

Original Article

# Design of a Mobile Application for Physical Treatments for People with Autism

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**Abstract** - People with autism have several problems with social stimulation as well as physical activities. Communication with their specialists is the main problem for which the objective is to design a mobile application for physical treatments for people with autism. As the methodology is given to mention, Scrum will have five stages (Planning Meeting, Sprint Backlog, Daily Meetings, Sprint Review and retrospective review) that will be dedicated to product development. In addition, these will have collaborative work techniques, such as the identification of user stories and the development of each sprint. The result shows us the solution of each phase of the methodology achieving finishing the work on time, fulfilling the acceptance of each defined sprint, and obtaining a validation by experts showing a 93% level of acceptance, indicating their satisfaction with the mobile design. The conclusion of the project shows the success in its development by being able to perform their physical therapies from the comfort of their home, maintaining a conversation and being advised by their specialist to meet their physical improvement.

**Keywords** - Autism, Figma, Mobile application, Physical therapies, Scrum.

## 1. Introduction

People with autism spectrum disorder (ASD) have several problems with their social stimulation. Many have problems with physical activities, lack of attention in their activities and the level of stress that causes them great problems [1]. Covid-19 was a serious problem for society as there were no methods for physical treatment. As its specialists were absent, the stress in people with autism increased every day, endangering their mental health and preventing them from developing their full potential [2]. In the United States, children, adolescents, and adults were kept in isolation during the entire pandemic process, containing several challenges such as virtual modality and a drastic change of routines affecting their behavioral health, as well as many unemployed young adults with autism spectrum disorders failing to reach their full cognitive potential [3] [45] [46]. In the world, there is no quick diagnosis for this disorder, so they are identified mostly in the 18 to 30 months of age. They are identified by problems such as anxiety, hyperactivity or other problems. When they reach adulthood, they have 10% and 33% of people with autism have verbal and nonverbal characteristics. In this way, they manage to perform labor jobs, which is why 25% of them live at home and the rest with their families [4] [5].

In Latin America, they do not have adequate treatment for their mental health, and even more so for families in rural

areas, it is very difficult to find someone specialized to attend them [6]. In the city of Quito, 51,463 students were evaluated, and 0.11% were found to have autism spectrum disorder [7]. In Brazil, it is indicated that most patients with autism have difficulties in communication, social interaction, and physical skills. Hence, social networks or technology are the best options for their cognitive development [8].

At the national level in Peru, it is recorded that students with autism problems have frustrations, physical abandonment, crying, depression, and resignation from classes in virtual modality. It is because of them that parents with covid-19 have difficulties coping with these scenarios [9]. The educational problems in Peru and the teachings transmitted by the teacher ensure a delay, which is why the department of Ayacucho and the indigenous populations are not prepared for this modality and the main problem is the lack of familiarization with the technology and the lack of physical rehabilitation for people with autism and the lack of contact with their specialist ensure a serious problem for their physical health [10] [11] [47].

The problems that often affect the world, Latin America and at a national level in Peru show us the anxiety that the person with autism has, indicating that the cell phone causes a call for attention where they can be distracted so that this



disadvantage becomes a solution for specialists to perform their operations in solving physical problems. According to what has been investigated, there is no cure for people with autism spectrum disorder; however, it can be of great help to have a variety of treatments to develop their cognitive abilities as their physical therapies, which is why the project's main objective is to make a mobile prototype for physical treatment in people with autism spectrum disorders providing them with a virtual contact with their specialist indicated the procedures of their physical therapies in people with autism.

This work is developed as follows: Chapter 2 describes the literature review to learn about the solutions proposed by other authors. Chapter 3 presents the methodology used to solve the problem. Chapter 4 presents the results where the project is written in detail, Chapter 5 details the discussion of the project, Chapter 6 presents the conclusions, and finally, Chapter 7 describes the future work.

## 2. Literature Review

The solution with mobile applications generates a novelty, and generally, everyone has a mobile device at their disposal; the project for physical therapies is a very good proposal for those people who do not have the facility to approach their specialist and do it virtually. Also, this author points out that mobile applications for virtual classes are fundamental and even more so since society underwent a great change of covid-19, and adapting to these methods is very satisfactory for some people since they can perform their classes from their comfort [12].

The cell phone can solve some problems. This author indicates that he developed a mobile application software for blood donations to register donors and minimize the donation process to speed up the increase in the number of donors, as most of them have the fatigue of long queues for their donation [13].

Mobile design is very effective because its development, by proposing new ideas for society, motivates developers to solve problems. Likewise, this author decides to show a mobile design to improve the logistical process in the fire company because their incidents are not recorded correctly, causing a delay in their publications [14]. In the same way that this author uses mobile design to improve the user experience to fall in love with his proposal using innovation techniques, he also fulfilled his goal of designing with the Figma application, making mobile software for children with dyscalculia in primary education using augmented reality, generating a high level of satisfaction by the experts in 86% [15].

