
SAPIENZA
UNIVERSITÀ DI ROMA

FACOLTÀ DI INGEGNERIA INFORMATICA: MASTER OF SCIENCE IN ENGINEERING IN COMPUTER SCIENCE

Tesina - Human-Computer Interaction

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# QUIZAPP

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# Contents

# Abstract

This report describes the workflow about the development of a mobile application called QUIZAPP whose fundamental purpose is to provide a way to search for the quizzes within several categories and try to answer as many questions as possible to get the rating. Of course, there are several applications already made in this type, but our application will be helping people no matter their age and specialty as we have questions in different categories.

Our application is pretty simple, but hard at the same time because in our database we contain several categories of quizzes with several numbers of questions inside each category. Thus, we have created our database and the frontend for adding, editing and deleting questions as the administrator likes.

# Introduction

Our project has one main target which is the users and one additional target which is the question selector for the quiz application. In this report, we will be dealing only with the user part as there is/will be only one developer and several users. Thus, in the following sections, we will be dealing with several scenarios and the analysis of the requirements. Then, we will be shown who are the competitors for our project and the advantages/disadvantages each one has. After that, it will be shown the design of the possible behaviors and actions to be done by the users by showing by some task modeling tools like HTA and STN. Then, we will be explaining the development part of the work where we will be dividing into some prototypes until the final release of the product. Finally, we will be presenting the final product with its features and conclude the report by including future work to be done in the future to make our product much more attractive and beneficial for users.

# Requirement Analysis

Before starting our project, we made several types of analysis and literature searches regarding the problem and solutions for that. We found out that, there are several products already made till today, but, of course, no product is perfect so every product has its good and drawbacks. In the following sections, we will be including the competitors we have in this project by showing their pros and cons.

## Competitors Analysis

These are the fundamental alternatives or competitors to our application:

1. QuizUp is probably the best application on the market that combines trivia and social networks help users to choose among 1200 topics for different types of quizzes.
2. Popcorn Trivia is one of the most popular applications on the market for its movie content where users can answer questions related to movies.
3. Heads Up are an application for especially families to have a good time together with its words/names/titles concept.
4. Psych is a game where each player submits a fake-but-plausible answer to different trivia questions, which are then displayed on the phone's screen. Those who guess the correct answer earns points.

| | **QuizUp** | **Popcorn** | **HeadsUp** | **QuizApp(ours)** |
|---|---|---|---|---|
| **Chat functionality** | No | Yes | No | Yes |
| **Register/Login with social network** | Yes | No | Yes | Yes |
| **Pros** | It has a lot of interesting categories to play with | It has a beautiful design with categories | It has many different topics to choose from | It has several categories with lots of questions in the database |
| **Cons** | 1. It has lots of security problems 2. It is available only for IOS | 1.It's only possible to have movie quizzes | 1.It is a paid product and you need to pay to play | It does not have any API at the moment |

## Questionnaire Analysis

In this section and the following paragraphs, we will show the result of our questionnaire analysis that we have received from other users. The received answers helped us to improve our original idea and showed us that some of our intuitions were good. We reached an amount of 97

answers in English. At the moment, we have done our questionnaire only in English due to lack of time.

## User Background

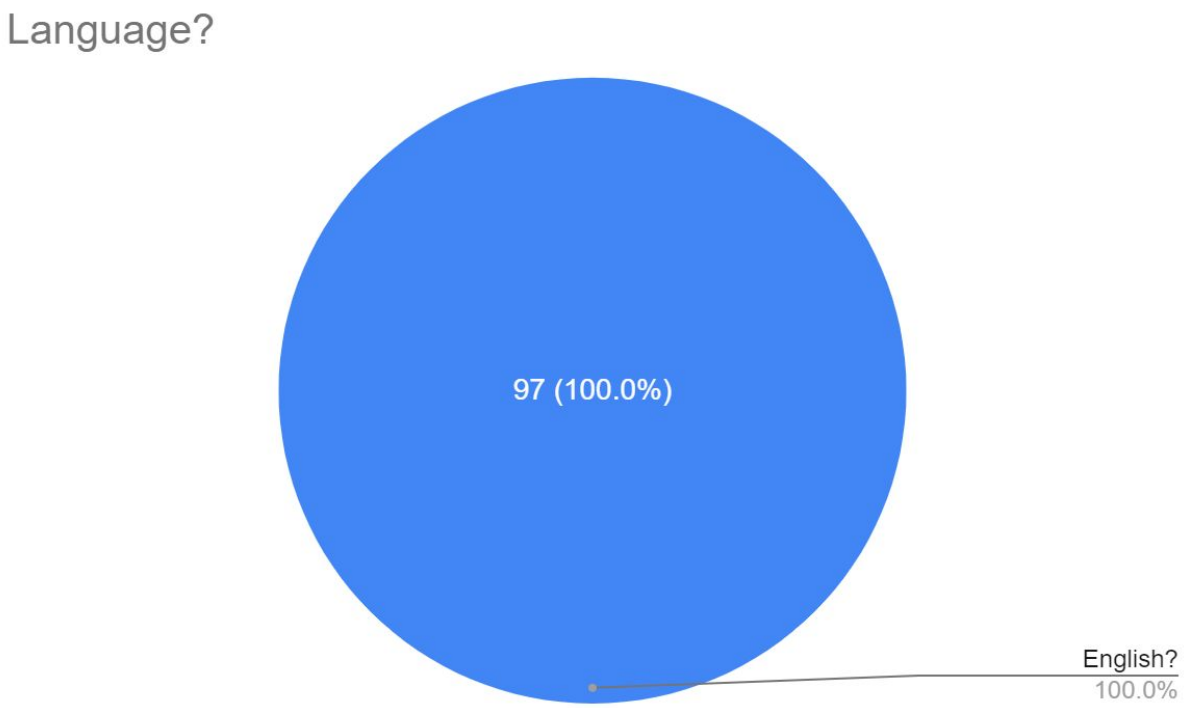



*Figure 1: Results about Language*

*Figure 2: Results about Age*

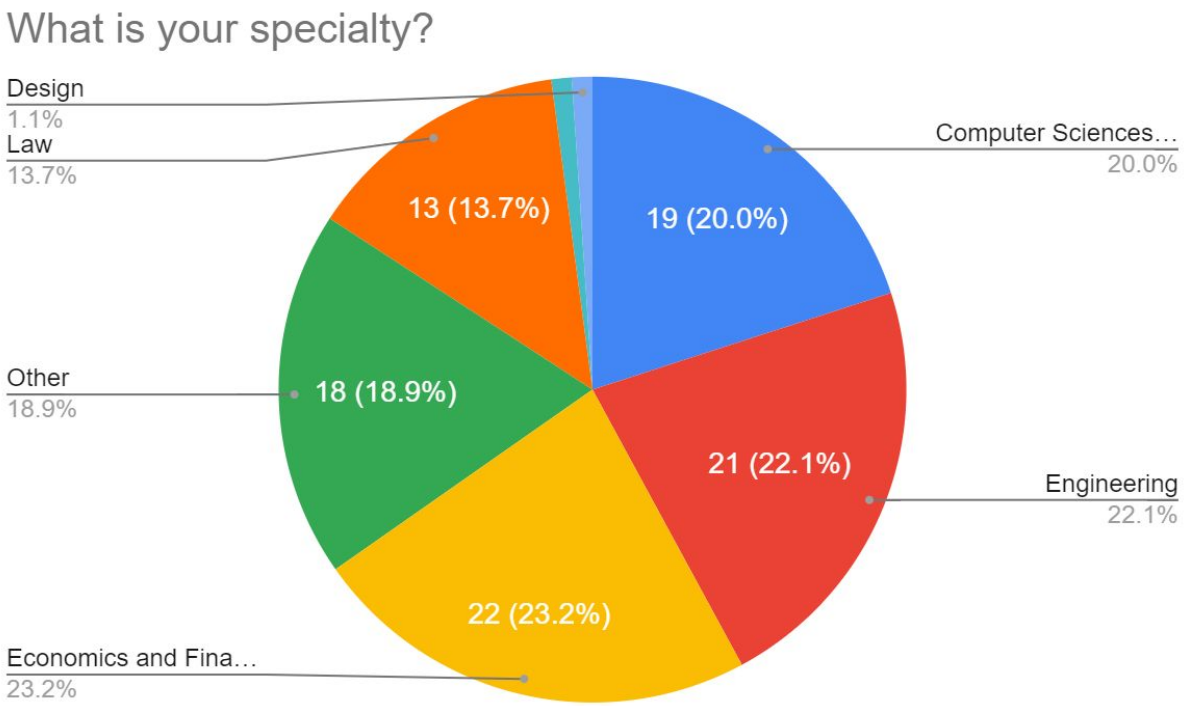



*Figure 3: Results about Specialty*

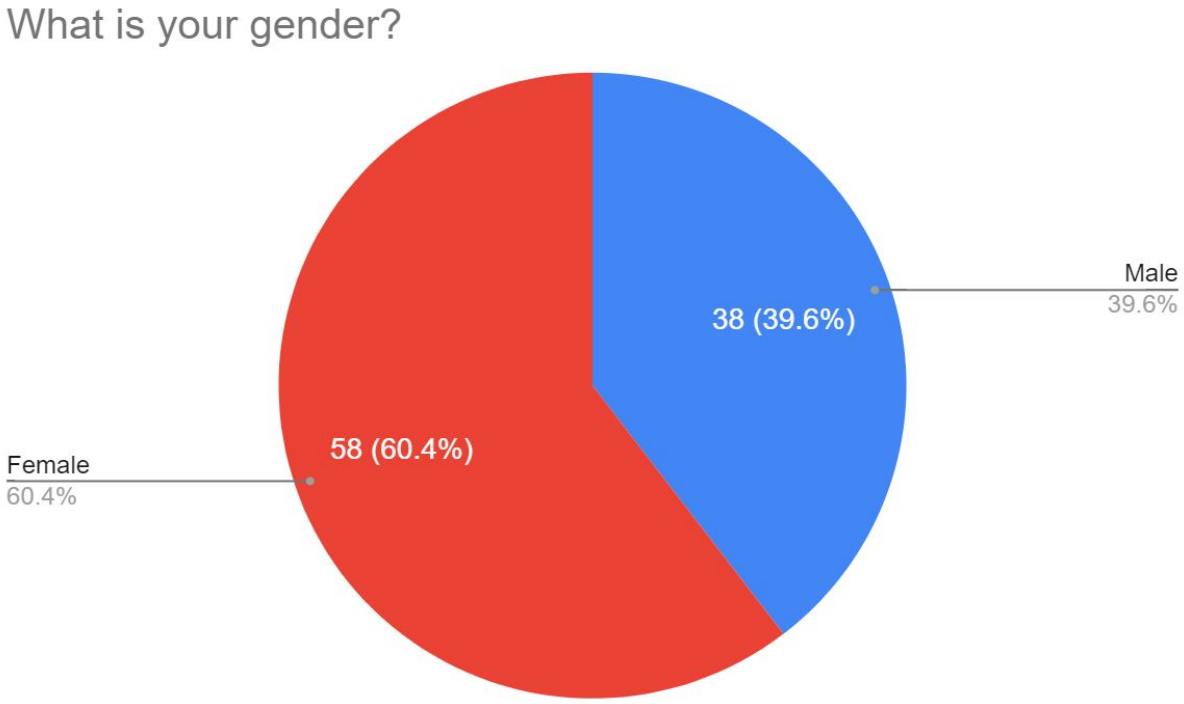



*Figure 4: Results about Gender*

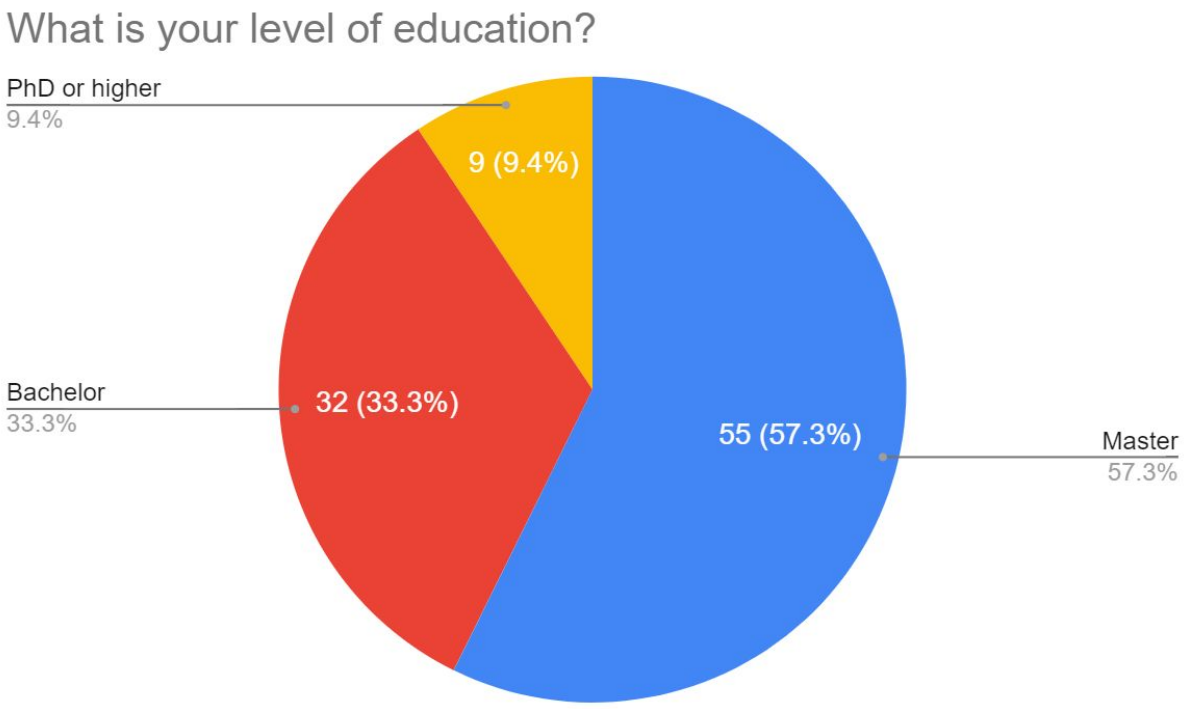



*Figure 5: Results about Level of Education*

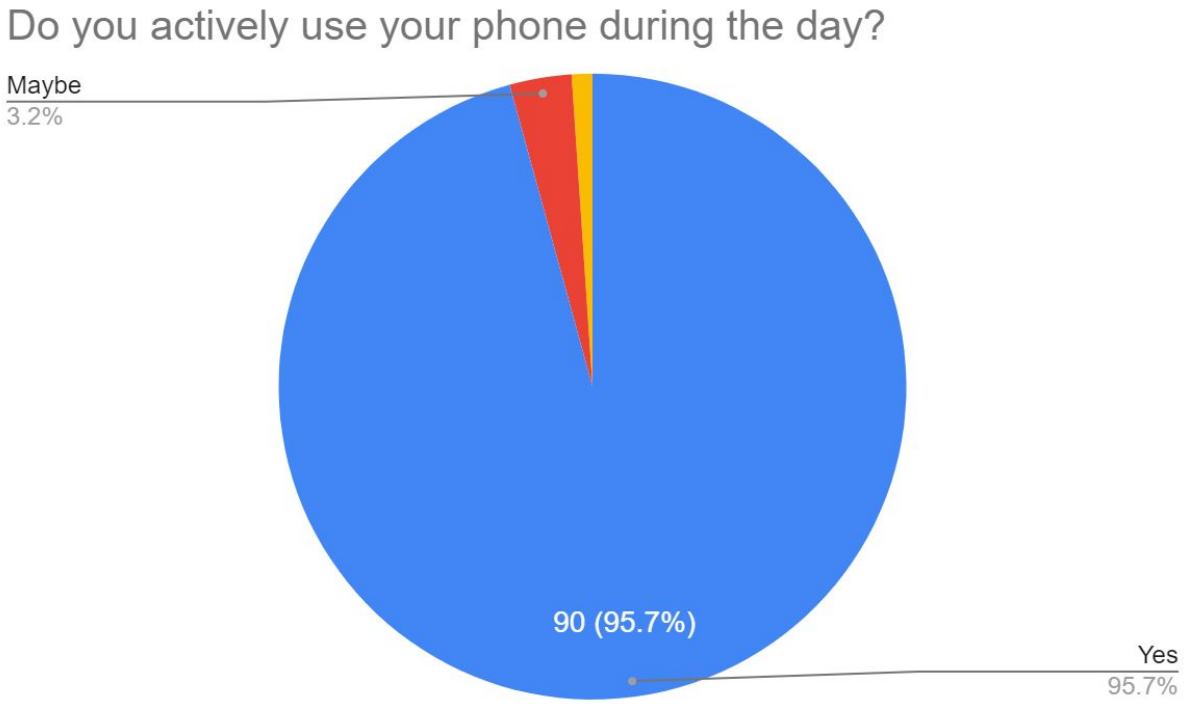
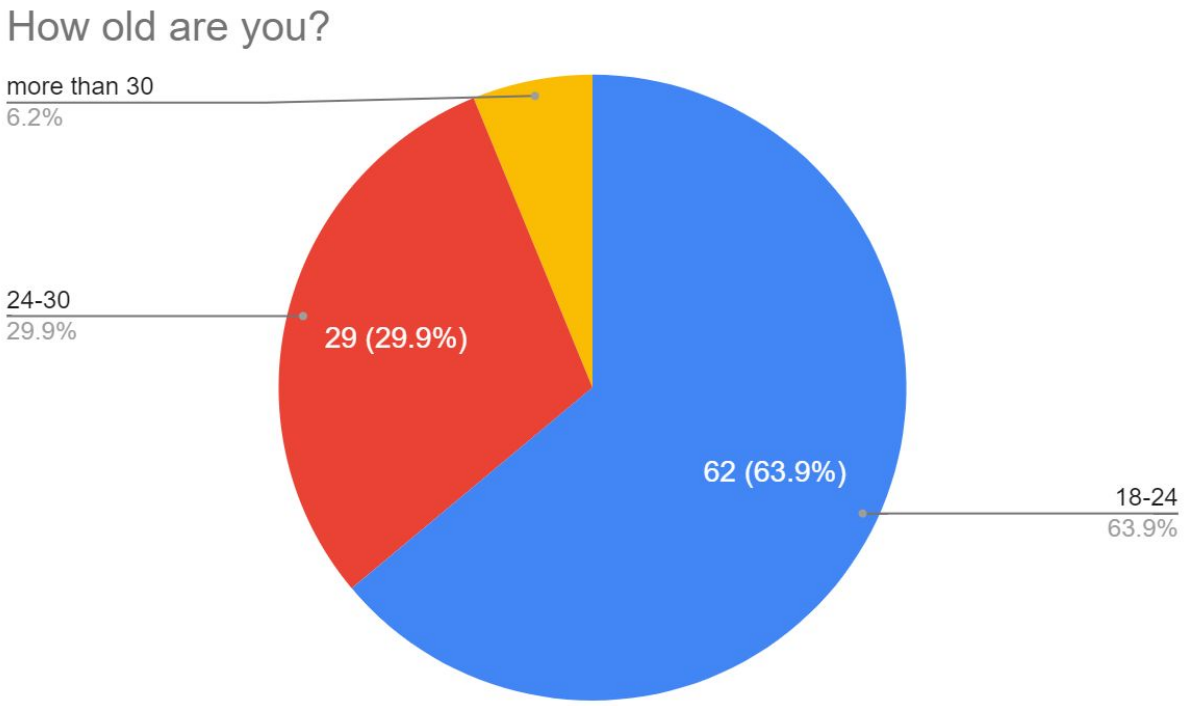


