

## RESEARCH ARTICLE

# Mobile application to improve the learning of secondary school students

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**Abstract:** In recent years, there has been a low percentage of learning in all educational centres. This research aims to design a mobile application to improve learning and technical and soft skills in educational institutions in Peru. This way, it can be replicated in another country with a similar reality. Also, we used the Design Thinking methodology, which promotes innovation in each of its processes. Thanks to this, we focus not only on the application's development and deployment but also on users' experiences and feelings. During the methodology development process, the survey was used for data collection and analysis and the impact of the mobile application's development on education, having a population of 40 students, obtaining. As a result, a good acceptance of the mobile application, especially in public education.

**Keywords:** design thinking, education application, mobile application, soft skills

## 1 Introduction

Education is a fundamental tool for the development of every society. Therefore, students require a learning path and methodologies that allow them to improve their skills. In a study conducted at the University of Tun Hussein Onn Malaysia to integrate a mobile application to improve the learning of vocational competencies (Gangaiamaran & Pasupathi, 2017), it was found that mobile applications, together with a teaching methodology, increase learning (Dahal et al., 2022). Integrating mobile applications with a methodology based on projects was sought to improve computer assembly students' vocational skills (Khan et al., 2019).

On the other hand, mobile apps have had an impressive boom in recent years and have encompassed various aspects of our lives (Foti, 2021). Education has yet to be the exception; we currently have multiple tools, such as the Internet (Bartra et al., 2022). The Internet allows students quick access to information (Drolija et al., 2020). However, it often does not provide a specific learning path and does not suit the need of each student (Vaiopoulou et al., 2021). Consequently, mobile applications arise intending to cover needs (Kalogiannakis & Papadakis, 2017). For example, Google maps have routes and relevant information about a place. A study conducted at Widya Kartika University to improve students' writing skills using a mobile app for learning mentions that students' writing skills are going through an even more difficult time in the growing and already developed digital era (Bano et al., 2018).

Now, mobile applications not only have a purely technical approach but can also be given an empathetic approach (Kalogiannakis & Papadakis, 2017; 2020). In an article on online learning tools in the era of m-learning: Utility and Attitudes in accounting university students (Papadakis, 2021), he mentions that modern learning environments are based on information and communication technology applications, being instruments for sharing knowledge and knowing the impact (Mozombite-Jayo et al., 2022). In other words, it is about more than just developing an application to cover a need without considering the user experience (Karakose et al., 2022). Therefore, we must focus on discovering to what extent the application impacts the improvement of student learning (Xezonaki, 2022). Another research mentions that it is essential to discuss students' perceptions of using a mobile application and describe the strengths and weaknesses from each student's point of view (Silva et al., 2022).

Regarding the user experience with a mobile application, it is crucial to consider the context in which it is used (Mohammed, 2022). A research paper developed at National Cheng Kung University in Taiwan mentions how relevant it is to consider the context in which the mobile application is developed so that the impact of its use is more significant (Katsaris & Vidakis, 2021).

In conclusion, this research focuses on helping to improve cognitive knowledge, the learning process and soft skills of high school students, both for public and private institutions in Peru. Therefore, we seek to impact the improvement of the learning process based on free courses that allow the development of these required skills not only in the student field but also in the world of work and also soft skills, all through the development of an application mobile (Verawati

et al., 2022). Therefore, the Design Thinking methodology will be used because it allows and promotes innovation in each application's processes since we seek to go beyond creating and implementing the application and be part of the user process. The investigation is crucial since it allows to contribute to the educational area, and in this way, all the actors of the educational part benefit.

The novelty of the research is that the mobile application allows more options in the teaching-learning process so that the student can advance in his studies quickly. This research aims to design a mobile application to improve learning and technical and soft skills in Peruvian educational institutions. The paper is structured as follows: section 2 contains the literature review, section 3 the methodology, section 4 the results and discussions, and section 5 the conclusions.

## 2 Literature review

In this section, we will talk about the works related to this research. According to [Hidayatulloh et al. \(2021\)](#), a quantitative methodology was used in their article to improve students' empathic attitudes through mobile applications. The data collection technique was carried out through a questionnaire to 119 students. The results obtained by this research show that fostering empathy in an educational environment promotes and improves correct learning.