The mobile application design strategy is reflected in the authors. However, the development of mobile applications is part of the usability, which is why this author implements a

mobile application using Android Studio with Kotlin open-source code, intending to develop an early stimulation application to learn to read and write [16]. Similarly, this author develops a mobile application to promote his business brand in order to communicate his company's news and improve its advertising, attracting new users [17].

The Scrum methodology is the heart of a successful project. It is very adaptable to any type of organized work, so this author shows the methodology's effectiveness by being adaptable and flexible, thanks to which he developed his web system for process improvement in academic grading and evaluation [18]. Likewise, this project indicates that using Scrum promotes good collaborative work practices with the objective of creating a mobile application aimed at older adults to increase their cognitive capacity [19].

The motivation to promote new innovative ideas is thanks to the authors who show us the different options to solve the problems of society with the help of technology; that is why the idea of designing a mobile application of physical therapies for people with autism was generated in order to not depend on face-to-face treatment and do it from the comfort of your home.

## 3. Methodology

This section explains the Scrum methodology that will consist of five phases (Planning meeting, Sprint backlog, Daily meetings, Sprint review, Sprint retrospective) as well as its techniques or tools to complete each phase, and finally details the technological tools that facilitate the development of the mobile application.

### 3.1. Scrum

This methodology is the most recommended by companies dedicated to the web or mobile development, from the basic to the most complex, in order to perform teamwork and carry out the project in the short term. It also has the 3 important bases, transparency, control, and adaptation, ensuring a high-quality system [20] [21]. The Scrum methodology will have a plan of values, roles and activities for teamwork, actively communicating to improve the project iteration and continuous improvement [22] [23]. The methodology begins with an explanation of the main objectives of the project; then, there will be a list of requirements that will be passed to the backlog that will be responsible for managing the main functions of the system. Finally, there will be feedback to verify the success of the project [24] [25] [48], as shown in Figure 1.

#### 3.1.1. Planning Meeting

This first stage is responsible for organizing the equipment and displaying a set of user stories to identify the system's function so that it has tools or techniques for its management [26] [27].

*Epic Map*

It is a technique that will be used to find product modules. For this, it should be done in a team that includes the development team and the Product Owner. In addition, these will be organized according to the product development operation [28].

*Backlog*

It is a Scrum methodology project that consists of making a list of requirements that the product to be developed will have. The objective of this list is to identify the needs of the product [29].

*3.1.2. Sprint Backlog*

In this second stage, the tasks and user stories are grouped and divided by a sprint to start the development of each group. The sprint contains a series of days or weeks for delivery. This phase will have tools and techniques for its management [30] [31].

*Planning Poker*

It is a Scrum estimation technique that is performed in a simple and fun way. This technique helps the team to estimate the effort to complete the development of user stories [32].

*Product Road*

It is a graphical representation responsible for placing the product's functionalities. The work team will be in charge of elaborating the first deliverables of the product [33].

*Sprint Planning*

Responsible for planning each sprint's duration, considering that the sprint lasts a minimum of 1 week and a maximum of 4 weeks [34].

*3.1.3. Daily Meetings*

The development team will have a daily meeting to discuss the work done, and these meetings should not exceed 15 minutes. The questions to ask are: What is going to be done? What will the next meeting be about, among other things? [35].

*3.1.4. Sprint Review*

This stage is responsible for reviewing the team's work for each sprint. This will take 3 to 4 hours for evaluation. The project manager will be responsible for meeting with the developers to determine any changes or terminate the first sprint and continue with the next one [36].

*3.1.5. Retrospective Review*

This process will allow us to identify the good and the bad of the project; once the whole sprint is finished and reviewed, it will allow us to know the attitudes of the team so that they are in charge of detailing the positive and negative events that took place during the sprint, in order to take into

account, the incidences and be prepared for the following projects [37].

**3.2. Technological Tools**

This part will explain the tools used to develop the mobile application.

*3.2.1. Android Studio IDE*

In charge of creating applications in the Android operating system, it has an integrated environment (IDE) based on a powerful code editor, is very flexible, has GitHub integrations, code templates and fast emulators with many functions associated with Google, dependent on Android Gradle plugins and programming logic, the programming language handled is Java and Kotlin [38] [39].

*3.2.2. Kotlin*

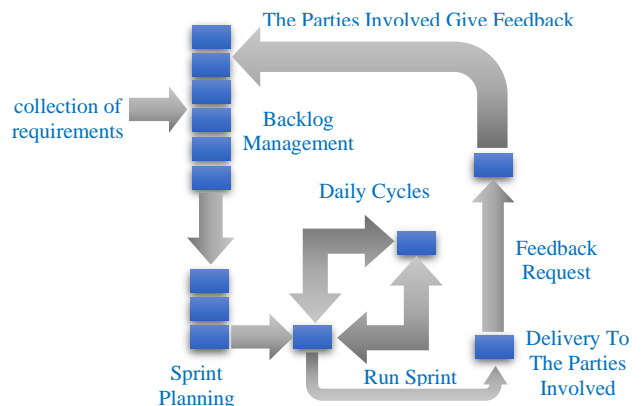
It is an open-source programming language that JetBrains created; it has a great popularity for application developers on the Android operating system; this language is considered more modern and simplified, facilitating good learning for beginners [40].