*Figure 6: Results about Using the phone*

## Summary about User Background

- The questionnaire is written entirely in English, and the answers are in English
- As you can see the majority of the students answered were aged from 18-24. (63.9%)
- The majority of the students that study Economics and Finance (23.2%) answered the questionnaire, and almost all the types of specialty answered the research.
- 60.4% of the participants that answered this questionnaire were females which are over half of the total amount. The rest of the 39.6% were males.
- Most of the students who did the research are from master degree 57,3%. However, bachelor's degree stays with 33.3% in second place.
- 95.7% of people actively use the phone during the day, but 1.1% do not use it.



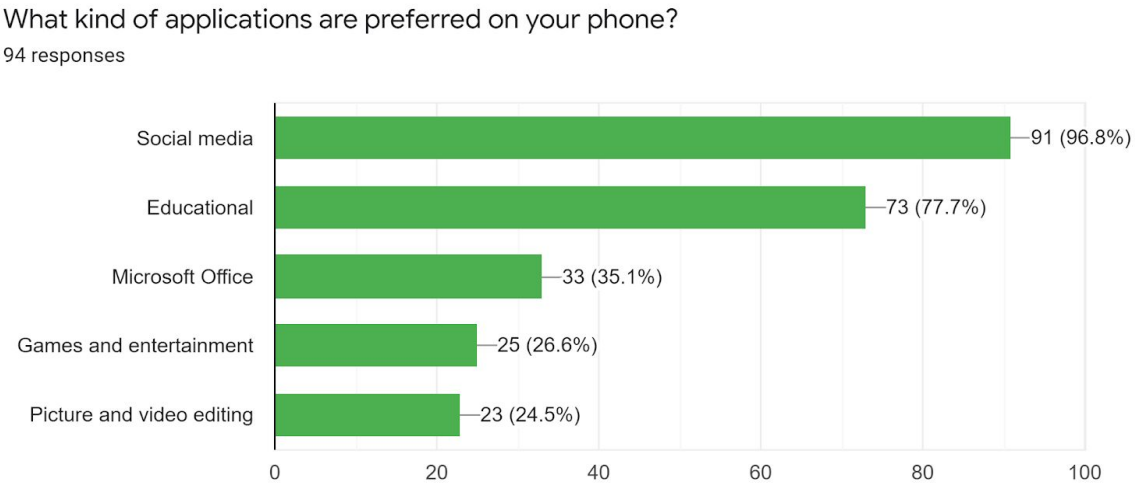




*Figure 7: Results about Most preferred applications*

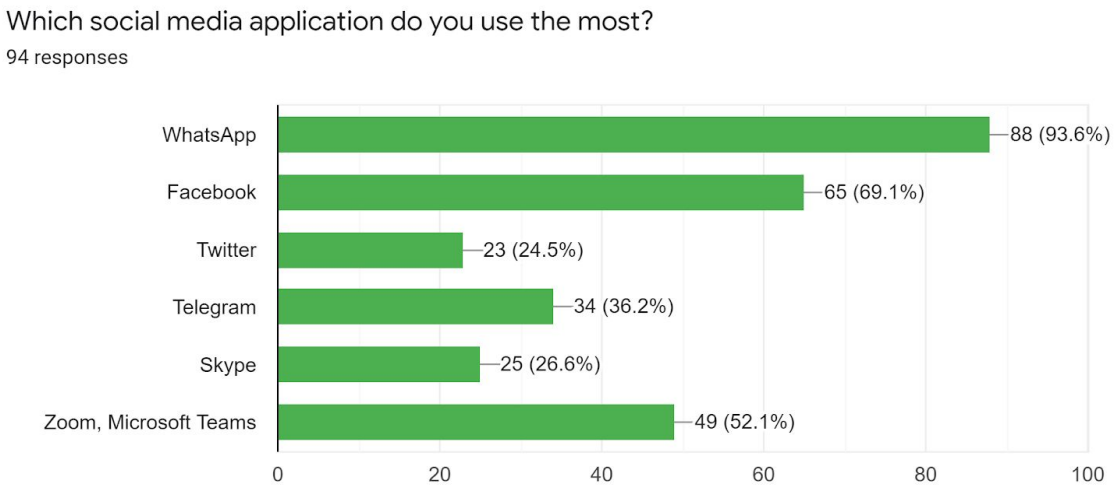



*Figure 8: Results about Most preferred Social media applications*

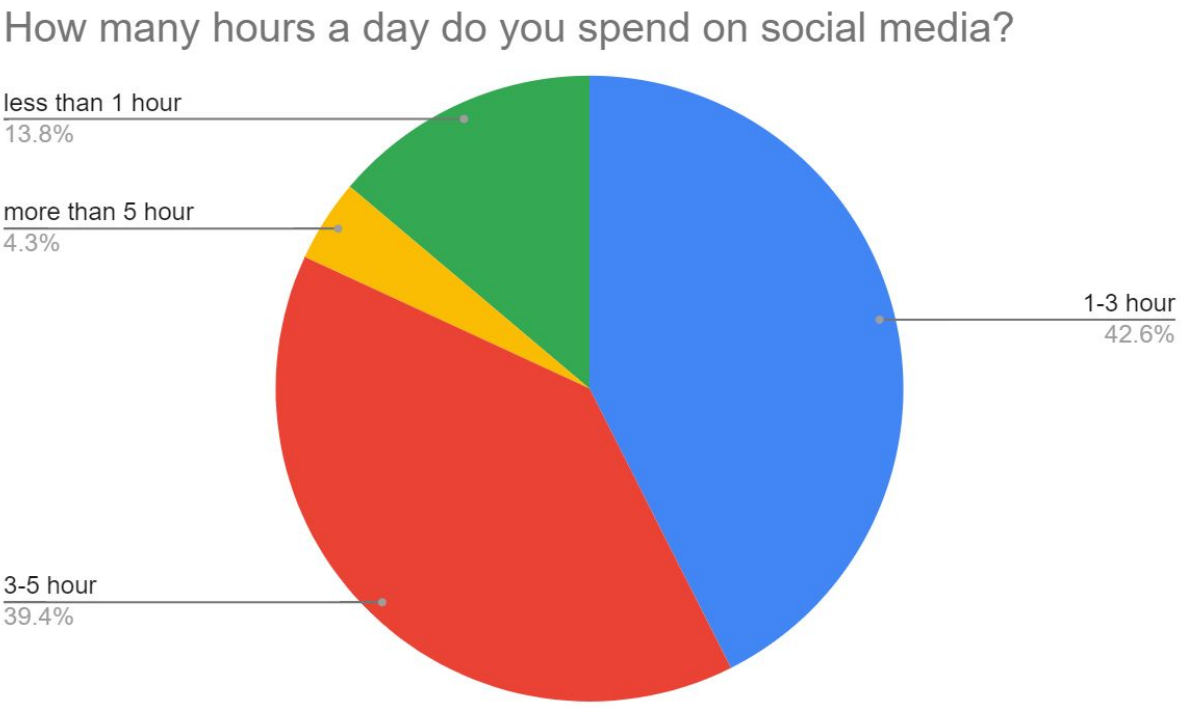



*Figure 9: Results about Time spending on Social media*

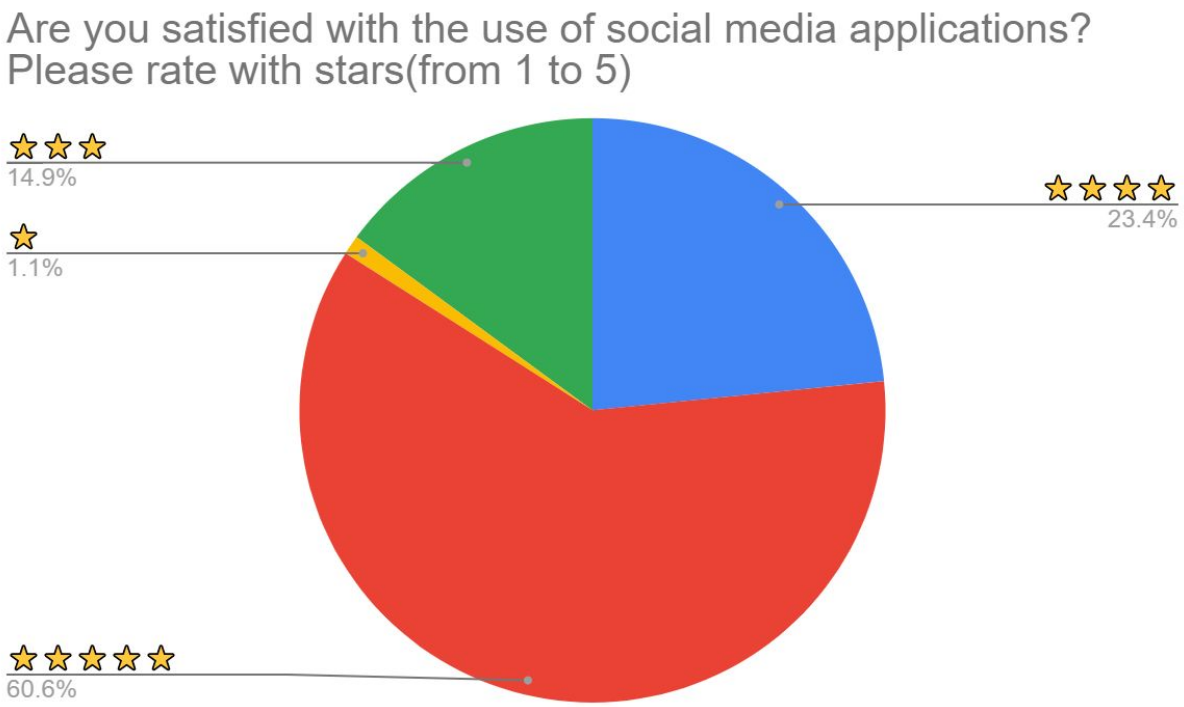



*Figure 10: Results about Satisfaction rate on Social media*

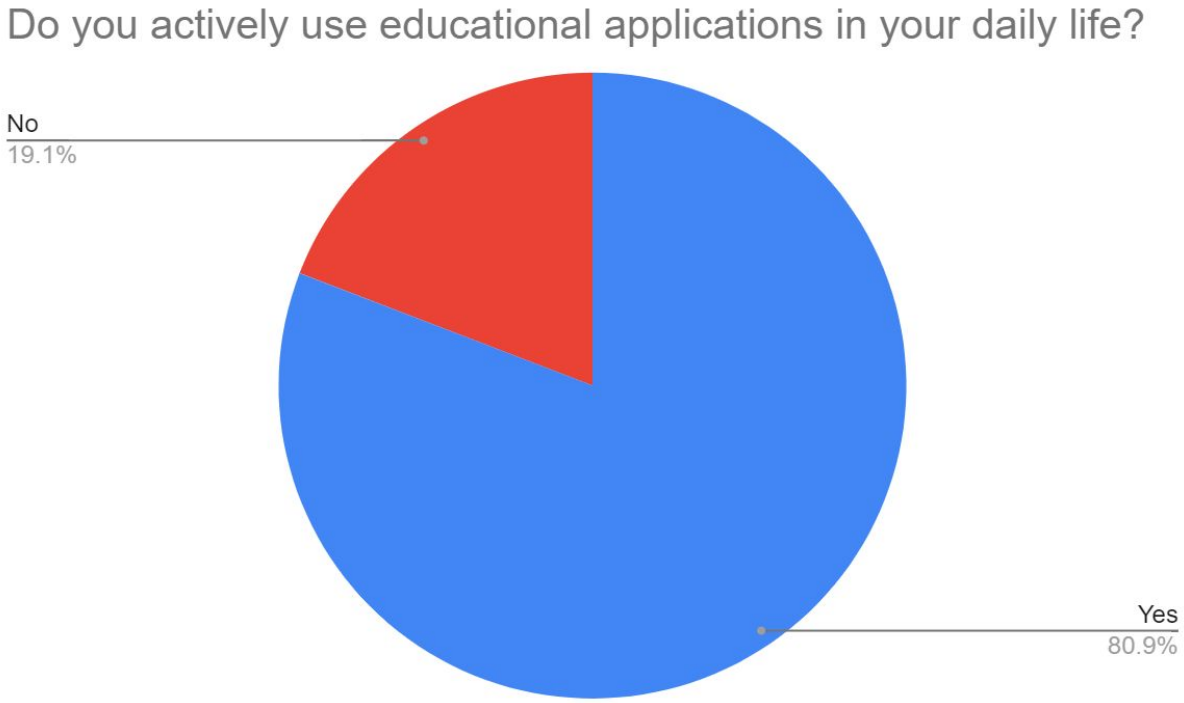


*Figure 11: Results about using educational applications*

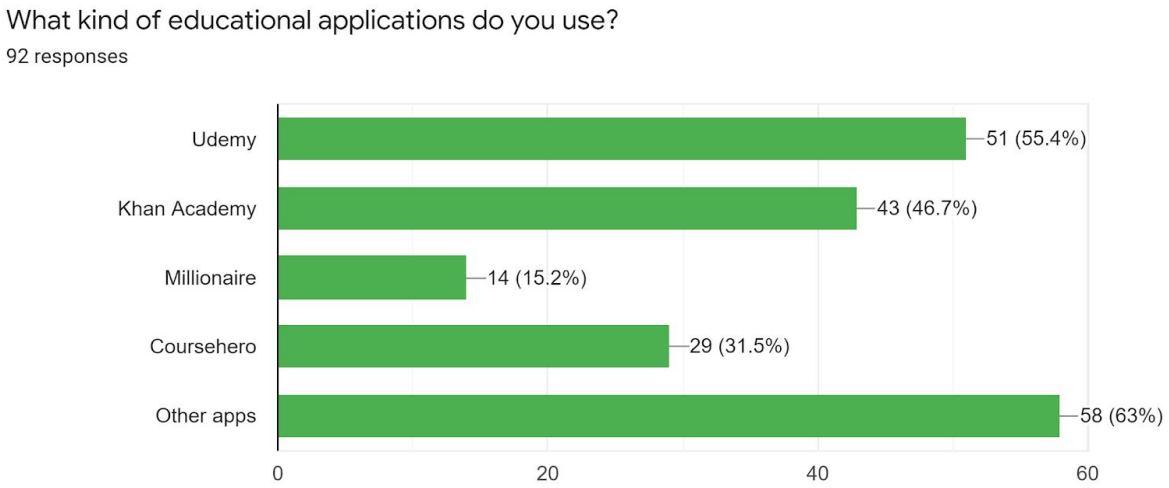



*Figure 12: Results about most preferred  educational applications*

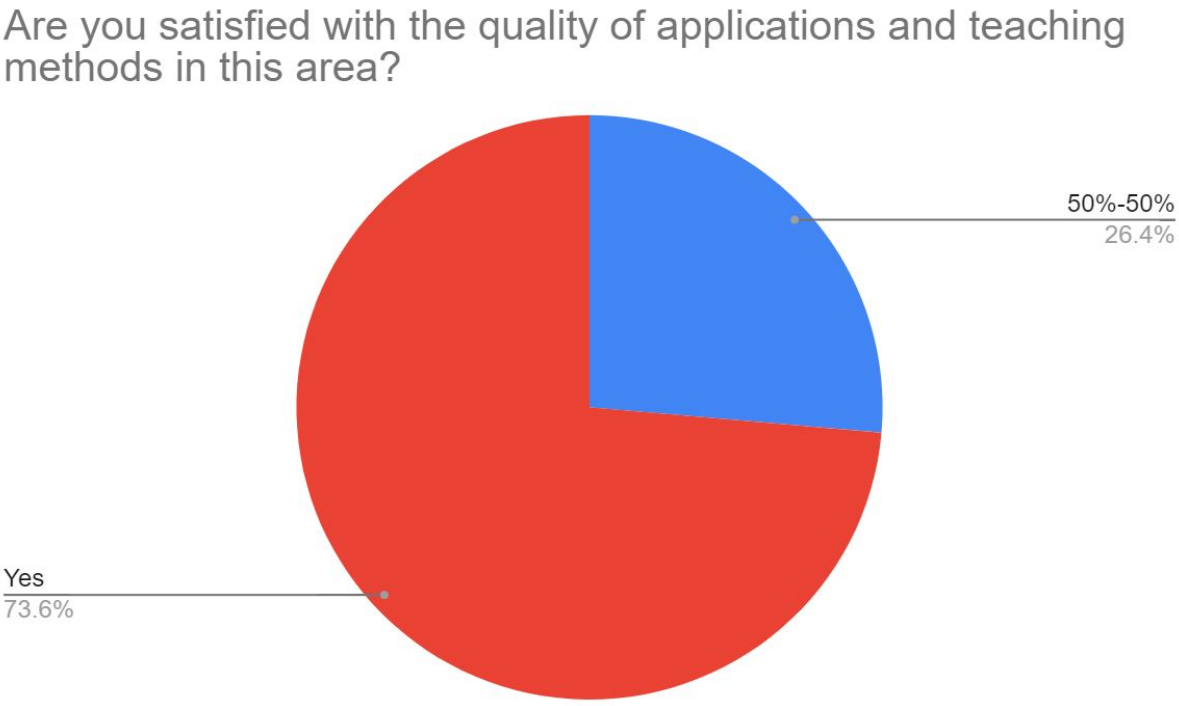



*Figure 13: Results about satisfaction for quality and teaching method of educational applications*

## Summary about Product research

- Based on the responses, we can say that people use more social media applications on their phones (91 votes), followed by Educational applications with 73 votes. Then Microsoft Office took third place with 33 votes, Games and entertainment took fourth place with 25 votes, and Picture and video editing took fifth and last place with 23 votes.
- According to the survey, WhatsApp is the most popular social media application with 88 votes. Facebook is in second place with 65 votes. Online classes and conferences related to the pandemic have increased the use of Zoom and Microsoft Teams. These programs are in third place with 49 votes. Fourth, Telegram is fourth with 34 votes, Skype is fifth with 25 votes and Twitter is sixth and last with 23 votes.
- 42.6% of people spend 1-3 hours a day on social networks, but in second place with 39.4% stop using 3-5 hours. In the last place with 4.3% stop using more than 5 hours.
