administrative employees to engage in other tasks. Based on the benefits achieved, students and teachers can experience an enhanced academic experience, which is essential for universities to improve academic performance and is regulated by laws in Peru. These findings align with the literature reviewed, emphasizing the significance of incorporating mobile technologies into the educational process. As future research, it is recommended to implement this application across all university faculties to further amplify its benefits, ensuring that all students and teachers can benefit from it. Further-

more, integrating this mobile application into the learning process would be advantageous, potentially leading to improved academic performance.

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