*3.2.3. Firebase*

It is a platform for developing web or mobile applications dedicated to real-time data storage and hosted in the cloud [41]. Firebase is considered a NoSQL that stores JSON; its main objective is to improve its performance in the implementation of the development of its applications, with security and ease of access [42].

*3.2.4. Figma*

It is a tool dedicated to web and mobile prototyping dedicated to vector graphics; it is a web platform that has cloud hosting and shares the project for group work to create, modify or update the project in real-time [49]. Figma has the facility to be downloadable to the computer and has a variety of templates for user satisfaction; this tool has a free version and can be exported in standard formats such as pdf, png, and jpg [44].



**Fig. 1 Scrum methodology**

## 4. Results

This section will show the results of the Scrum methodology using the tools and techniques for your mobile design development. It will also have validation by experts to ensure your satisfaction.

### 4.1. Results of the Planning Meeting

To start with this phase, two techniques will be used: the epic maps and the backlog that will be used to define the modules of the mobile application and the user stories that are the system's functionalities.

#### 4.1.1. Epic Map

This technique will show us the main modules defined by the work team, which will help us to find the user stories, starting with the backbone that will be the main module to develop, which is the users, and then the walking skeleton that will help us to develop the therapy and physiotherapy consultations, then the reports and finally the messages, as shown in Figure 2.

#### 4.1.2. Backlog

The backlog is the list of user stories found from the epic maps in Fig 2, which is why the work team will be in charge of defining the user stories, as shown in Table 1.

### 4.2. Results of the sprint backlog

To start the sprint backlog results, it is necessary to use the Planning Poker techniques to score the difficulty of the stories, the product roadmap to define the sprints, the sprint calendar to visualize the weeks of work that each sprint will count and at the end to show the development of each sprint.

Table 1. Backlog

ID	User History
H1	As a user, I would like to register to access the mobile application.
H2	As a user, I would like to have a button to retrieve my password and access the application.
H3	As a user, I would like to have a search option to search for my physical problems.
H4	As a user, I would like to have a checklist to select levels of physical therapies in order to progress from zero physical therapies.
H5	As a user, I would like to have an example of each therapy so that I can perform each therapy correctly.
H6	As a user, I would like to have a graphical report of my activities to show the progress report.
H7	As a user, I would like to be shown in writing the progress of my physical therapies to understand my evolution.
H8	As a user, I would like to be in contact with a specialist to consult my problems.

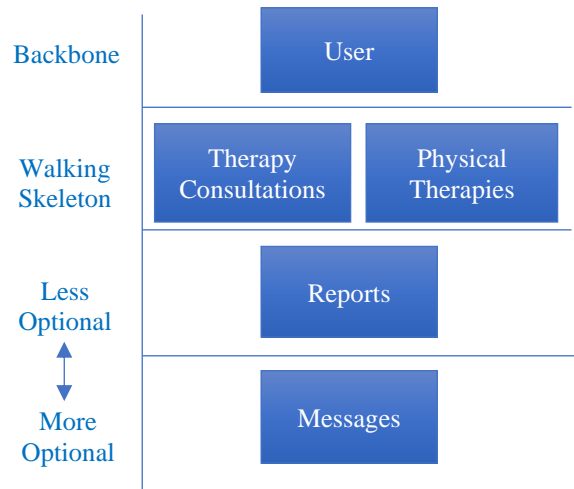


Fig. 2 Epic map

#### 4.2.1. Planning Poker

To make the estimates, the backlog must already be defined; this will help us to identify the amount of effort. The history points will be used to make metrics and measure the effort made. As shown in Figure 3, an enumeration of 1,3,5,8,13,21 is made. They will be classified by tasks where 1 to 3 are small tasks, 5 to 8 medium tasks, 13 in large tasks and 21 as very large tasks.

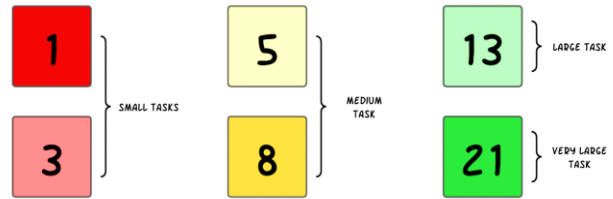


Fig. 3 Enumeration

Once the scores are defined, the planning poker will be performed to score the user stories and identify the difficulty of each one of them, which will allow us to give the score of each one of the developers and the highest value that will be validated as a total value as shown in Table 2.