- The majority of people surveyed are very satisfied with social media applications, with 60.6 percent rated them as 5 stars. The percentage of those dissatisfied is 1.1 percent.
- Since the majority of respondents are students, the percentage of those who use Educational applications is 80.9 percent, and the percentage of those who do not use is 19.1 percent.
- People use other educational applications with 58 votes. In the second place, they use Udemy with 51 votes. Khan Academy is in third place with 43 votes, Coursehero is in fourth place with 29 votes, and Millionaire is in the last place with 14 votes.
- Results about satisfaction for quality and teaching method of Educational applications illustrate that more than half of people (73.6%) are satisfied.

QuizApp research

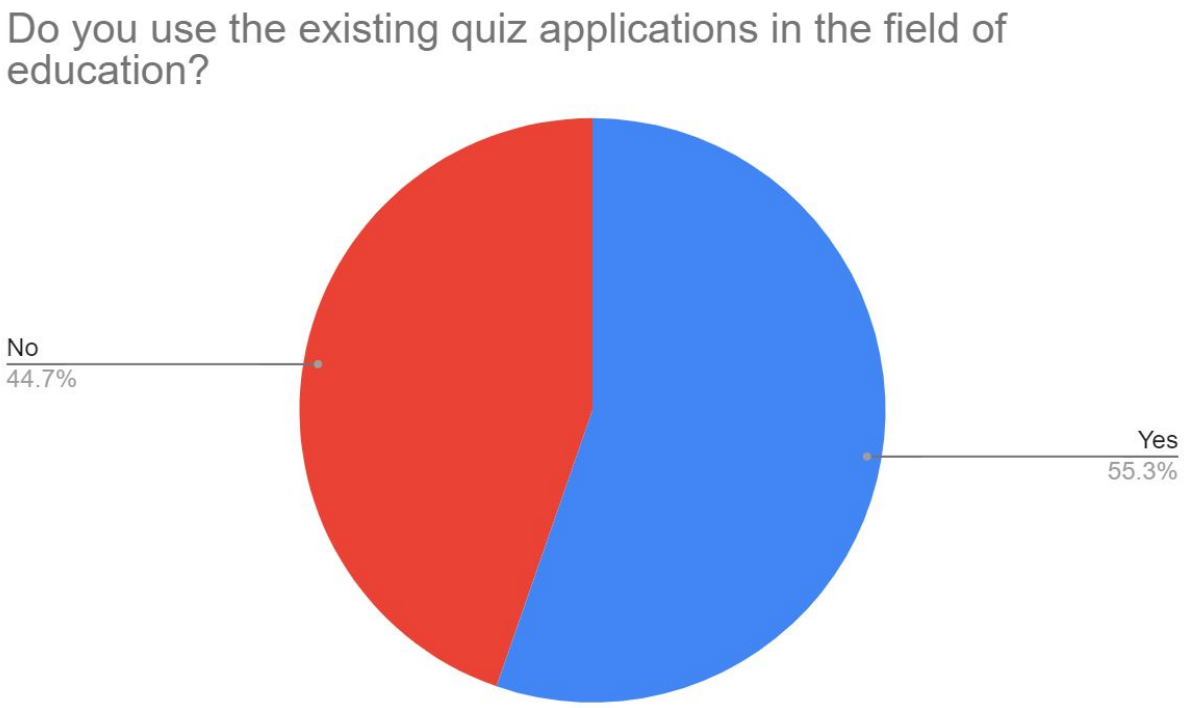



*Figure 14: Results about using quiz application in the educational field*

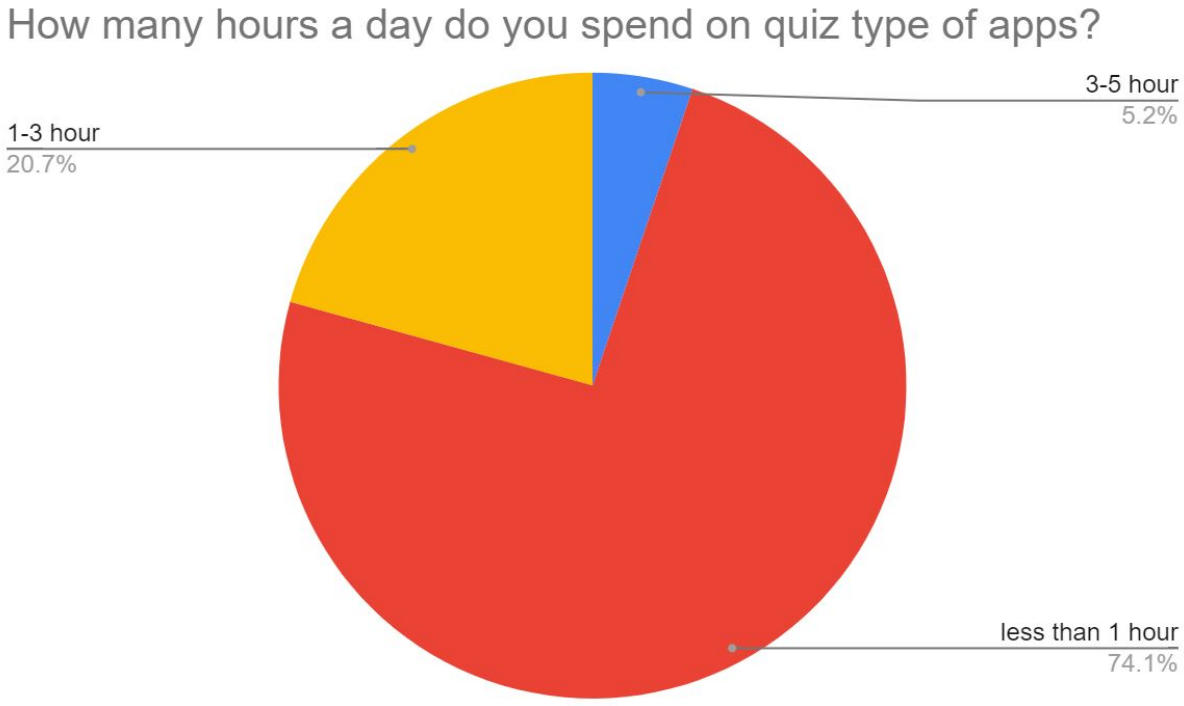


*Figure 15: Results about time spending on quiz apps*

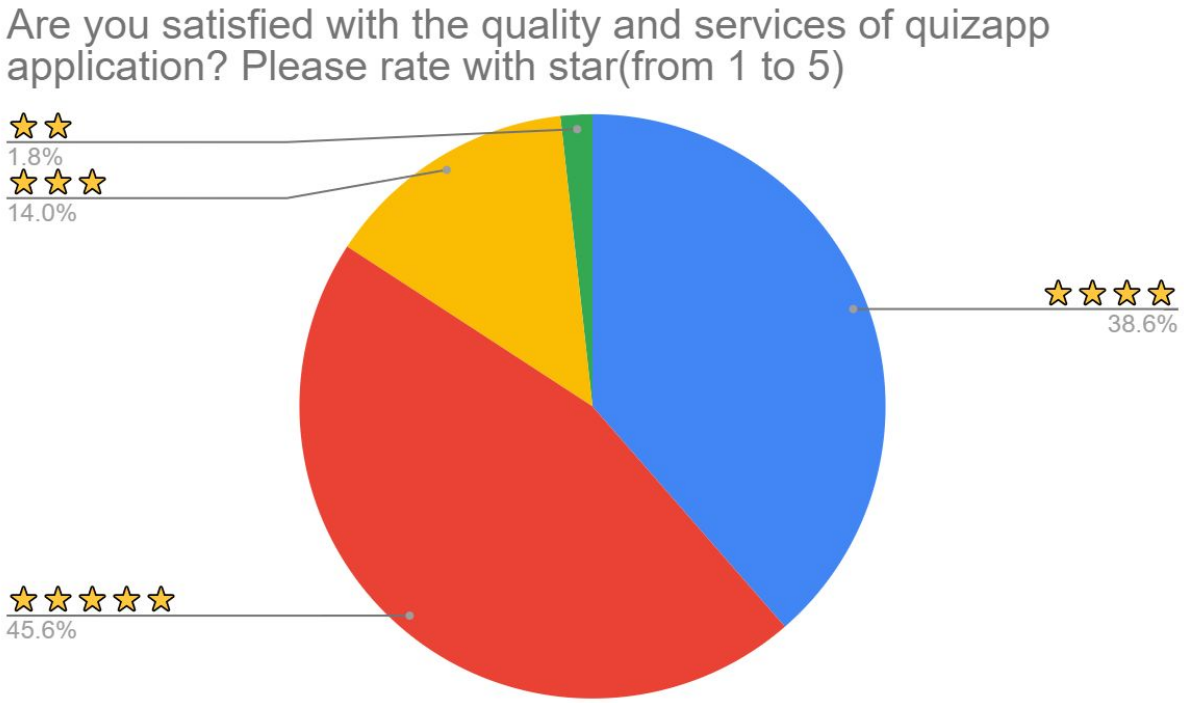



*Figure 16: Results about satisfaction rate for quizapp application*

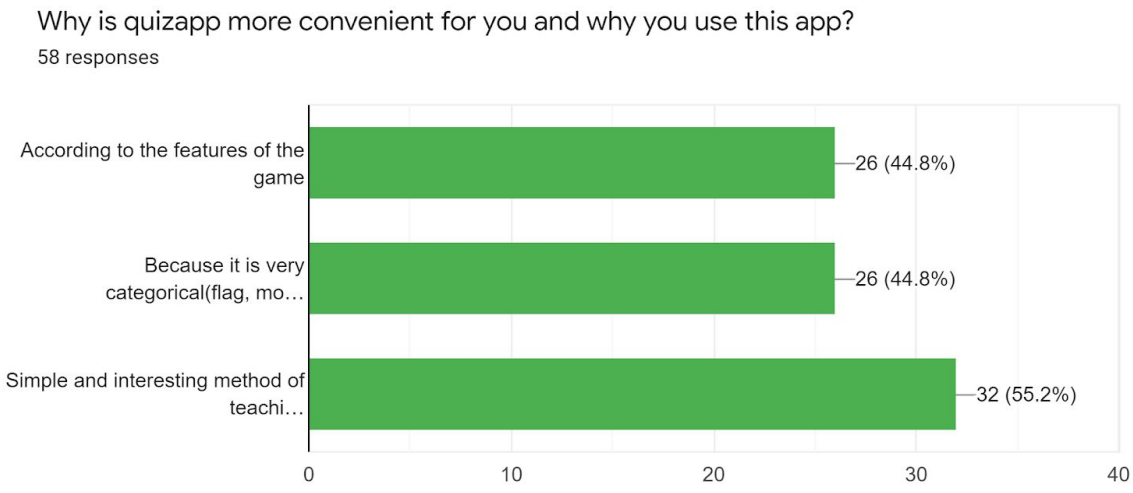



*Figure 17: Results about Cause for using Quizapp application*

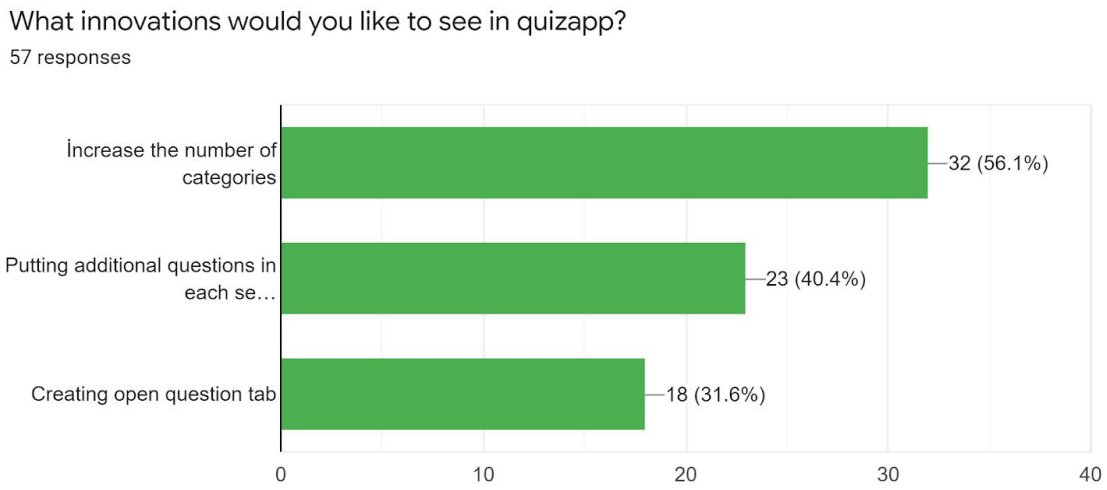



*Figure 18: Results about any features that need to be added to the quizapp application*

## Summary about QuizApp research

- According to the answers, 55.3 percent of people use the existing quiz applications in the field of education but 44.7 percent do not use it.
- More than half of people (74.1 percent) spend less than an hour on quiz applications. However, the lowest percentage (5.2 percent) is between 3-5 hours, and we can say that no one spends more than 5 hours on these applications.
- Results about the Satisfaction rate for the Quizapp application show that 45.6% of people rated these applications with 5 stars. 38.6% of people rated them with 4 stars, 14.0% with 3 stars, and 1.8% with 2 stars. Besides, there is no 1-star rating.
- Due to the simple and interesting method of teaching information (32 votes), quizapp is more convenient for people, and for these reasons they use this app and are at the top. However, in second place, according to the features of the game, and the number of different categories (flag, movie, etc.) are selected with 26 votes.
- People want to see additional features like as increase the number of categories(32 votes), putting additional questions in each section (23 votes), and creating an open question tab with 18 votes in quizapp.