According to the authors [Kocakoyun and Bicen \(2017\)](#), in their article called Development and evaluation of an educational application for android, which aimed to determine the opinions about the environment and structure of a mobile application for learning, the importance of not only developing a mobile application but also perceiving the student experience. The methodology was quantitative, using surveys as a data collection method for 27 students who used the application for eight weeks. It is concluded that the mobile application supports students' education and motivation, thus improving their academic performance.

According to [Karim et al. \(2020\)](#), examining mind mapping applications to increase writing performance, a significant problem and deficiency in student writing are found. It was found that university students are now experiencing innovative learning development through mobile applications, improving their learning performance. The study's objective was to examine the application of mobile learning technologies through mind maps to increase writing performance. Their study was based on three research theories: Flower and Hayes's Writing Process Model, Radiant Thought Theory, and Unified Technology Use and Acceptance Theory (UTAUT). They found positive responses towards implementing mental maps through mobile applications to improve the writing of the English language, serving as a basis for future public policies.

In their research work, [Mota et al. \(2018\)](#) highlighted the importance of using technologies with an emphasis on mobile applications and their versatility to adapt to environments and people. The work objective was the development of a mobile application with the use of augmented reality that serves as a reinforcement in the learning of Science and Technology. The objects of study were 30 students from the sixth grade of primary school and the first year of secondary school. The final result demonstrated the importance of mobile applications based on satisfaction, interest and understanding.

In their study, [Verdes et al. \(2021\)](#) highlighted the problems that the COVID-19 pandemic brought with it in the educational sector; the way of learning was affected by the lack of attendance. The study's objective was to develop a series of mobile applications and associated educational activities for university-level courses that involved fieldwork in invertebrate zoology. The object of study was university students in Spain. The study's conclusion determined the high potential of mobile applications and Augmented Reality and Virtual Reality, which improve student motivation and learning, can adapt to different learning styles, reduce social inequalities and facilitate learning practices—inclusion and diversity in the classroom.

According to the author [Villagómez et al. \(2020\)](#), the Ibero America Horizon Report predicts that within three years, mobile technology will have a potential impact on teaching, learning, research, and creative expression in the global education sector. The current development of mobile devices presents exciting possibilities since it allows the creation of educational environments tailored to each need. This communication identifies and describes the Personalized Learning Environment (PEL) and provides general and specific examples of applications tested on smartphones and tablets.

According to the authors [Al-Samraie and Saeed \(2018\)](#), in this article, we present the findings of a case study related to the use and potential of mobile applications in postgraduate studies. This research aims to theoretically develop an educational model based on mobile applications for studying and learning the "Research Methods" discipline. For this, learning matrices designed to link goals and actions to mobile applications, based on Bloom's theoretical classification model in the digital age, have educational potential.

In their article, [Hussein et al. \(2017\)](#) presented the findings of a case study related to the use and potential of mobile applications in postgraduate studies. This research aims to theoretically develop an educational model based on mobile applications for studying and learning the "Research Methods" discipline. For this, learning matrices designed to link goals and actions to mobile applications, based on Bloom's theoretical classification model in the digital age, have educational potential.

According to [Viberg et al. \(2018\)](#), the summary of the open educational movement is an essential contribution to students' learning processes. However, even commonly used technologies, resources, and other tools, such as web 4.0 technologies and handheld devices, also interfere with learning and Open Educational Resources (OER). On the other hand, citizens' access level to ICT (IT) is different from the different continents, which may affect the understanding and management of OS Keywords: tutorial, mashup, an open educational movement, OER, and open teaching assets. The open education movement summarizes an essential contribution to the learning processes of students; However, popular technologies, resources, and other standard tools, such as Web 4.0 and handheld devices, are also involved in the learning mode and are part of Open Educational Resources (OER). On the other hand, the level of access of citizens to unauthorized information and communication technology (IT) between the different continents can affect the understanding and management of OS.