#### 4.2.2. Product Road

According to the estimated difficulty of the planning poker, the user stories should be sorted and grouped by sprint; that is why this technique is performed; each of the sprints will have a different colour (Yellow first sprint, Turquoise second sprint and Green third sprint) as shown in Figure 4

#### 4.2.3. Sprint Planning

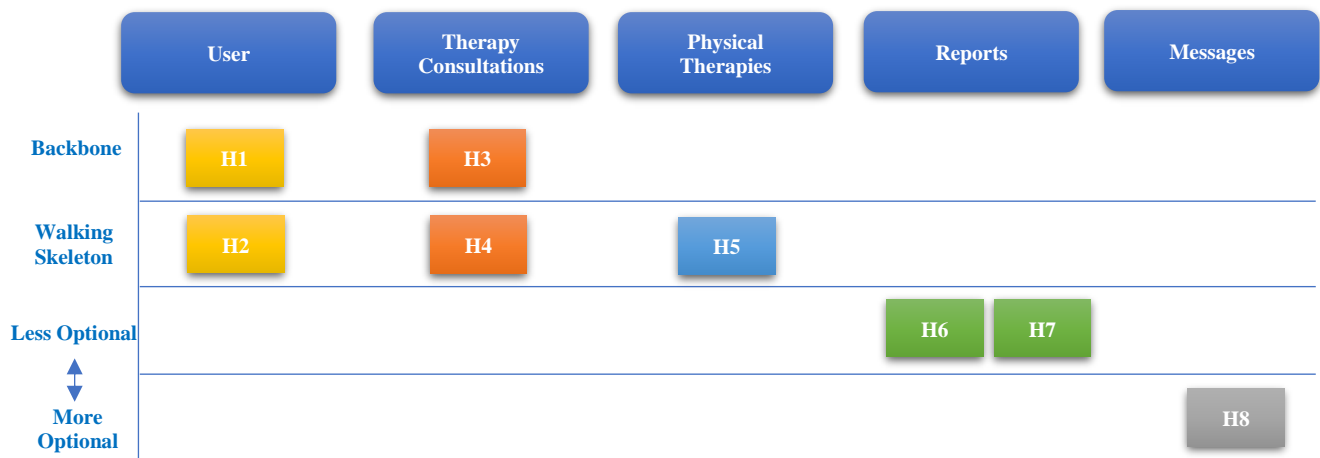
The work weeks per sprint are planned, indicating that the first sprint will have 2 weeks of work, the second sprint will have 3 weeks, and the third sprint will have 4 weeks, as shown in Table 3.

**Table 2. Planning poker**

ID	User History	Developer 1	Developer 2	Total
H1	As a user, I would like to register to access the mobile application.	3	5	5
H2	As a user, I would like to have a button to retrieve my password and access the application.	3	5	5
H3	As a user, I would like to have a search option to search for my physical problems.	8	8	8
H4	As a user, I would like to have a checklist to select levels of physical therapies in order to progress from zero physical therapies.	8	8	8
H5	As a user, I would like to have an example of each therapy so that I can perform each therapy correctly.	13	13	13
H6	As a user, I would like to have a graphical report of my activities to show the progress report.	13	13	13
H7	As a user, I would like to be shown in writing the progress of my physical therapies to understand my evolution.	13	13	13
H8	As a user, I would like to be in contact with a specialist to consult my problems.	13	21	21

**Table 3. Sprint planning**

ID	User History	Weeks	Sprint
H1	As a user, I would like to register to access the mobile application.	2 Weeks	Sprint 1
H2	As a user, I would like to have a button to retrieve my password and access the application.		
H3	As a user, I would like to have a search option to search for my physical problems.		
H4	As a user, I would like to have a checklist to select levels of physical therapies in order to progress from zero physical therapies.		
H5	As a user, I would like to have an example of each therapy so that I can perform each therapy correctly.	3 Weeks	Sprint 2
H6	As a user, I would like to have a graphical report of my activities to show the progress report.		
H7	As a user, I would like to be shown in writing the progress of my physical therapies to understand my evolution.		
H8	As a user, I would like to be in contact with a specialist to consult my problems.	3 Weeks	Sprint 3



**Fig. 4 Product road**

The following will show the development of the three sprints, with their respective user stories that will be responsible for implementing the mobile application while maintaining the functionality for the user.

4.2.1. Sprint 1 (H1)

This part shows the design of the first user story, as shown in Figure 5. The first image (a) shows the start of the application, and (b) shows the user registration, filling in their personal data with their full name, email, age and password.

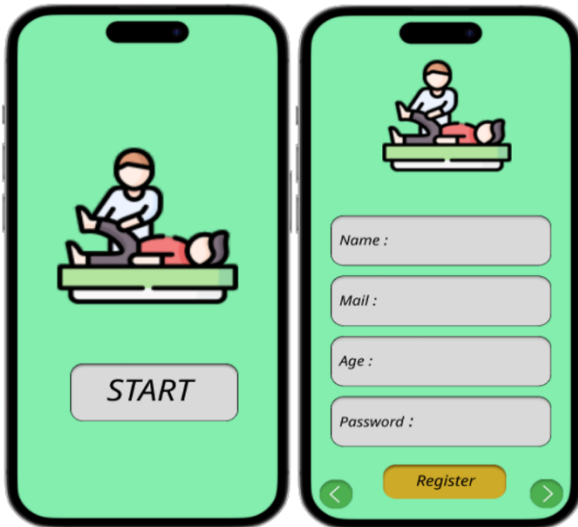


Fig. 5 Sprint 1 (H1): (a) Start application (b) Register

4.2.2. Sprint 1 (H2)

In this part, the design of the second user story is indicated, as shown in Figure 6. The application will show the password recovery where the user goes to the system login to place the option to recover the password (a); in the second step, the user will use his/her registered email (b) and finally, he/she will be able to reset his/her password (c).