### General Summary of Questionnaire Analysis

- We want to aim at the people who are aged 18-24.
- Users prefer to use mostly Social media and Educational applications.
- They focused mostly on Udemy educational applications.
- They often use the QuizApp application, but only 55.3% of people have used QuizApp
- Users use QuizApp because they like the simple and interesting teaching method of this app
- People want to see an increase in the number of categories in QuizApp.

### Conclusion of Questionnaire Analysis

- My application is for mostly students which is visible from the graphs that most of the users answered are between 18-24.
- I will increase the number of categories in the application, for example adding math, actors, and so on.
- I will create an open question tab for users.
- I will increase the number of questions from 10 to 15 in each section.
- I will create a competition platform for 2 people competing at the same time.

## User analysis

To collect the requirements, a questionnaire was published on Facebook and LinkedIn, having the possibility to get a sensitive number of responses. Analyzing the results, it was possible to define a good user profile.

- *Age: 18 - 40 years old*
- *Gender: More female than men*
- *Job title/education: Students or workers*
- *Technology: Smartphone with GPS and internet connection*
- *Income: Paid by family or salary*

## Persona 1 — Angela

### User profile

*Name: Angela*

*Age: 22*

*Gender: Female*

*Job title: Student*

*Location: Barcelona, Spain*

*Income: Scholarships*

### Persona

Angela is a 22 years old girl studying in Barcelona, Spain in one of the universities. She loves studying, thus in her free time, she reads books and articles to learn new things. She does not spend too much time while playing games.

### Scenario

Angela is preparing for the exam and she has a little bit of time, thus she wants to learn something new while playing games. She sees our application but does not pay attention in the beginning, but after some time she realizes that the application has several categories with lots of different types of questions. She tries that and continues playing and exploring new things with our application.

# HTA — STN

The HTA and STN that we are going to present in this section are related to the main tasks of our application:

- The user can choose a category between several categories and enter the quiz game in that specific category. After finishing all the questions in that category for that section, he/she earns some points. Points are added to the account and saved in the database. After winning the games users can get several badges from that category and also add the interests to the account to play that category whenever he/she wants.
- The user can select a chat button and see the history of chats he/she made with other users.
- The user can check the notification in the notifications panel and see the notifications like messages, updates he/she made. The user can also delete all the notifications for that session.