According to [Bojović et al. \(2020\)](#), mobile applications are considered one of the most prominent technological groups of the last decade. Currently, they are considered valuable tools for developing various human activities. Therefore, this type of software can also be seen as a unique opportunity to be considered in the educational process since it offers different features and functionalities through mobile devices. Its use can provide a very flexible interaction for students when the need arises to learn academic content ([Karakose et al., 2022](#)). All that is required is a smart mobile device capable of multitasking and a wide range of software applications available.

This article presents mobile applications in higher education, highlighting current trends in the adoption of technology; Again, the types of apps discussed and how some organizations have integrated technology into their curricula may limit the functionality, number, and scope of their mobile apps. The purpose is to present a point of view to illustrate the classification of applications and their advantages and disadvantages. The present study aims to clarify the technical details surrounding the design, development and implementation of mobile applications for teaching and learning.

### 3 Methodology

This section will detail the design thinking methodology and the tools used to develop the prototype.

#### 3.1 Design thinking methodology

[Altman et al. \(2018\)](#) in their research mentioned that design thinking has a peculiar characteristic focused on the improvement and transformation of culture; it has as its objective the deliberate change of unsatisfied conditions into something better, fresh and new ([Altman et al., 2018](#)).

However, the question arises as to how these dissatisfactions are resolved. [Micheli et al. \(2019\)](#) mention that a design thinking methodology is a form of teaching that aims to generate innovative ideas and explore alternative solutions, avoiding using existing alternatives to a lesser extent.

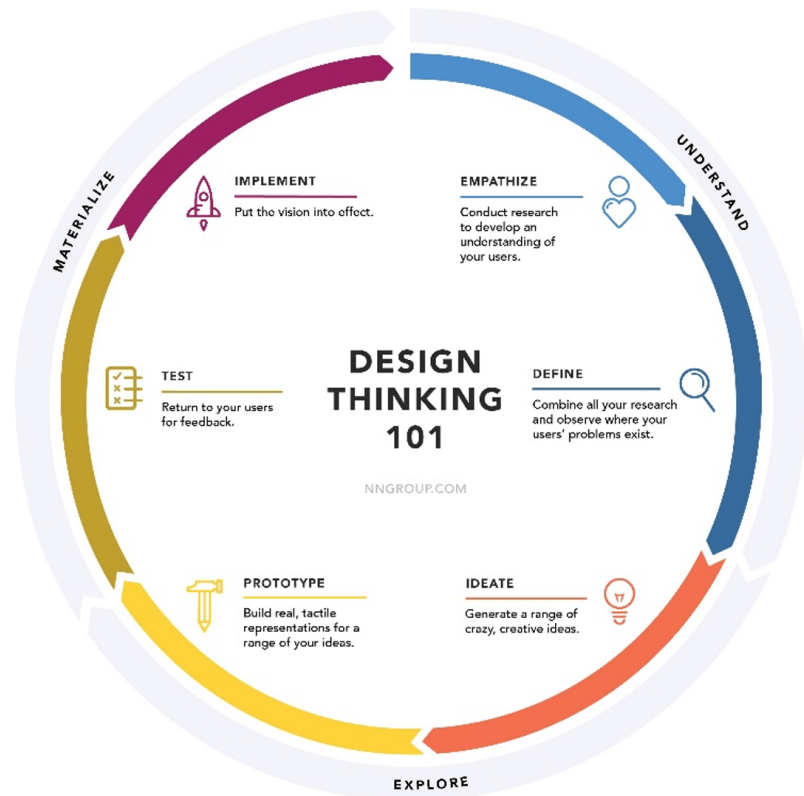
Therefore, the Design thinking methodology is based on developing the creative process to generate innovative solutions to unsatisfied conditions. Once the concept is defined, it is essential to know the phases by which solutions are obtained through this methodology. Consider the following structure of the Design Thinking methodology ([Figure 1](#)).

The design thinking methodology has three pillars: Understand, Explore and Materialize, on which the phases of Empathize, Define, Ideate, Prototype, Test and Implement are developed.

1) **Empathize:** Empathy is vital to design solutions that work for people. Here, we will look at empathy, how it helps design thinkers create solutions that work, and how a lack of empathy can lead to product failure. We will also understand the empowering notion that everyone can master empathy and design truly human-centred solutions ([Wrigley & Straker, 2015](#)).