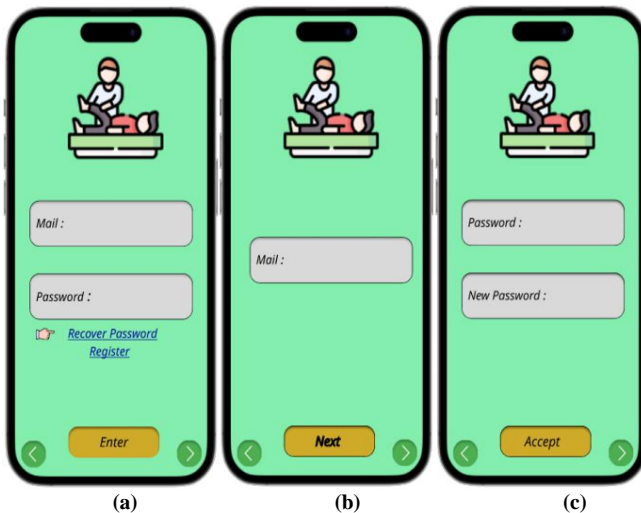


Fig. 6 Sprint 1 (H2): (a) Login (b) Enter your email address (c) Reset your password

4.2.3. Sprint 1 (H3)

Figure 7 shows the application developed for the user with the functionality to consult his physiotherapy.

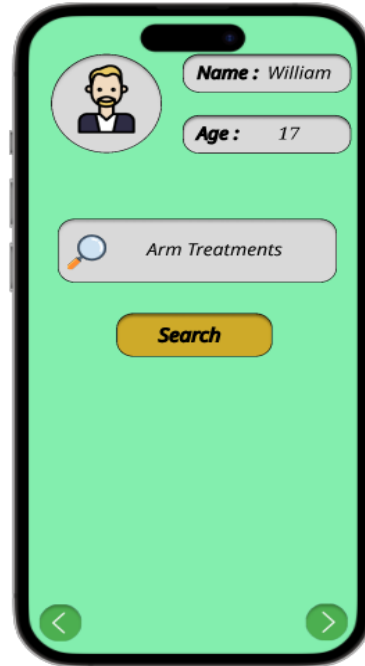


Fig. 7 Sprint 1 (H3)

4.2.4. Sprint 1 (H4)

As shown in Figure 8, the user will have the option to manage his or her difficulty and the time he or she has to work each day.

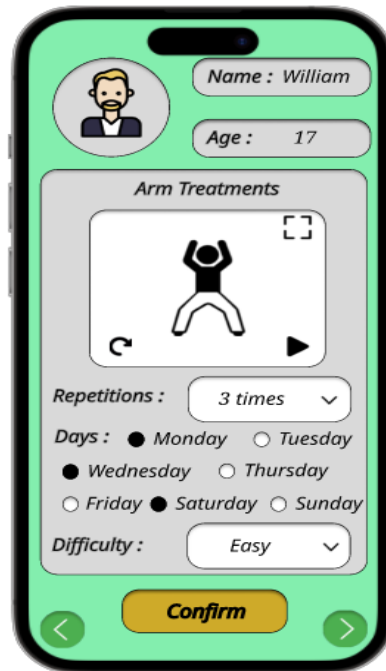


Fig. 8 Sprint 1 (H4)

4.2.5. Sprint 2 (H5)

As shown in Figure 9, the user will be able to visualize an example of how each activity is carried out with the facility to assist in its processing.



Fig. 9 Sprint 2 (H5)

4.2.7. Sprint 2 (H7)

As shown in Figure 11, the user will have the option to view their situation in detail and verify the specialist's opinion.

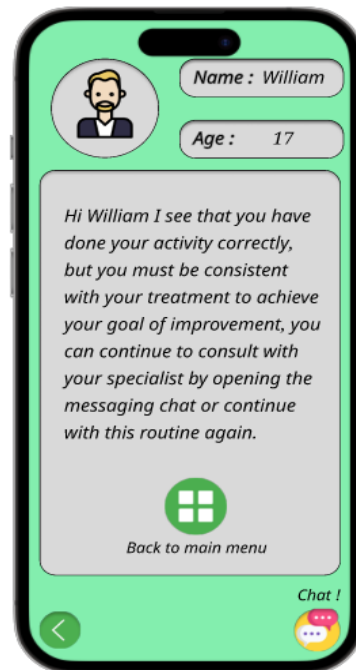


Fig. 11 Sprint 2 (H7)

4.2.6. Sprint 2 (H6)

As shown in Figure 10, the user will have a progress report for each therapy performed during the day.