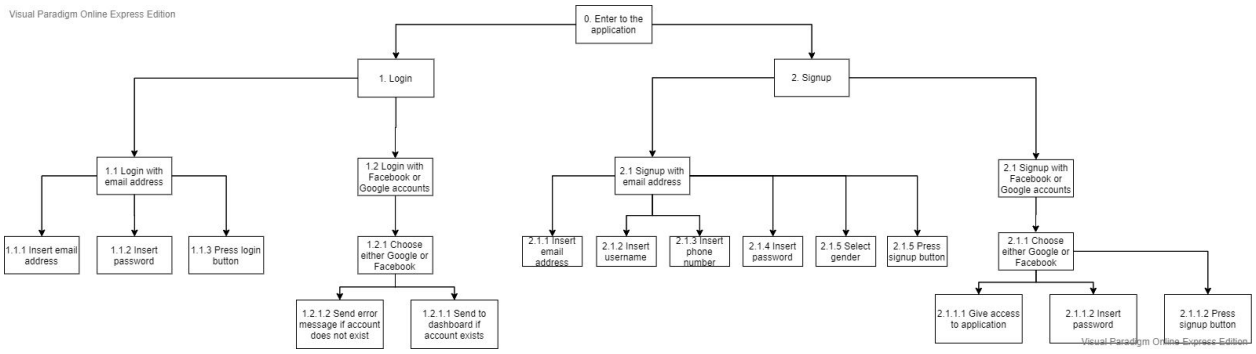



*Fig. HTA for login or signup*

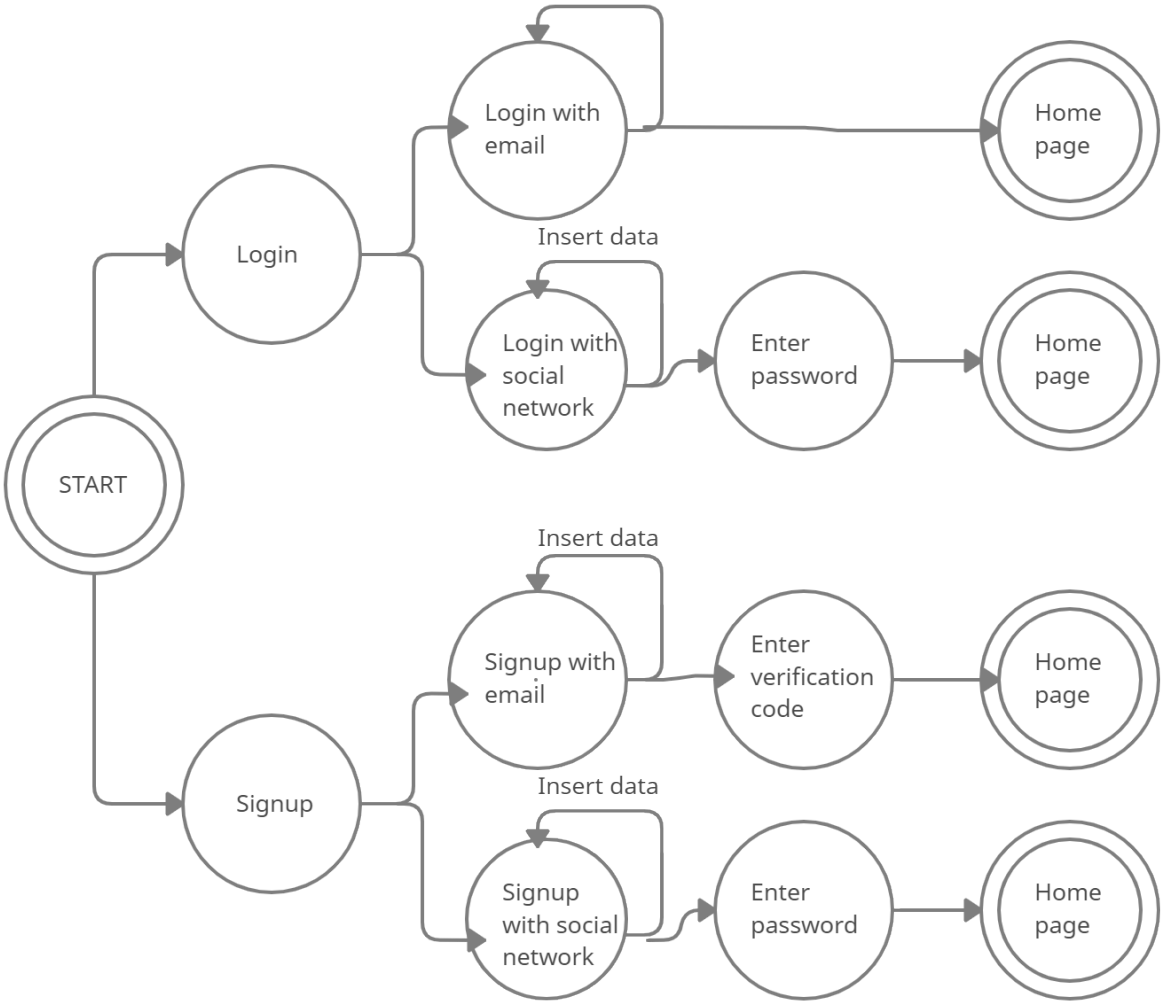



*Fig. STN for Login or Signup*

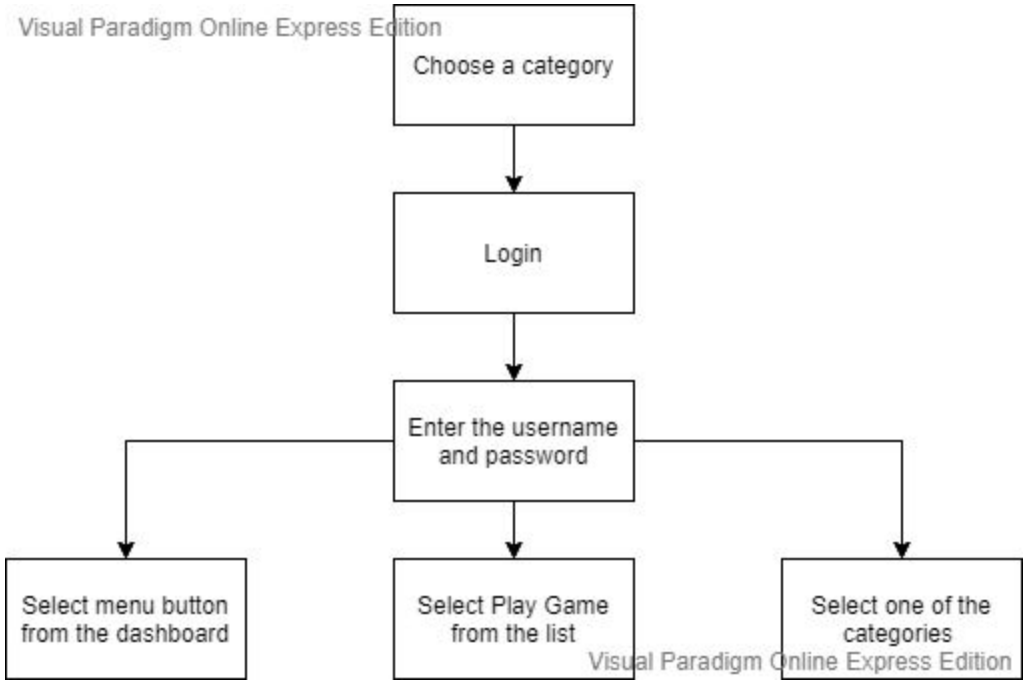



*Fig. HTA for choosing a category*

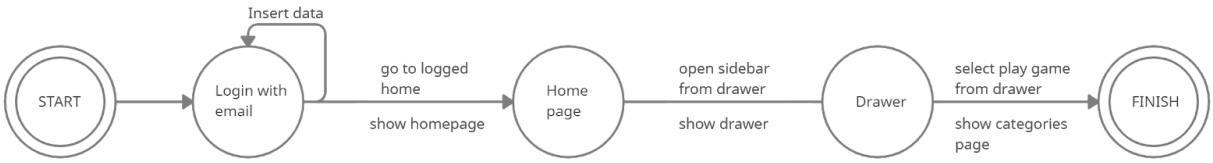



*Fig. STN for choosing a category*

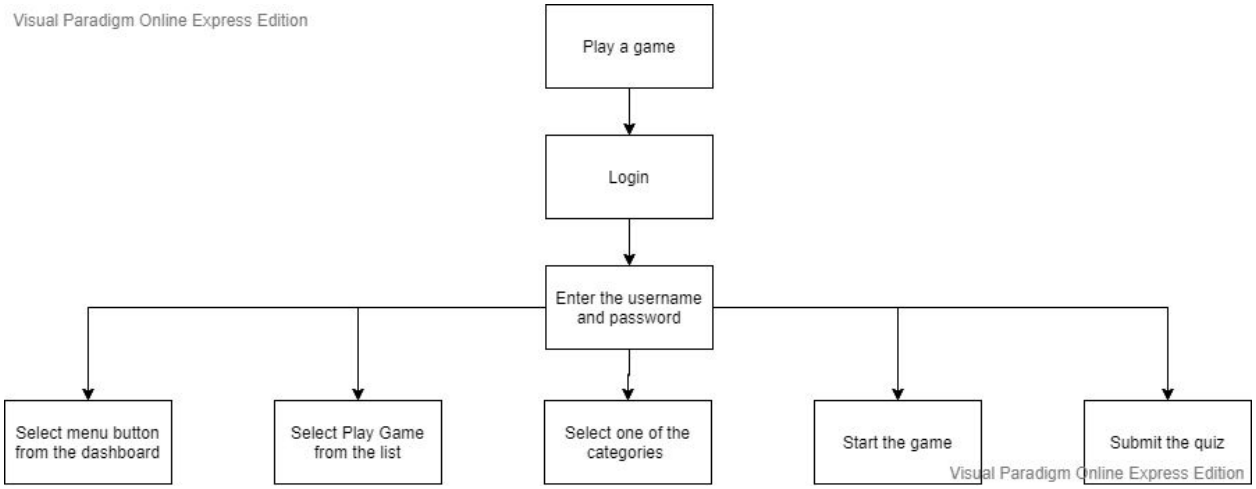



*Fig. HTA for play a quiz game*

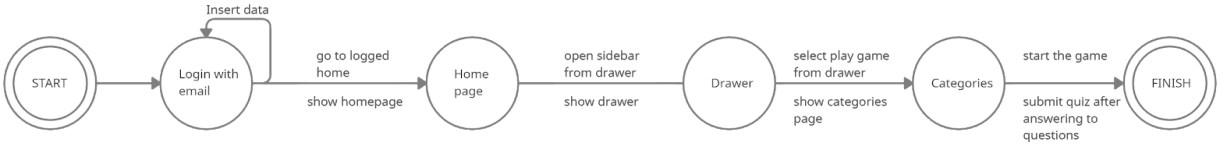



*Fig. STN for play a quiz game*

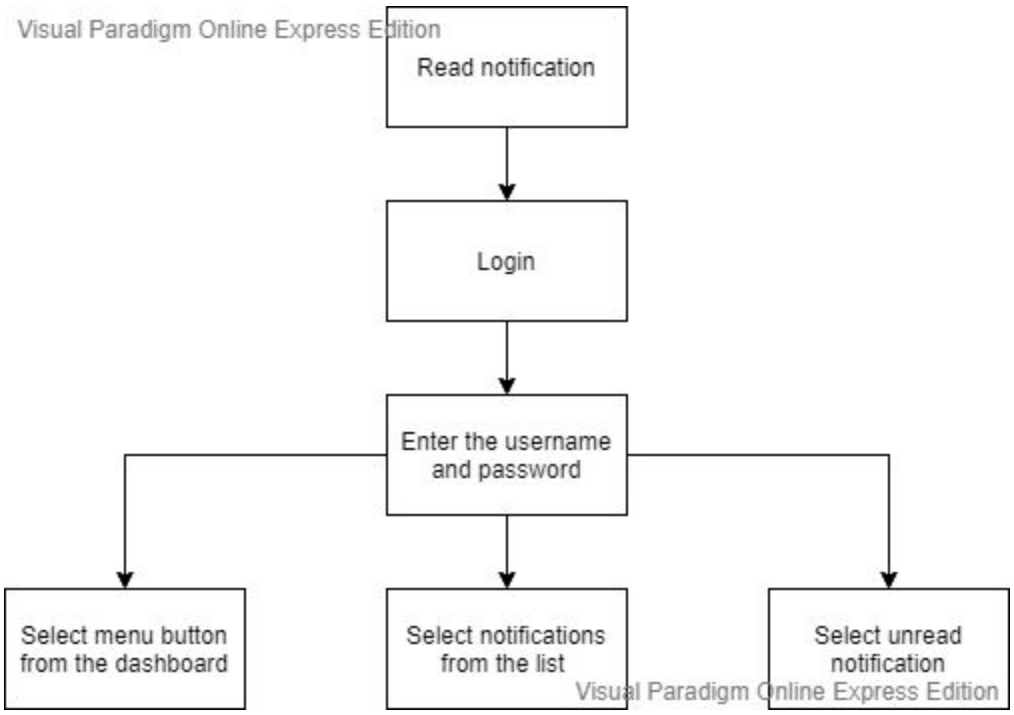



*Fig. HTA for reading a notification*

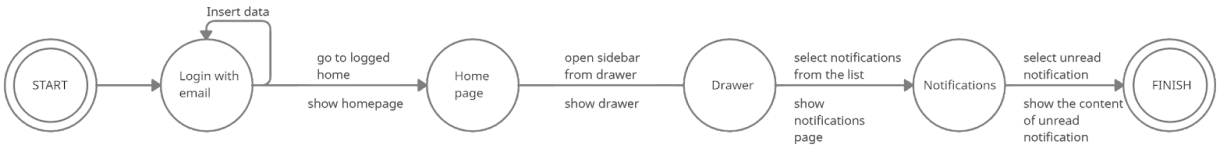



*Fig. STN for reading a notification*

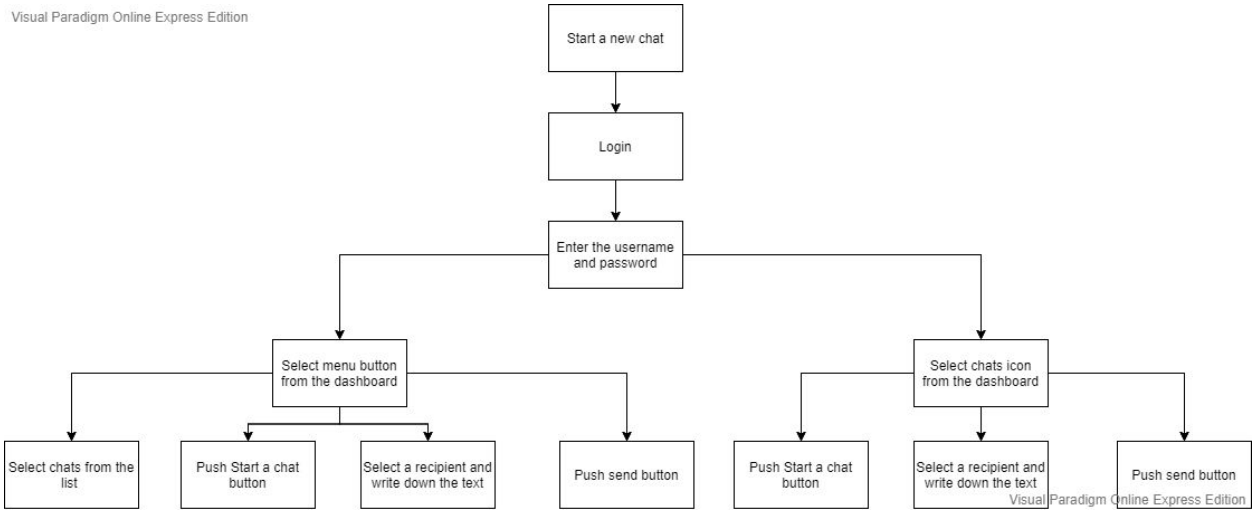



*Fig. HTA for start a new chat*

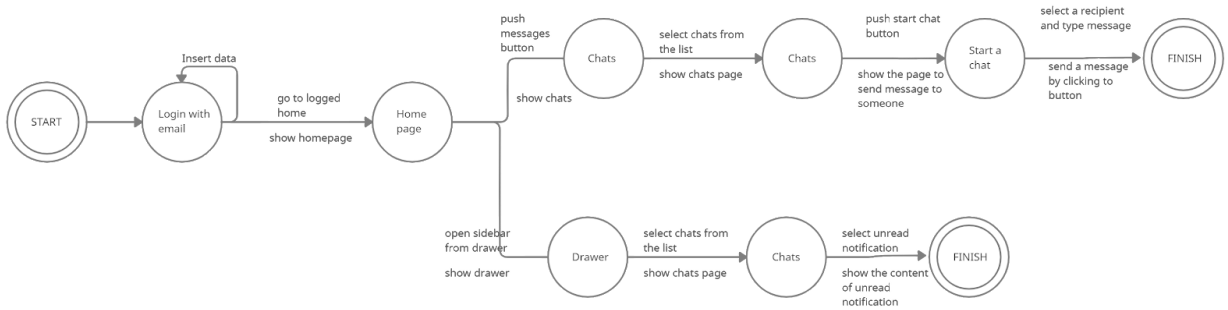



*Fig. STN for start a new chat*

# Mockups and Prototype 1

## Main functionalities

In this chapter, I will be explaining the functionalities that we have included in the application and present the mockups that I will display for the prototype. Thus, this section is devoted to showing the functionalities included within the application.

- Firstly, we all know that most of the applications on the market have a login and registration system and it is a requirement for especially educational applications to have that functionality.

- If you have signup and login forms, of course, you need to have a changing or forgetting password section where users will be able to change their passwords by including the email address or the telephone number for the pin code.
- After successful registration/login we have another page where the user can decide if she/he wants to turn on notifications or not. Turning on notifications can enable users to know the updates (push notifications) we share in the application.
- After choosing the notifications section, the user directly goes to the dashboard where we show the points, badge users have and the categories for the quiz application. We have included the tab in the dashboard so users can choose different sections such as playing games, settings, leaderboard, and notifications.
- The fundamental part happens when the user selects to play the game. In that case, the user is given several options from the categories to choose to start the game and if the user selects one, he/she's moved to the game.
- If a user selects one of the categories, the game starts and the user is given several questions with options within that category. When a user submits the last answer he/she can see the points he/she received during that game and can move to two different sections which are leaderboard or taking a new quiz.
- Inside the leaderboard area, users can see the ratings other users have which start from the first place and go until how many users are in the database.
- If a user clicks the notifications section, he/she sees the updates we have in the application and chat if anyone sent a message.
- Besides the notifications area, we also have the chats area where users can have a chat and challenge each other within the game.
- In the settings tab, the user can update the information about himself/herself such as email address, password, push notifications, connecting to a social account and log out button in case the user wants to log out.