2) **Define:** Empathy is crucial to a human-centred design process such as Design Thinking. Empathy helps design thinkers set aside their assumptions about the world to gain insights into their users and needs.

3) **Ideate:** Designers like us need to develop the best possible understanding of our users, their needs, and the issues that underlie the development of the particular product or service we



**Figure 1** Design thinking structure

intend to design (Henriksen et al., 2017).

4) **Prototype**: Integrating prototypes into product development can be transformative. It can enrich the experience, bring the team closer, and reduce time.

5) **Test**: If performing user testing on a prototype, using a natural environment (that is, the typical environment in which your users would use the prototype) is ideal. If testing in a natural environment is challenging, try having users perform a task or play a role in testing the prototype (Camposano, 2018).

6) **Implement**: Implementation is the key to creating the final product or service. In this space, the creation of prototypes is significant, made test within a small and well-selected sample.

### 3.2 Tools to design the prototype

In this section, a user will be able to understand the workflow management platforms and the used prototyping tool.

1) **Miro** is an online collaborative whiteboard platform in real-time. It allows working with brainstorming through digital sticky notes, project planning and management of the flow of agile methodologies

2) **Figma**: It is a primarily web-based vector graphics editor and prototyping tool with offline features.

### 3.3 Tools and programming language to develop the prototype

This section will address the programming languages used to develop the prototype.

1) **HTML5**: Information markup language that allows us to define the structure of our websites.

2) **CSS3**: Cascading style language allows us to add greater versatility to the design of our websites.

3) **Vanilla JS**: Dynamically typed prototype-based programming language.

4) **React.js**: Reactive JavaScript library allows the creation of web applications focused on user interface design.

5) **React Native**: It is an open-source JavaScript framework that allows cross-platform mobile applications for Android, IOS and web applications, all with a single code base.

6) *Visual Studio Code*: Microsoft code editor supports different programming languages and has different plugins.

## 4 Results and discussions

This section shows how the design thinking methodology was applied to our project.

### 4.1 About the survey

*Empathize*: In this stage of the methodology, the survey was used as a data collection tool for 40 students, both from public and private institutions, regarding the quality of teaching and the study methodologies they use to learn, to obtain a vision objective and accurate of the needs of the students. In this section, the methodology suggests empathizing with users and leaving assumptions aside. The questions asked in the survey are found in [Table 1](#), a survey on teaching quality and study methodologies.

**Table 1** Survey on teaching quality and study methodologies

No	Questions
1	Do you consider yourself a resilient person?
2	Do you like to work in a team and share what you know?
3	Are you able to handle stress?
4	Would you like that each course requires a delivery of a final project that reinforces what has been learned during the year?
5	Do you consider that technical skills are essential to finding a job?
6	What career are you thinking of pursuing when you finish high school?
7	Do you plan to study at a University, Technical Institute, or do you have any other alternative? If you have another alternative, tell us what it is.
8	Do you consider yourself a self-taught person?
9	Would you like access to free courses that improve your soft skills (resilience, collaborative work, critical thinking and more)?
10	Do you know anything about information technologies?

*Define*: Once the information provided by the survey was obtained, the students' most critical needs were determined and then synthesized into statements that demonstrate the problem (Dove et al., 2017). Therefore, in our current project, it was determined that there need to be more project-based methodologies and soft skills focused on developing student learning. Regarding the questions we had the following results:

- Do you consider yourself a resilient person? We obtained the following data: YES: 30% NO: 70%
- Do you like to work in a team and share what you know? We obtained the following data: YES: 25% NO: 75%
- Are you able to handle stress? We obtained the following data: YES: 15% NO: 85%
- Would you like each course to deliver a final project that reinforces what was learned during the year? We obtained the following data: YES: 10% NO: 90%
- Do you consider that technical skills necessary to find a job? We obtained the following data: YES: 70% NO: 30%
- To the question, what career are you considering pursuing when you finish your secondary studies? We obtained the following data: Engineering: 20%, Communications: 40%, Medicine: 30% and Economy: 10%
- Do you plan to study at a University, Technical Institute or do you have any other alternative? If you have another alternative, let us know. We obtained the following data: University: 60%, Institute: 38%, Boot camp: 2%
- Do you consider yourself a self-taught person? We obtained the following data: YES: 28% NO: 72%
- To the question Would you like access to free courses that improve your soft skills (resilience, collaborative work, critical thinking and more)? We obtained the following data: YES: 80% NO: 20%
- Do you know anything about information technology? We obtained the following data: YES: 30% NO: 70%

In conclusion, at this stage, we define the following statements that express the problem:

- Students present deficiencies in the skills necessary to improve their learning, such as (resilience, self-directed, stress management, teamwork and determination)
- The vast majority of students do not show much enthusiasm for completing final projects.