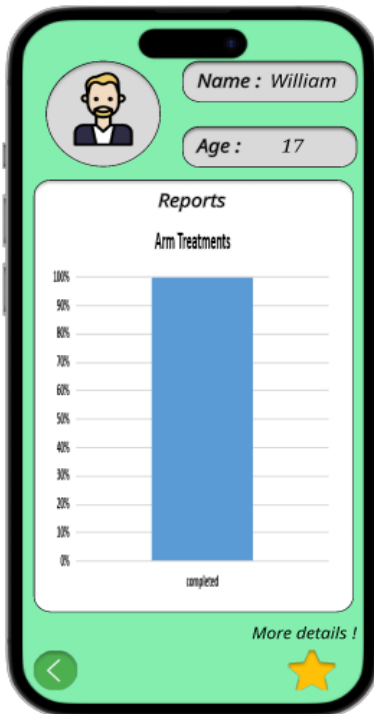


Fig. 10 Sprint 2 (H6)

4.2.8. Sprint 2 (H8)

As shown in Figure 12, the user will have the option to communicate with their specialist through the messaging chat to consult their problems and see the specialist's recommendations.



Fig. 12 Sprint 3 (H8)

**4.3. Results of Daily Meetings**

To carry out the development of each sprint, daily meetings were held, which is part of the Scrum methodology to have feedback, monitoring or impediments that the project has to perform each sprint. The meetings lasted 15 minutes every day and asked: What was done yesterday, what will I do today, what obstacles I have, what obstacles do I have?

**4.4. Results of the Sprint Review**

In this phase, the sprint review will be performed to evaluate the progress of each user story in compliance with the weeks established for each sprint, with the objective of observing any changes.

**4.4.1. Sprint 1 Review**

Figure 13 shows the review of sprint 1, indicating that its development began on October 15 and ended on October 29, with no delays and meeting the estimated time, which is considered an acceptable sprint.

**4.4.2. Sprint 2 Review**

Figure 14 shows the review of sprint 2, indicating that its development began on October 30 and ended on November 20, with no delays and meeting the estimated time, which is considered an acceptable sprint.

**4.4.3. Sprint 3 Review**

Figure 15 shows the review of sprint 3, indicating that its development began on November 21 and ended on December 12, with no delays and meeting the estimated time, which is considered an acceptable sprint.

**Table 4. Retrospective Review**

Questions	Answers
What was done well?	Meet established deadlines.
What can be improved?	Better plan meetings to define user stories.
What should be left undone?	Do not be silent to establish solutions; freely expose ideas.

**4.5. Results of Retrospective Review**

In this last phase, an evaluation is carried out, which will serve to improve future projects, so the following questions are asked: What was done well, what can be improved and what should be left undone, as shown in Table 4.

**4.6. Expert Validation of the Prototype**

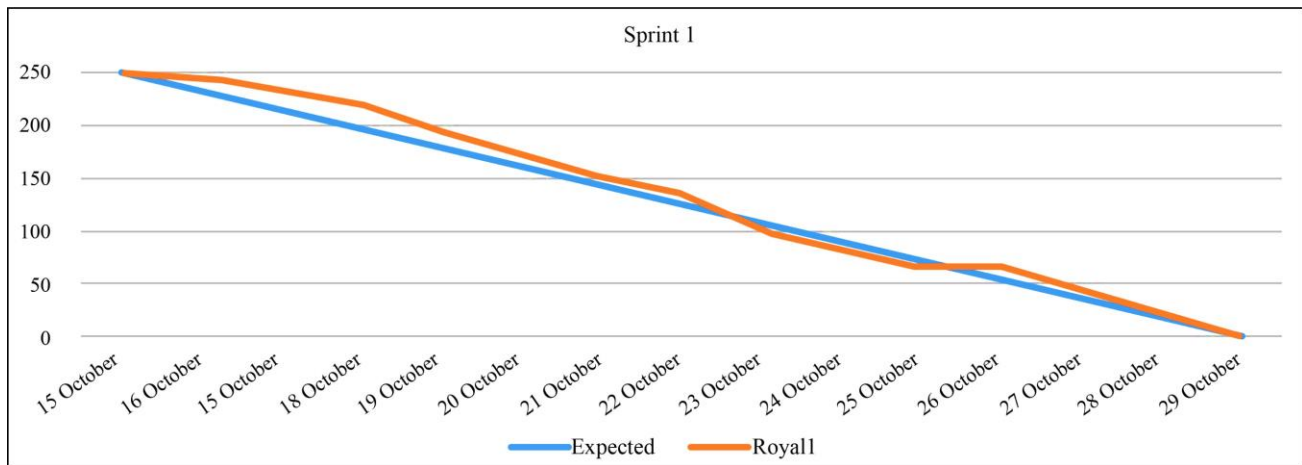
In this final part of the results, an expert validation is performed on the prototype, fulfilling the four acceptance criteria (Coherence, Functionality, Integration and Usability); each criterion has three levels; the low level has a score of 0% to 49% where it indicates the ineffectiveness of the prototype. This medium level has a score from 50% to 79%, which indicates that the prototype should be readapted until the correct application is achieved and the high level that has a score from 80% to 100%, which indicates satisfaction and acceptance by the experts, as shown in Table 5.