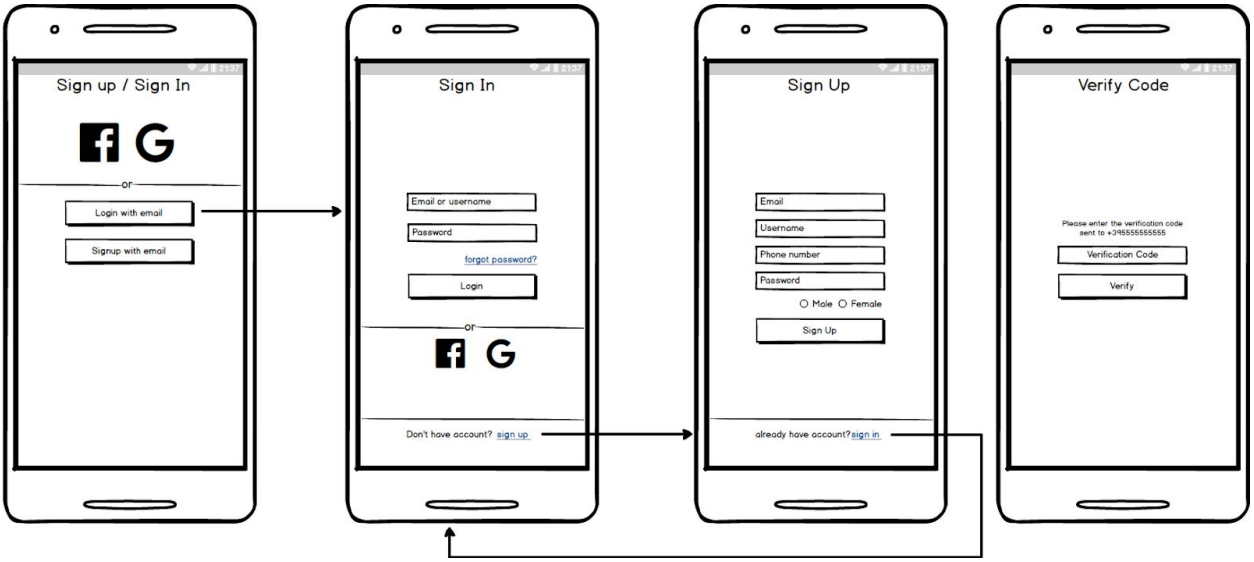



*Figure  Mockup of the first page and sign in and sign up pages*

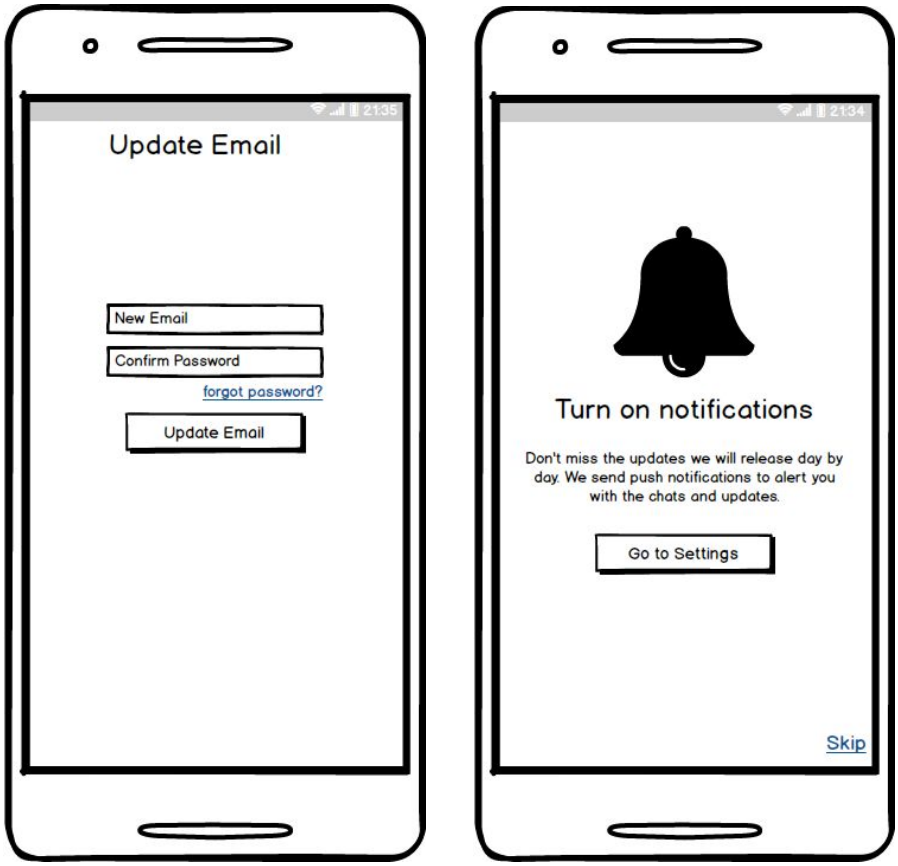



*Figure  Update email and notification pages*

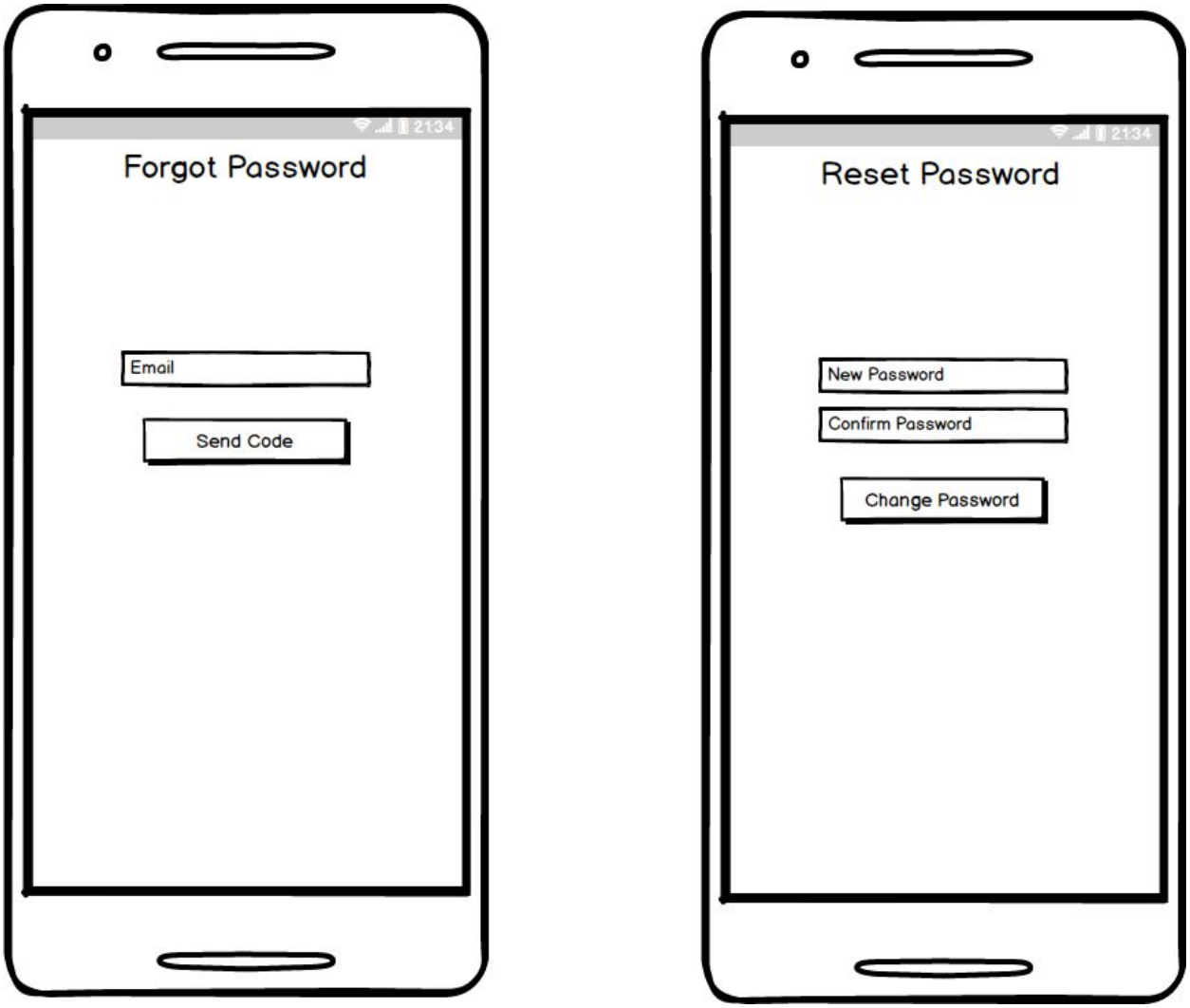



*Figure  Forgot and reset password pages*

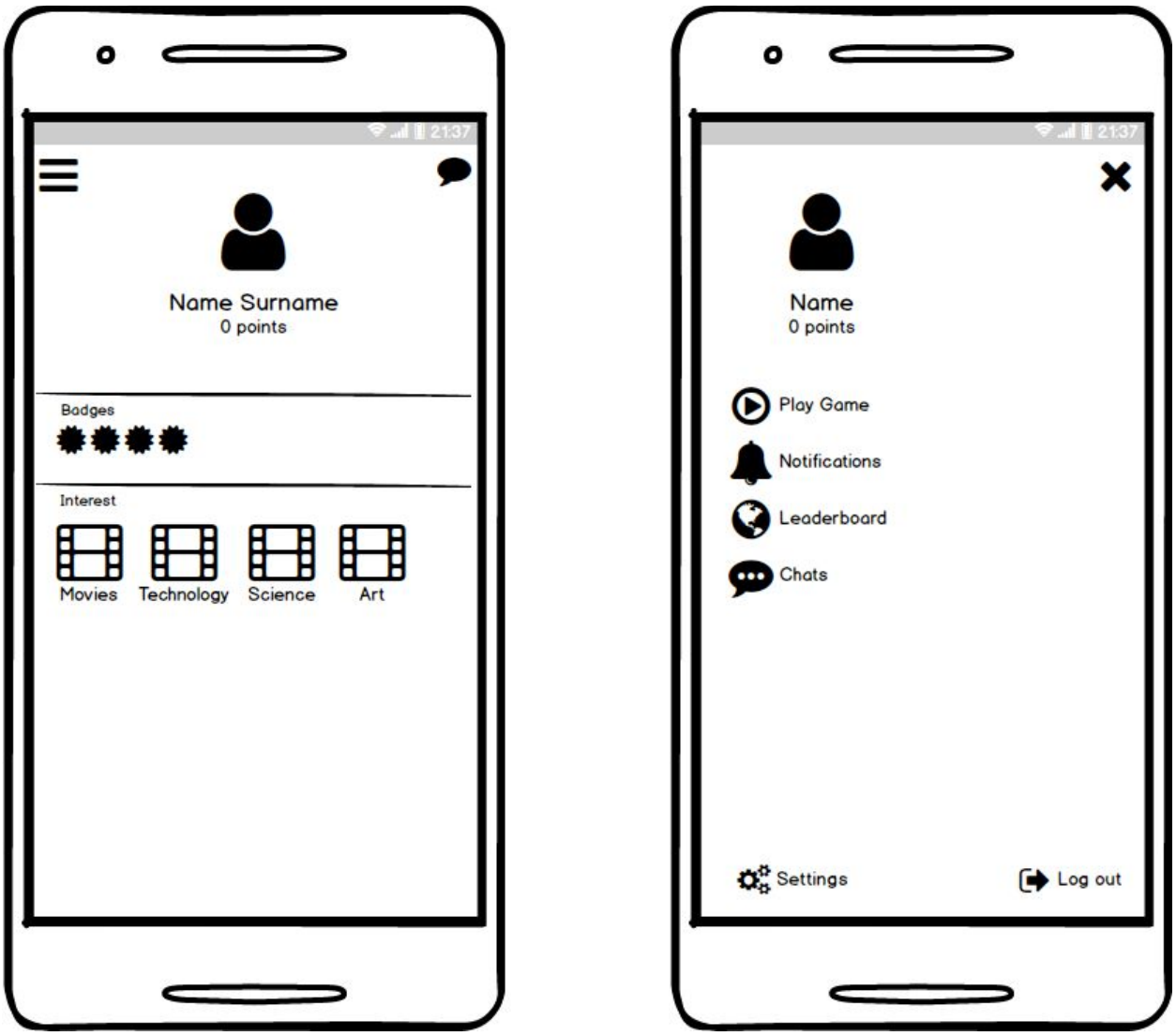



*Figure  Dashboard page*

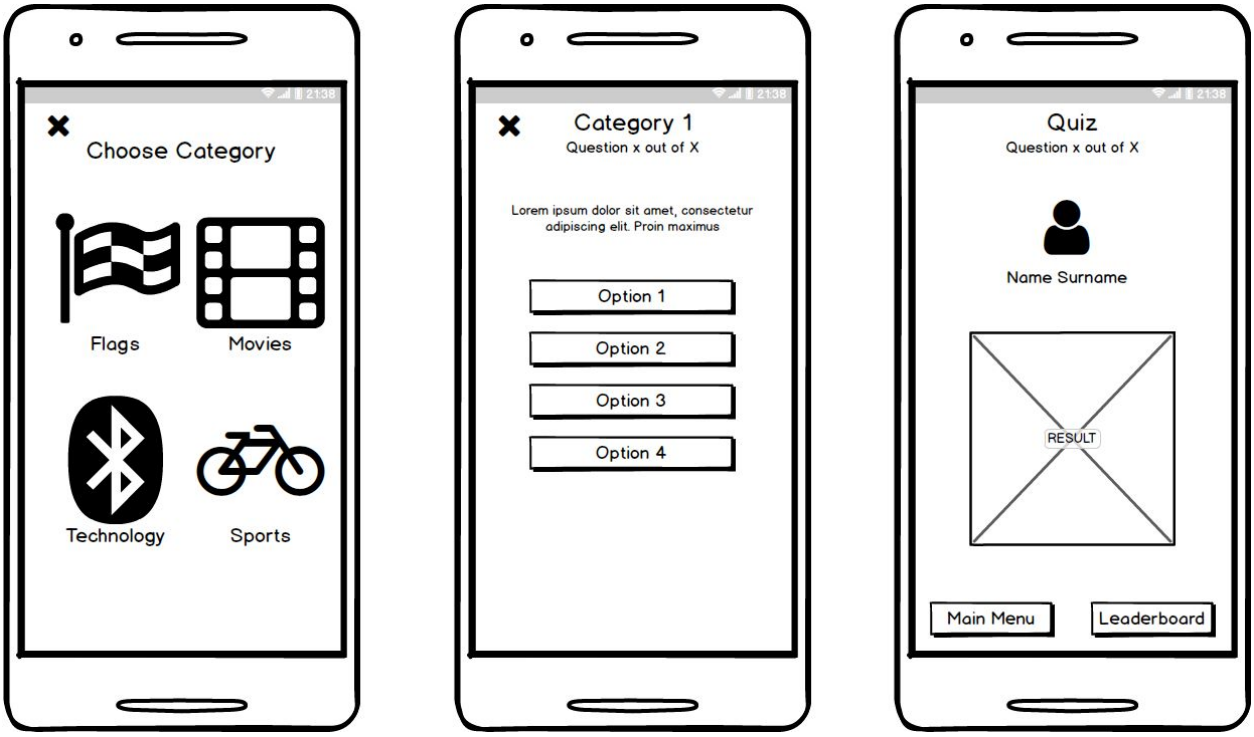



*Figure Quiz page*


*Figure Chats page*

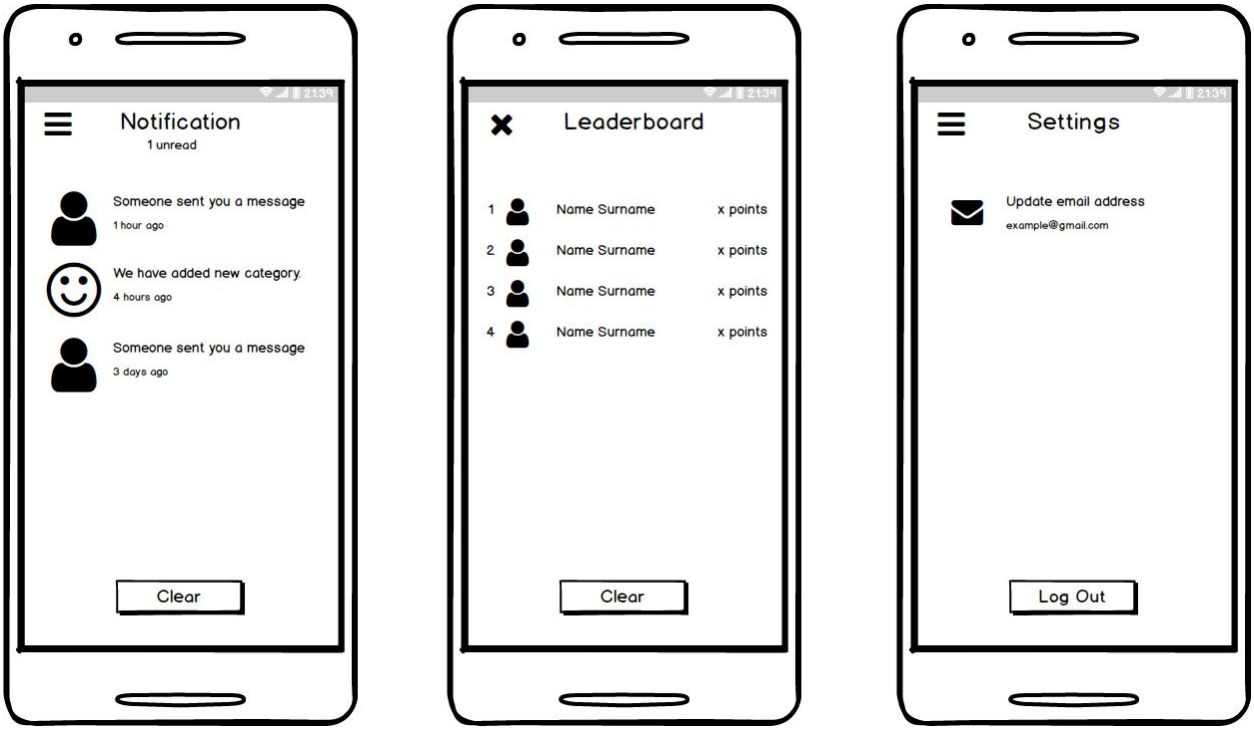



*Figure Additional pages*

## Prototype 1

The prototype was developed following both the mockups presented above and the steps described in HTA and STN diagrams. Moreover, some secondary features were implemented, like chatting with others. This function can be accessed from the main page, where a set of quick links is provided to the user, or through the side menu that allows easier navigation through the main pages.

There are not many changes we have made to the prototype, so it's almost identical to the mockups. The following section shows the images of the prototype of our application with its login/signup, reset password/email, dashboard, quiz, and other pages.