- Students in public schools have less knowledge of information technology than in private schools.
- Students have a great acceptance towards free courses.

**Ideate:** With the problem identified, we proceeded to brainstorm in order to find a solution. We conclude that high school students need a new way of approaching the project-based methodology, they show an interest in free courses, but there needs to be more optimism at the time of learning (Shute et al., 2017).

Therefore, based on this stage of the design thinking methodology, we opted for developing a mobile application that allows students to learn and access courses with recorded videos on Personal Development, Technology, and general secondary-level courses.

## 4.2 About the prototypes

Figure 2 shows the application of the courses, which. In Figure 2, (a): TechPeru Login - In this Login view, we allow the user to register with their Google account and thus be able to have a detailed record of their courses associated with their Google account as it is the most used in all areas. Also, in Figure 2, (b): Home Tech Peru - In this view of the Home, we give users a general view of the opportunities this mobile platform will generate and what they can find.

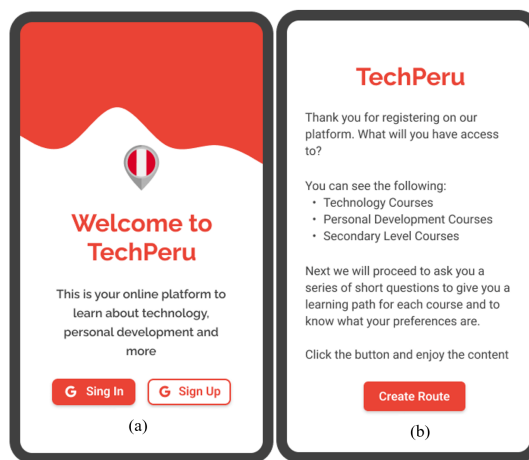


Figure 2 Mobile application: (a) Login, (b) welcome to the platform.

Figure 3 shows all the technology courses and personal courses. Figure 3(a) shows TechPeru Technology Course - In this Technology Course view, users are shown the technology-related courses. Also, Figure 3(b) shows TechPeru Personal Course - In this Technology Course view, users are shown the list of courses related to personal development and growth.

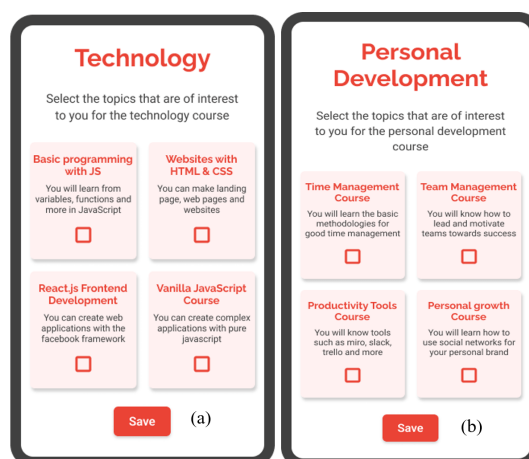


Figure 3 Mobile application: (a) courses, (b) personal courses.

Figure 4 shows TechPeru’s secondary course - This view shows those secondary level courses such as Communication, Mathematics and more.

Figure 5(a) shows the TechPeru control panel - In this view, you can see the path chosen by your interests. Also, Figure 5(b) shows the TechPeru video - In this view, users can see the topics covered in each course and the estimated time each video lasts.