**Table 5. Level of acceptance**

Lower	Middle	High
0% - 49%	50% - 79%	80% - 100%

Table 6 shows the score of the criteria for each expert showing the success of the mobile design in physical therapies for people with autism, for the total result will be the level at which the validation is, to count a grand total by the experts should consider the sum of the acceptance criteria and be divided by the number of criteria.

Figure 16 shows the results of the prototype validation; the first expert shows a high level of acceptance with 94%, the second expert shows a total of 93%, the third expert shows a total of 92%, the fourth expert shows a total of 94%, the fifth expert shows a total of 93%, all the experts scored show an overall total of 93% indicating the high level of satisfaction with the mobile design for physical therapies for people with autism.



**Fig. 13 Sprint 1 review**



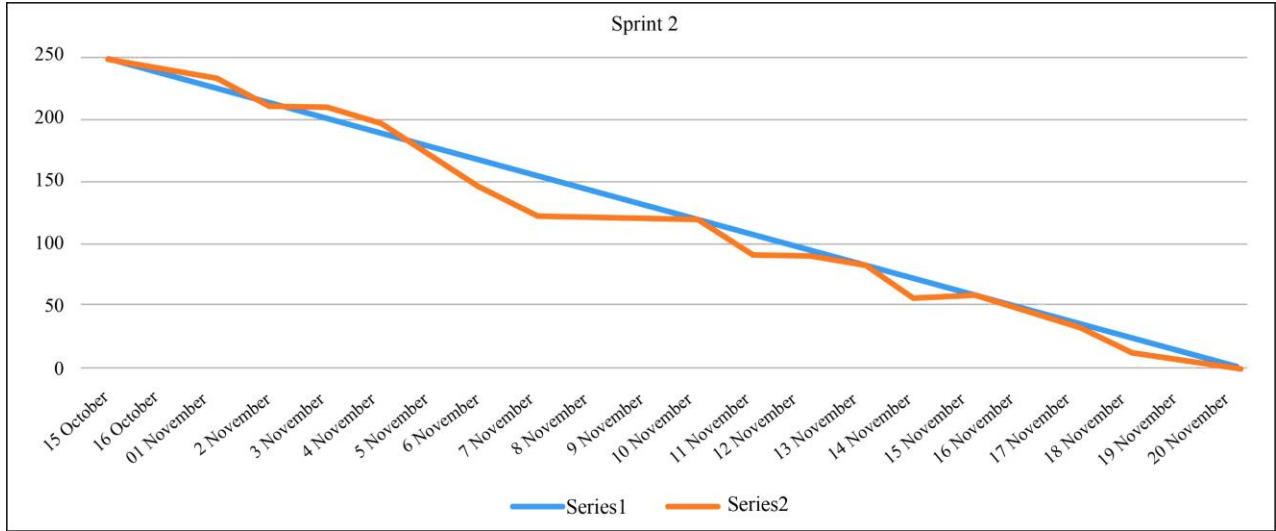


Fig. 14 Sprint 2 review

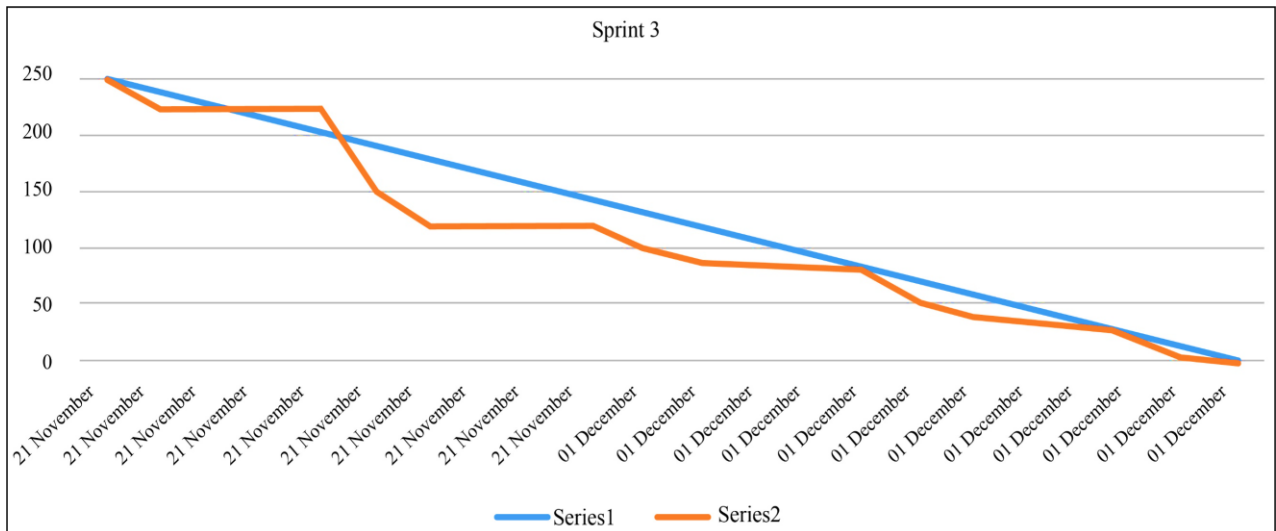


Fig. 15 Sprint 3 review

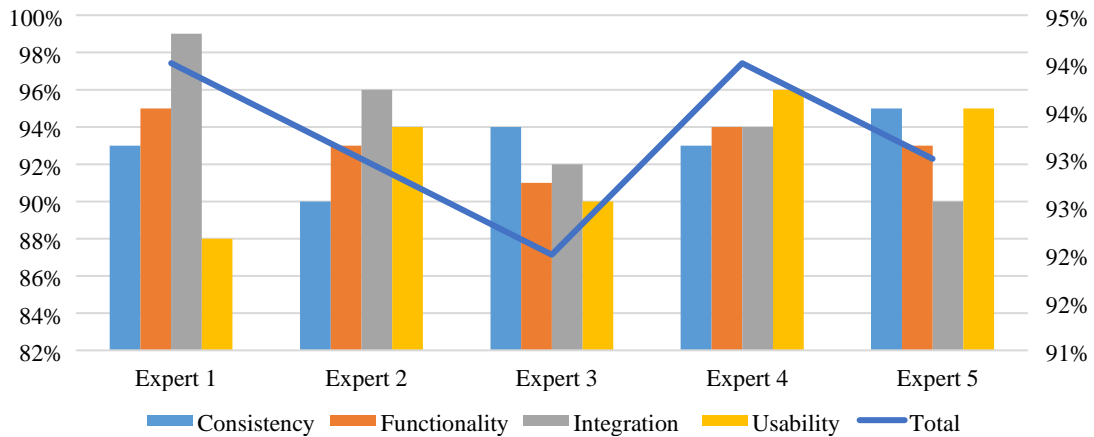


Fig. 16 Expert validation

**Table 6. Scoring by experts**

Experts	Functionality	Usability	Consistency	Integration	Total	Level
Expert 1	95%	88%	93%	99%	94%	High
Expert 2	93%	94%	90%	96%	93%	High
Expert 3	91%	90%	94%	93%	92%	High
Expert 4	94%	96%	93%	93%	94%	High
Expert 5	93%	95%	95%	90%	93%	High

**Table 7. Validation of results by experts**

Experts	Mobile Design	Mobile Development	Scrum Methodology
Expert 1	94%	85%	96%
Expert 2	92%	89%	97%
Expert 3	88%	81%	92%
Expert 4	98%	83%	94%
Expert 5	87%	84%	97%

**4.7. Validation of Results by Experts**

This part will show the validation of the results as shown in Table 7, where the experts will make sure that the developed method meets the objective of the work; that is why it is mentioned how specific the mobile design, mobile development and Scrum methodology in such a way that the experts will be able to score and demonstrate that the project is correct.

**4.8. About the Methodology**

**4.8.1. Advantages**

The main advantages of the Scrum methodology are the clarity of its objectives since it delivers efficiently and on time, is flexible and adapts quickly to customer-generated changes. It also manages teamwork, the most important part of developing activities with total freedom and organization.

**4.8.2. Disadvantages**

The disadvantage of working with this Scrum methodology is that the team must be highly trained to respect their role in order not to clash functions, as well as not completing tasks on time will result in financial losses, lack of focus in their project management and distrust from the customer.