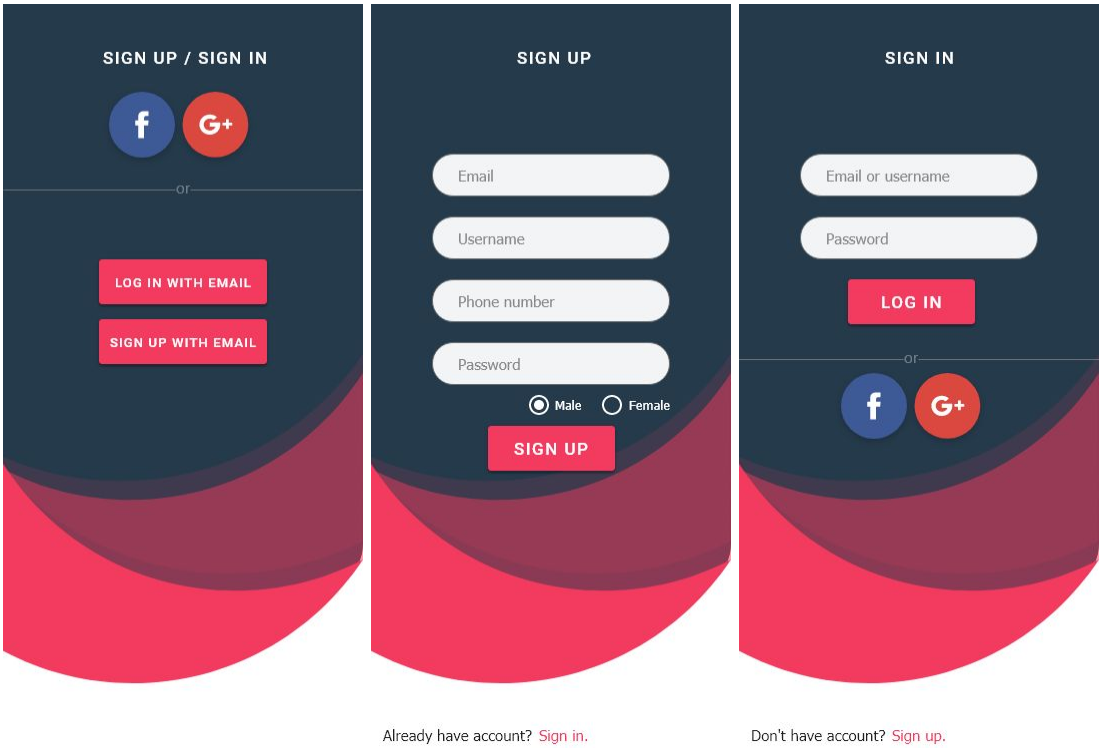



*Fig. Sign in or Sign up*

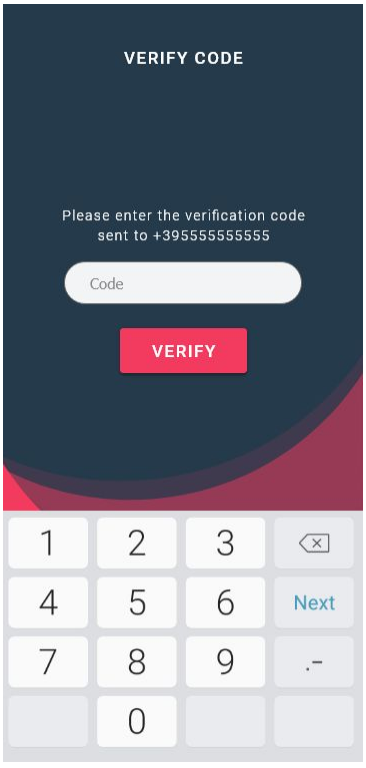



*Fig. Verifying code after registration*

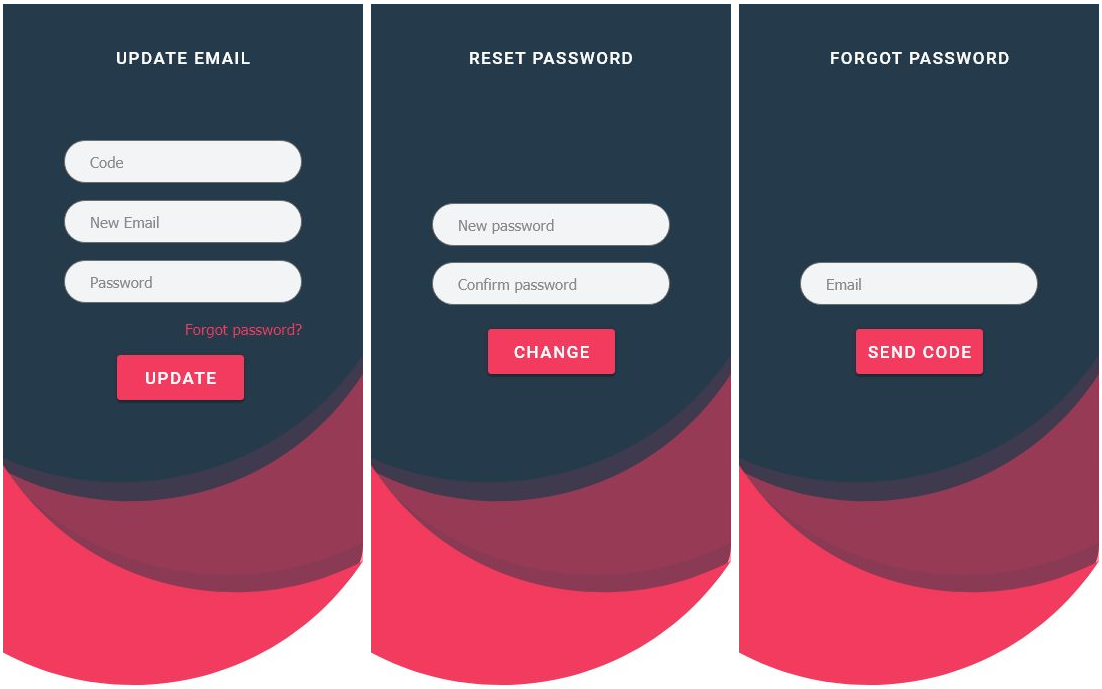



*Fig. Updating email and resetting password*

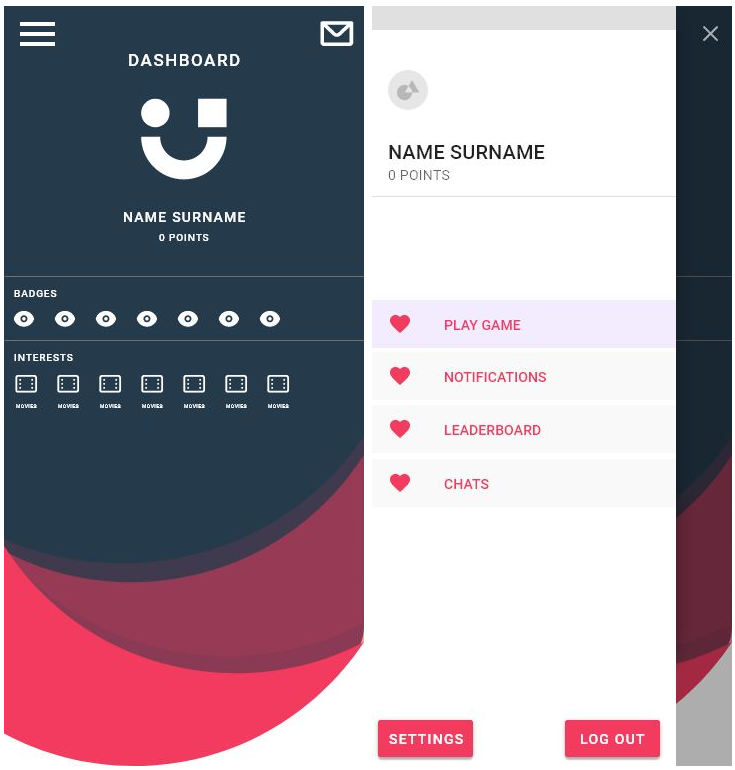



*Fig. Dashboard*

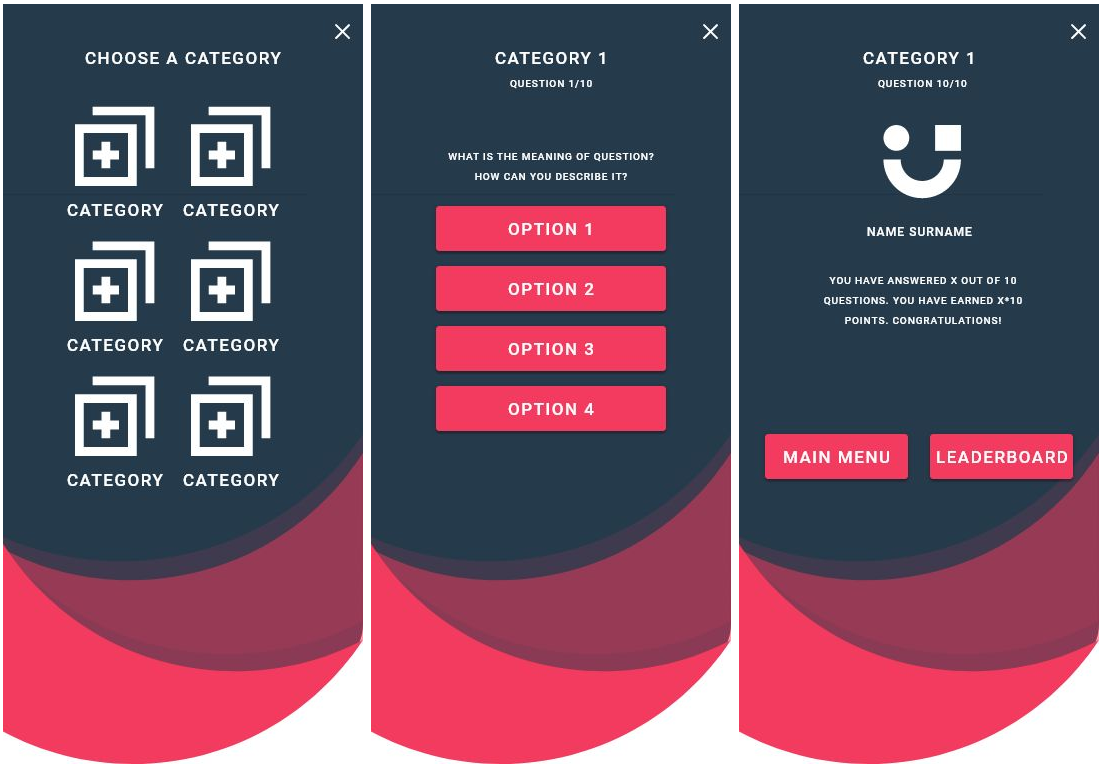



*Fig. Quiz categories and quiz*

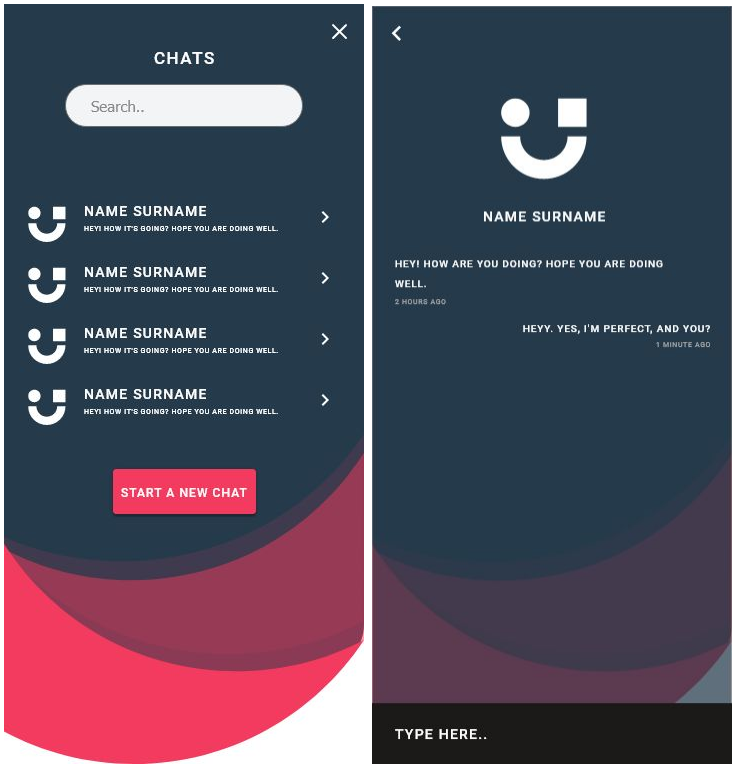



*Fig. Chats*

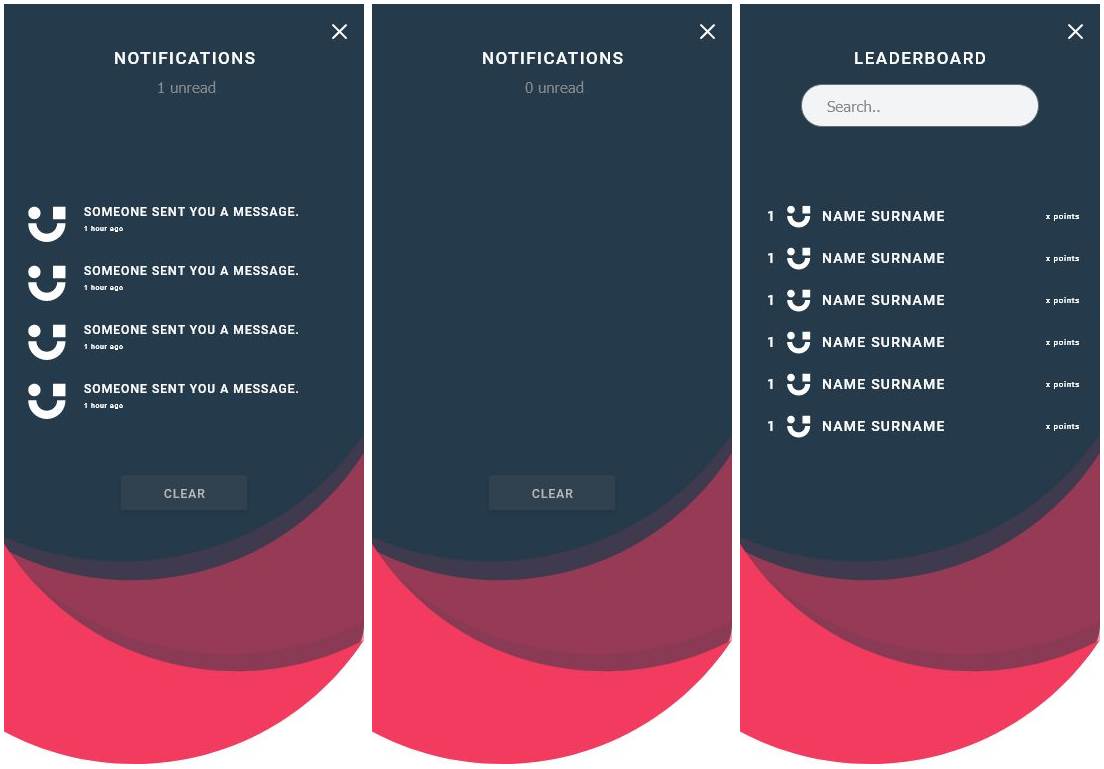



*Fig. Notifications and Leaderboard*

# Expert-based Evaluation

Evaluation occurs in laboratory or field, especially in collaboration with the user, that should be considered through the entire development lifecycle, to make tests of the functionalities and usability of the current system. It is useful to evaluate both design and implementation and ideally, the evaluation process should be considered at all stages in the design life cycle.

Evaluation techniques have multiple goals to achieve: the evaluation of a possible extent of system functionalities, like for example the task that users are interested in; the evaluation of the effect of the interface on the user, like for example the user's experience of interaction or how it is easy to learn and to use or the satisfaction of the user; the identification of specific problems, like for example errors, confusion, and unexpected results. Heuristic Evaluation and Cognitive Walkthrough are examples of expert analysis methods.

## Heuristic Evaluation

A heuristic evaluation is a usability inspection method for computer software that helps to identify usability problems in the user interface design. This method was developed by Jakob Nielsen and Rolf Molich and it is based on the comparison between your interface and the usability principles. Given that usability criterion, called ”the heuristics”, the interface and its compliance will be examined, the analysis results in a list of potential usability issues.

## Molich and Nielsen’s Heuristics

Molich and Nielsen developed a heuristics list which is composed of 10 ”heuristics”:

1. Visibility of system status: The system should always keep users informed about what is going on, through appropriate feedback within a reasonable time.
2. Match between system and the real world: The system should speak the user’s language, following real-world conventions, using words, phrases, and concepts familiar to the user, and making information appear in a natural and logical order, rather than using system-oriented terms.
3. User control and freedom: Given that users often make mistakes, choosing the wrong system function, they need a clear” emergency” exit to leave the unwanted state. Because of that, the system should support undo and redo.
4. Consistency and standards: Follow platform conventions so that users don’t have to understand if different words, situations, or actions mean the same thing.
5. Error prevention: Having a careful design that prevents a problem from occurring in the first place is better than a good error message, so eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action
6. Recognition rather than recall: Minimize the user’s memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate
7. Flexibility and efficiency of use: Allow users to personalize frequent actions with accelerators. Accelerators, unseen by the novice user, may often speed up the interaction for the expert user such that the system can provide for both inexperienced and experienced users.

8. Aesthetic and minimalist design: Dialogues should not contain information that is irrelevant or rarely needed, because every extra unit of information in dialogue, competes with the relevant units of information reducing their visibility.
9. Help users recognize, diagnose and recover from errors: Error should not be expressed in codes, but in plain language, precisely indicating the problem and constructively suggesting a solution.
10. Help and documentation: It may be necessary to provide help and documentation, even though it is better if the system can be used without documentation. Any information should be easy to search, focused on the user's task, so make a list of concrete steps to be carried out, and not be too large.

## Expert report

In this case, the evaluation was done by our professor Valeria Mirabella. After the expert-based evaluation, it has been reported that the following heuristics have been violated:

| **Frame** | **Heuristic violated** | **Severity** | **Description / Comment** |
|---|---|---|---|
| Sign in | Help users recognize, diagnose, and recover from errors | 3 | Include a *Forgot Password?* link |
| Sign up | Error prevention | 2 | Provide a function to show password in clear text |
| Chat search | Recognition rather than recall | 2 | A placeholder text with a search example will help the user in understanding how to use the search bar |

| | | | |
|---|---|---|---|
| Chat | Recognition rather than recall | 3 | Show who is the user involved in the chat |
| Notification | Visibility of system status | 3 | Make clear unread notifications |
| Settings | Recognition rather than recall | 3 | A placeholder text with a search example will help the user in understanding how to use the search bar |

**Heuristics used**

1. Visibility of system status
2. Match between the  system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose and recover from errors
10. Help and documentation

The "severity" number identifies:

- 0 - I don’t agree that this is a usability problem at all
- 1 - Cosmetic problem only
- 2 - Minor usability problem
- 3 - Major usability problem
- 4 - Usability catastrophe

# Prototype 2

After receiving the expert-based evaluation with the heuristics violated in Prototype 1 we made some changes to solve these issues:

- **Problem 1, "Sign in", Heuristic violated: "Help users recognize, diagnose, and recover from errors", Severity: 3**: after the professor's evaluation, I found out that I was missing forget password link which could be helpful for the user if he/she forgot the password, so he/she could be redirected to another page to reset the password with email or phone number.
- **Problem 2, "Sign up", Heuristic violated: "Error prevention", Severity: 2**: of course, one of the important things while login in or register to the system is to check the password field. For the prototype, I was missing that part, so it is necessary to have a functionality to show the password in cleartext.
- **Problem 3, "Chat search", Heuristic violated: "Recognition rather than recall", Severity: 2**: another small bug I have missed to fix for the prototype was to put a placeholder text with a search example that would be helpful for the user to understand how to use the search bar. In the second prototype, I have managed to fix that issue by including the placeholder in the text folder to assist the user in what to do.
- **Problem 4, "Chat", Heuristic violated: "Recognition rather than recall", Severity: 3**: as it is suggested by the expert, I have added an image section inside the chat to assist the user to see which user he/she is talking to. Additionally, I have added the name of the user followed by his/her picture.
- **Problem 5, "Notification", Heuristic violated: "Visibility of system status", Severity: 3**: the problem was that it was not perfectly visible which are the user of the notification received due to the styling of the notifications section. Thus, for that, I added a background rectangle with a dark color to darken the background image, so the notifications show clearly.
- **Problem 6, "Settings", Heuristic violated: "Recognition rather than recall", Severity: 3**: Initially, there was not a clear placeholder for the settings search, thus it was not clear for the user which specific text he/she needs to put. According to the expert analysis, I have added the placeholder text with a search example that could be helpful

for the user to understand how to use the search bar. However, I thought changing the layout of the settings as it's necessary and should look good, so changed the layout to something nicer.

The following images show the changes applied to the application after the expert evaluation:

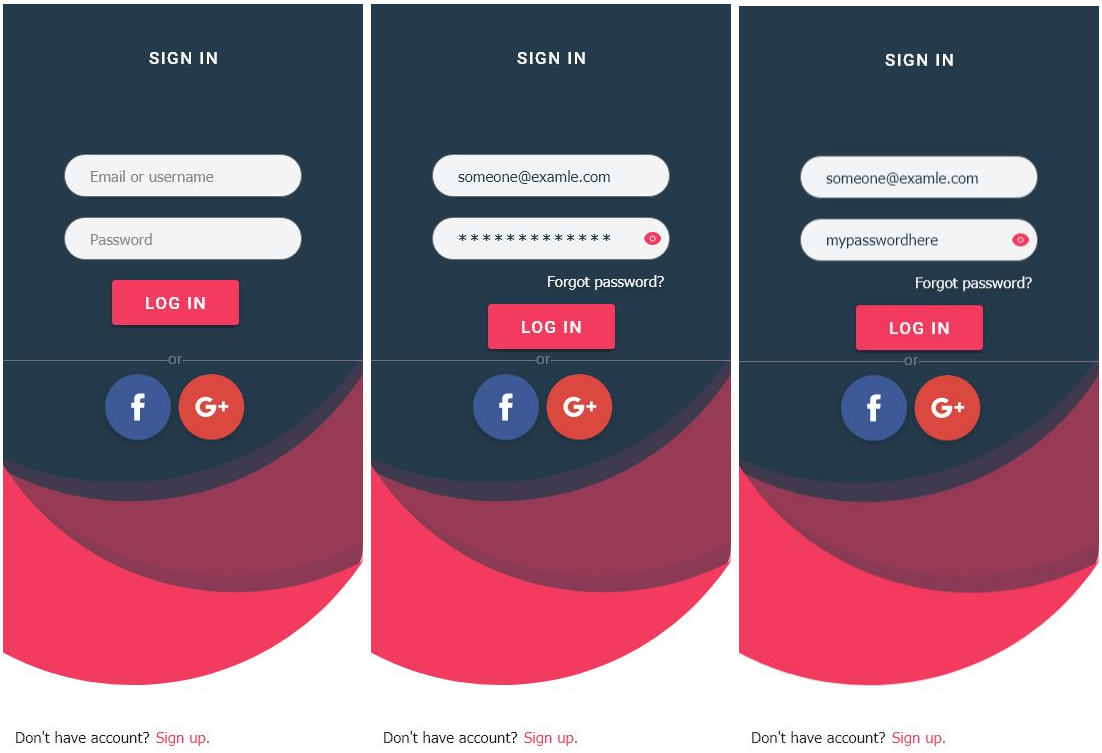



*Fig. Changes made for 1st problem*

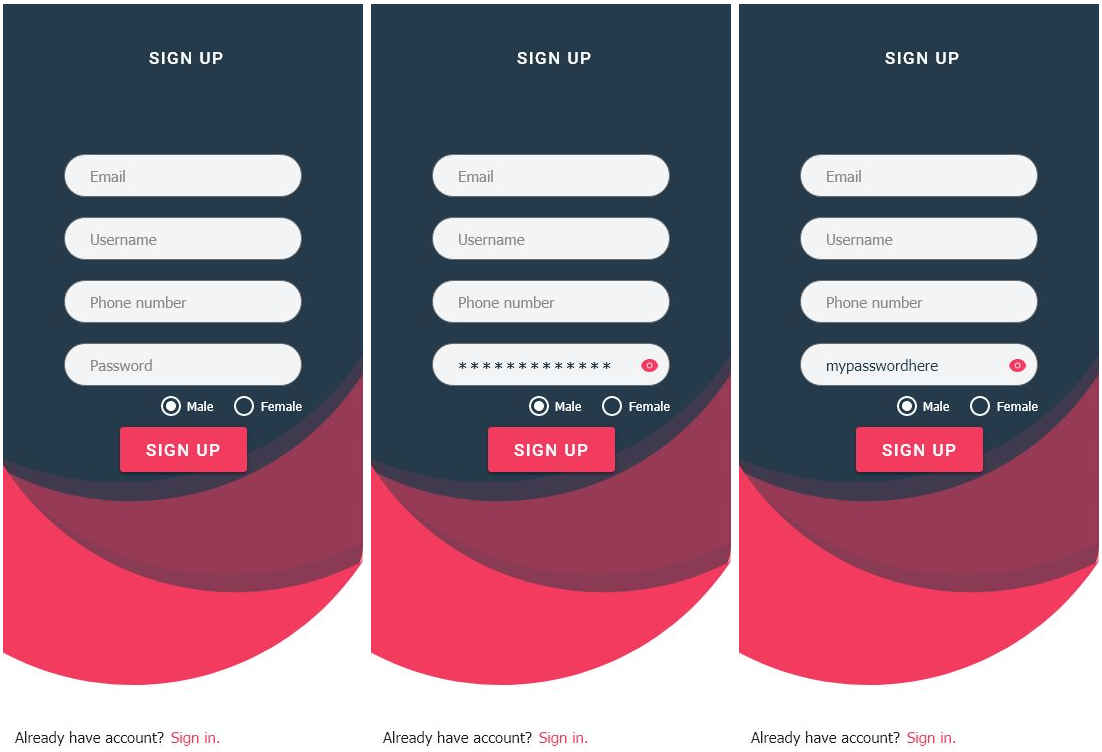



*Fig. Changes made for 2nd problem*

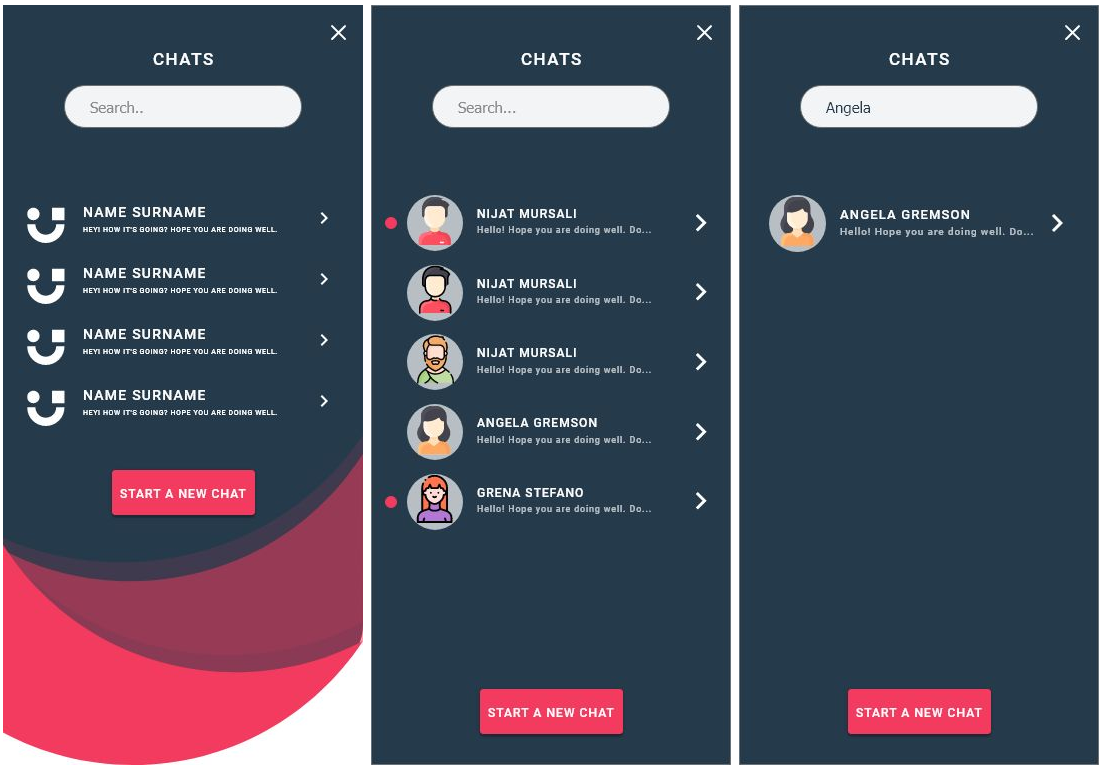



*Fig. Changes made to 3rd problem*

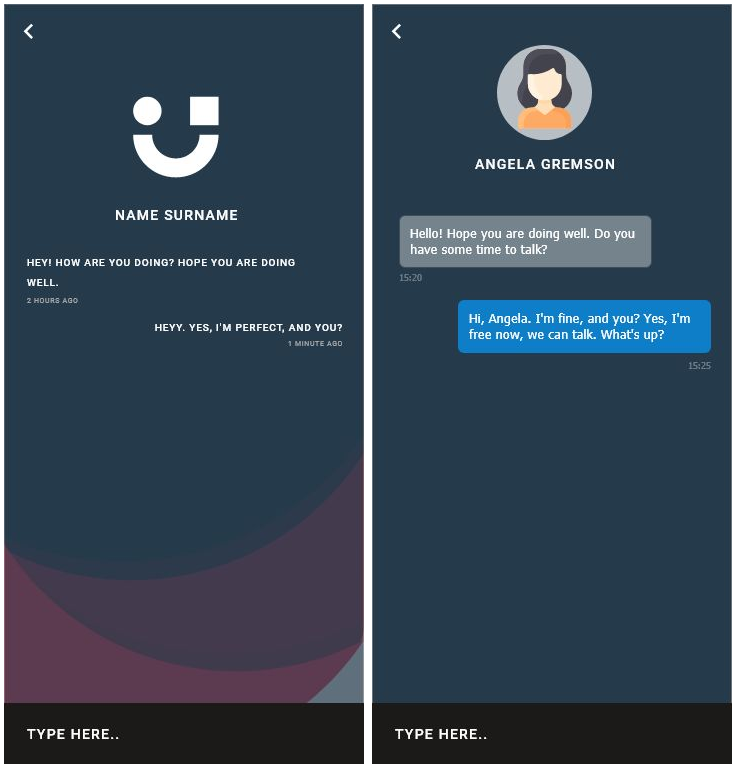



*Fig. Changes made to 4th problem*

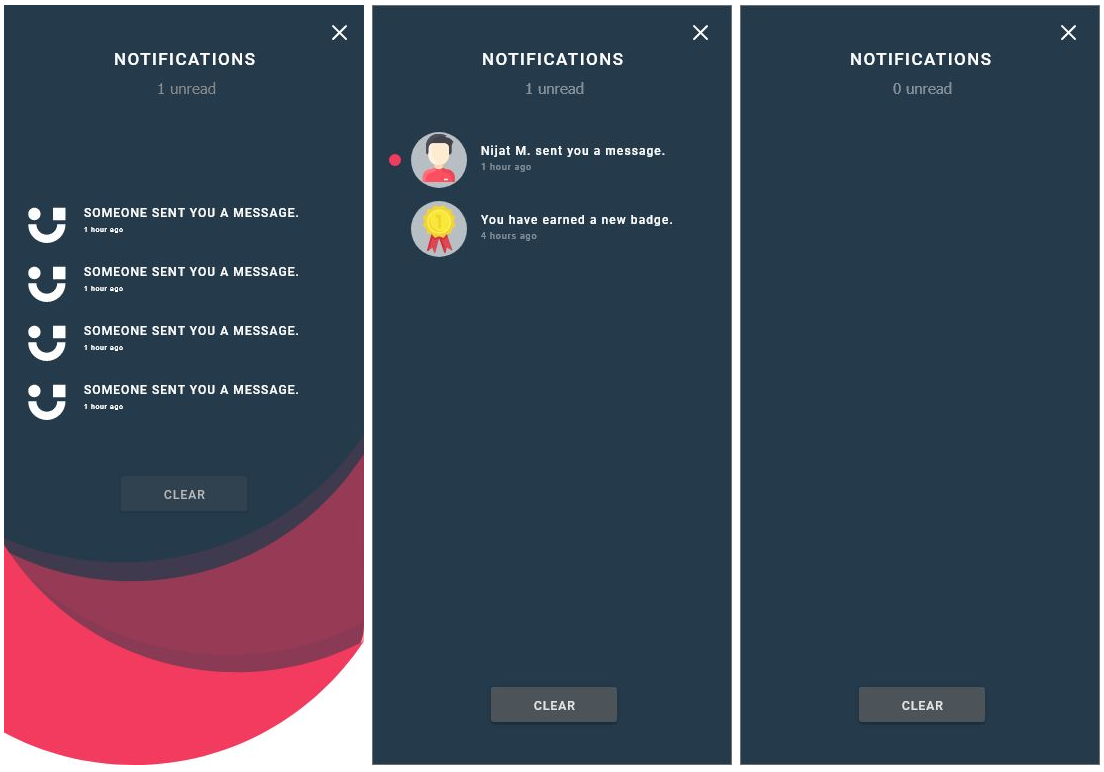



*Fig. Changes made to 5th problem*

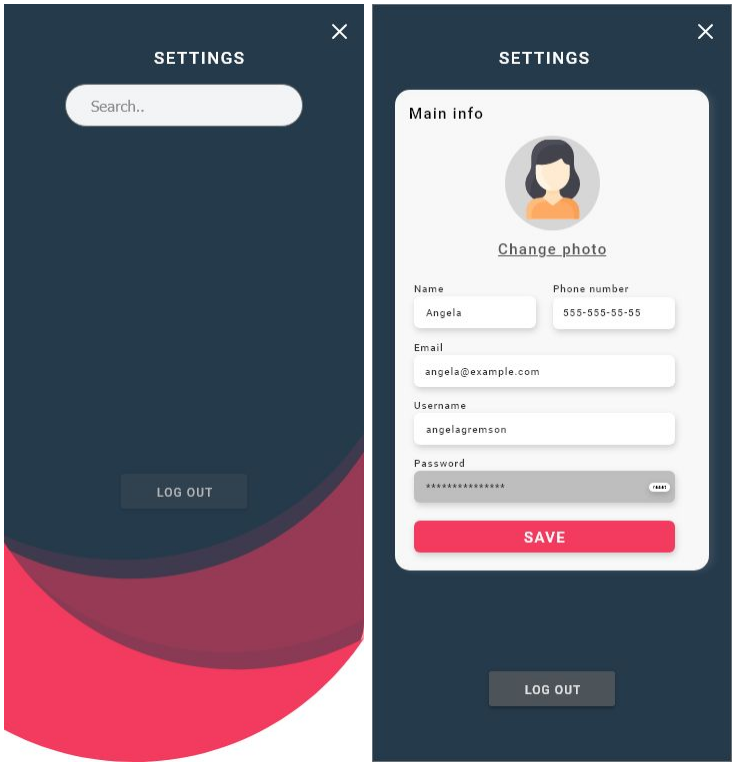



*Fig. Changes made to 6th problem*

# Think Aloud Evaluation

To accomplish this evaluation, we chose a group of 6 people of different ages, and did the experiments using the following criteria:

1. We firstly explained why we grouped them and what we are doing. Of course, due to the Covid-19, it all happened in Zoom chat and we gave the link to users to download the application and explained to them what we had to accomplish.
2. Each person had to accomplish a series of task, which were:
    a. login
    b. play a quiz game by choosing the specific category
    c. go to the notifications panel and check the notifications
    d. select the chats icon from either dashboard or drawer and write a new chat to someone else

3. As we have mentioned above, the experiment that took place using Zoom as a Covid-19 sanitary emergency is becoming a very crucial problem, thus we sent the required files to test our application.
4. While executing each task, we asked the users to say aloud what they were doing, what they thought was happening, and whatever they were thinking related to the app.
5. During the experiment, we took notes of users' thoughts.

## Discussion about the session

The group of people involved in our think-aloud evaluation seems to be quite happy and enthusiastic about our application and our idea. None of them found any problem to accomplish the task, but they pointed out some UI features that we needed to change to improve the results and make better UX. Thus, we have made the changes to the drawer of our application to make better UX. Thus, we have made changes in our final product as shown in the following section.

# Final Product

After checking the first prototype and making the changes to some parts of the application and also getting the reviews from the people for the think aloud section, we understood that we had some problems with the user interface. For instance, the categories part did not have a really good design, so we wanted to change that one into something good-looking. Thus, the following images show the changes we have made to categories, quizzes (with results page), and the dashboard.

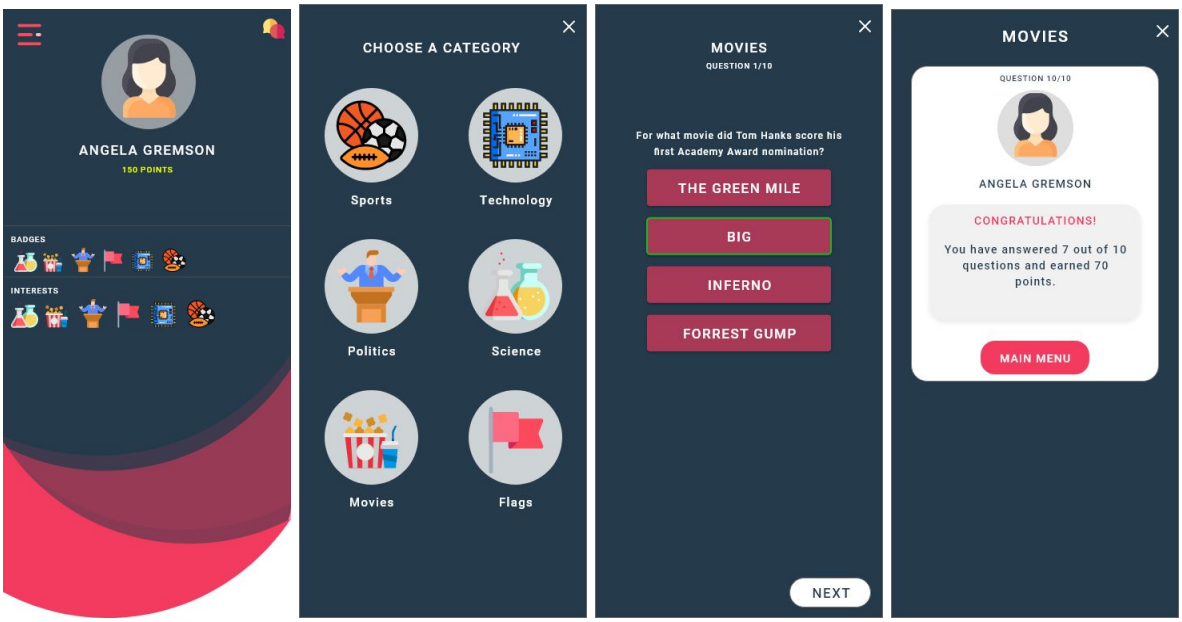



*Fig. Final changes*

# Controlled Experiment

A controlled experiment is an experiment in which everything is held constant except for one variable. Usually, a set of data is taken for a control group, which is commonly the normal or usual state, and one or more other groups are examined, where all conditions are identical to the control group and each other except this one variable. Sometimes it's necessary to change more than one variable, but all the experimental conditions will be controlled so that only the variables being examined change and the amount or way they change is measured. Controlled experiments are considered to be the most rigorous of empirical methods capable of providing empirical evidence to support a particular claim or hypothesis.

Thus, during the building phase of the application, we noticed that a user could have wasted time pressing some icons to go to the chats section, thus we have added the chats section to the dashboard as an icon to help the user to go to the chats section with one click only which is good for user experience side. Thus, we have assumed that the first interface makes the user click to buttons several times and accomplish the task in much more time than the second interface. To verify our hypothesis, we have performed a controlled experiment that we will be showing in the next section.

## ANOVA One-Way Analysis

The controlled experiment has been performed by ANOVA One-Way Analysis where we sent the application to 10 different people to perform the tasks. The users performed the experiments under different conditions since we split the 10 people into 5 people which will use the first interface and the other 10 people who will be using the second interface.

- **Participants**: 10 people in a range of age 18-35 years old according to the user profiles.
- **Variables**:
  - *independent*: the two interfaces
  - *dependent*: the time in seconds to execute the task
- **Hypothesis**:
  - *null*: there are no differences between the two interfaces.
  - *our*: users will be faster using the second interface rather than the first one.
- **Experiment**:
  - *task*: while being in the dashboard, go to the chats section and try to write to someone
  - *assumptions*: the user has completed the introduction which can be being logged in, and he/she is on the homepage (dashboard).
- **How to apply ANOVA?** We have used a chronometer to check how much time each user performs the same requested task with the two different interfaces. All the values are collected to compute the analysis.

| Interface 1 | Interface 2 |
|---|---|
| 18.32 | 9.54 |
| 16.65 | 10.53 |
| 20.51 | 11.76 |
| 17.95 | 10.32 |
| 21.85 | 12.58 |

Thus, the results and the summary for ANOVA is shown in the following tables:

**SUMMARY**

| Groups | Count | Sum | Average | Variance |
|---|---|---|---|---|
| Interface 1 | 5 | 95.28 | 19.056 | 4.36858 |
| Interface | 5 | 54.73 | 10.946 | 1.46858 |

**ANOVA**

| *Source of Variation* | *SS* | df | MS | F | P-value | $F_{crit}$ |
|---|---|---|---|---|---|---|
| Between Groups | 164.4303 | 1 | 164.4303 | 56.33913 | 6.89e-05 | 5.317655 |
| Within Groups | 23.34864 | 8 | 2.91858 | | | |
| Total | 187.7789 | 9 | | | | |

*Table. ANOVA results*

## Analysis of the results

The ANOVA analysis was performed using the *Data Analysis* function in Microsoft Office Excel. The results showed that $F > F_{crit}$, thus we can reject the *null* hypothesis, therefore confirming *our* hypothesis. Thus, we can say it was a much better experience for users to have the second interface than the first interface.

# Conclusion

After working on this project, a lot of my design skills in designing mobile applications and interfaces. Concerning other projects, this was the first time I had direct contact with the users to collect requirements, suggestions, feedback about general usage concepts. A new way of working has been assimilated. I could improve

## Future implementations

Some of the features remain to be developed for this project and those have been left to future development. Here's a list of some interesting features that could be added:

1. **enabling admin dashboard** for adding/deleting/editing questions and categories
2. **extra functionality** for the user's sections
3. **adding more functionality for the categories** section and increasing the number of categories

# References


- https://piazza.com/class/k6j72f4v1j03mu?cid=75
    - used to get the course material to understand the content more clearly
- https://www.flaticon.com/
    - used to display the icons for the users in chats/notifications/settings sections
- https://balsamiq.com/
    - used to build the powerful mockups for the first part of the project
- https://www.adobe.com/products/xd.html
    - used to design the application with nice templates
- https://statisticsbyjim.com/anova/one-way-anova-excel/
    - used to build ANOVA for the controlled experiment part