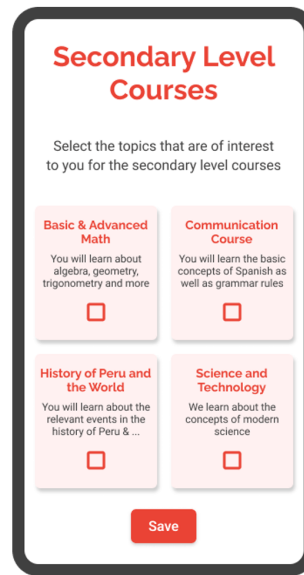


Figure 4 Secondary-level courses

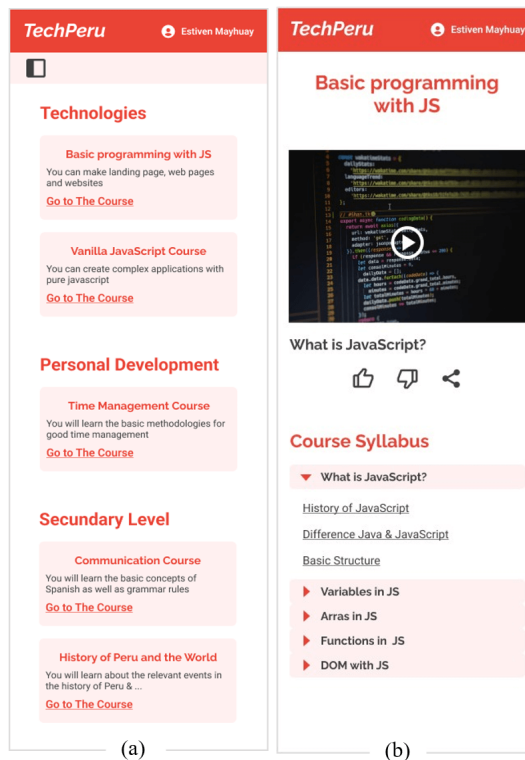


Figure 5 Courses: (a) recourses elected, (b) course syllabus.

**Test:** In this section, through a survey, we seek to receive feedback from users regarding our application. A total of 7 questions were asked in two dimensions: Usability and Security. Therefore, we draw the following conclusions:

- Do you consider it easy to log in to TechPeru? 36.4 per cent of the surveyed users consider the login very friendly.
- Do you consider that the selection of courses is intuitive? 45.5 per cent of the surveyed users consider the way they select the courses is effortless.
- Do you consider that the course information is understandable and appealing? 72.7 per cent of the surveyed users consider that the information exposed in the course is understandable and engaging.
- Do you consider that the selection of topics covered is interesting for you? 63.6 per cent of the users surveyed consider that the topics covered in the application are of interest.
- Do you need additional knowledge to use the application? 27.3 per cent of surveyed users

need additional knowledge to interact with the application.

- Do you consider that the login with your Google account is adequate? 54.5 per cent of the surveyed users consider using their Google account as a login option more effortless.

- Do you agree that we access the primary data of your Gmail account, such as Name and Email? 63.6 per cent of the users surveyed consider it appropriate that the application can access the primary data of their account with the aim of the best customization. Therefore, at this stage of the methodology, we decided to improve on offering new logging alternatives apart from Google.

Based on the designed prototype, the recommendations in this article are based on the application's functionality, which can be more extensible (Maharjan et al., 2022). It is sought to have new and better functionalities shortly once the mobile application has been implemented. Therefore, if in the future, as part of the improvements, it is sought to adapt the mobile application for teachers, they must be trained (Papadakis, 2021; 2022). In addition, the entire system must be constantly updated (Camposano, 2018).

## 5 Conclusion

As a final result, the support of a mobile application as a tool to reinforce high school students' soft and technical skills contributes significantly to their performance (Kastriti et al., 2022). Also, it is an integral part of their student future since courses focused on technology are proposed as the most demanded area at the labour level. Thanks to its phases of the Design Thinking methodology helped a lot to achieve the proposed objective. On the other hand, this conclusion is accompanied not only by the opinion surveys conducted on the 40 students but also by ten experts based on two critical areas, usability and security, having an average of 1.80. Therefore, with these results, we seek to improve the mobile application by adding better features (Papadakis et al., 2021). Future work is required to implement applications focused on learning for all levels of education. We recommend that the research be scaled with pedagogy and computer science experts.

## Conflicts of interest

The authors declare that they have no conflict of interest.

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