**4.8.3. Comparison**

The comparison of Scrum with other methodologies is very important to choose the ideal one for any type of project that is presented to us; Kanban is a methodology to organize the work team with activity flows, but it does not have the possibility to modify its times and activities to improve the quality of the product as well as Scrum does. Likewise, with the RUP (Rational Unified Process) methodology, its projects are of a long scope and long development. It has its deliverables in its business cases, list of risks, and iteration

plan, among others. That is why RUP is characterized by carrying out its projects from start to finish, something that Scrum does not have in this project plan.

**5. Discussions**

This work meets the objective of performing physical therapies using the mobile application, so similar solutions exist. Likewise, this author [13] indicates that the mobile application development project is of great help to minimize the delays of long lines for blood donation, registering you quickly and increasing more donors.

Then the author [18] assures us that the Scrum methodology meets its flexibility and adaptability to the changes for its systems development, fulfilling its tasks in the estimated time and ending with the sample of its product which is a web system for the process of qualification and evaluation in the academies in the same way this author [19], who considers good practices with the Scrum methodology since it is motivated to perform collaborative work, fulfilling its objective of developing a mobile application for older adults to increase their cognitive ability. These authors agree that the work is the best option for using the Scrum methodology and the development of the mobile application, allowing quick solutions for the users.

**6. Conclusion and Future Word**

The application was developed successfully, fulfilling its objective, which is to design a mobile application of physical treatments for people with autism to perform their activities from the comfort of their homes, being in constant conversation with their specialist. The project was carried out with the Scrum methodology fulfilling its objective to perform its work in a short time showing the functional product from its first sprint; thanks to that, this work was completed. The main limitation of the project is the lack of mobile programming since the work is focused on making a mobile design and not on its implementation. As future work, this project should be done with other types of technology, such as augmented reality or artificial intelligence, to improve the user experience and contribution to society, taking into account that these technologies are ready to solve any problem in schools, hospitals, and companies, among others.

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