



# **IDX Report**

## **Math4kids**

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Faustas Volkovas, student number 293152

Flavius-Alin Boanca, student number 269073



## **Table of Contents**

1. Introduction	3
2. Methodology	3
3. Findings	19
4. Discussion	23
5. Conclusion	24
6. Appendix	25



# 1. Introduction

By combining the idea of games, educational learning is adopting a new approach. There are several applications that help spread knowledge because of the development of modern technology. Both teachers' teaching and students' learning have benefited from the current environment of digital games and applied sciences in the classroom.

Better ways for learning and teaching can be achieved with the help of game-based learning. Kids are given the chance to work on a variety of educational games with high expectations, combined with rewards and surprise components that help to maintain their interest in learning.

By giving kids the opportunity to cooperate, communicate, interact, and work in teams, game-based learning plays a crucial role in teaching. Strategy games improve brain function, encourage kids to learn new things, help them improve their skills, and help them form an emotional connection to the material they are learning. The capability of receiving feedback right away after playing a game provides knowledge on how to enhance performance.

The aim of the project is designing a mobile app that focuses on providing mathematical exercises for children from grade 2 to grade 8. The app is made to keep kids interested in using it by catching their attention using an emotional design concept. The benefit in using the app is for children to learn or improve their mathematical skills, as well as making the process of learning interesting and exciting.

# 2. Methodology

Throughout the project work, we have been following the Double Diamond model, which was used to split the development of the idea into four different stages: discover, define, develop, and deliver. It was decided to follow this model due to the simplicity of it. It covers the design process from start to finish, which was the most important aspect for our group in order to have a good and reliable design.

Apart from following a double diamond model, an Iterative design process has been followed as well. When problems were found in user testing, we went back to discussion and redesigned and fixed those problems, and then we continued with more tests and observations to see the effects of fixes. In this way design and development were iterative, with cycles of design->test->measures->redesign being repeated as often as necessary, and it can be seen in our **Developing** phase in which the design / prototyping steps are shown.



To avoid unnecessary work on detailed design, design activities need to be conducted alongside and around agile iterations where chunks of design portions were passed through the iterative method mentioned above. The product that was developed during every iteration was validated according to goals and constantly ensured that the product is being designed according to the right specifications.

In order to get a better understanding of the goal of this project **Personas** have been created for reliable and realistic representation of our key audience for reference.



## Tommy

### About

- 10 years old
- 3rd grade
- visual learner
- loves learning new things
- likes playing video games

### Personality

Tommy is a 10 year old who loves learning and enjoys playing video games. He is a curious and energetic kid.

### Frustrations

- doesn't like reading text books
- has trouble with math

### Goals

Tommy wants to improve his math skills to be able to show his teacher and friends that he is good at math

### Design needs

- colorful design
- rewarding system
- multiple option choices
- fun and engaging



## Jim

### About

- 38 years old
- father of one child
- works overtime
- hopes his child is succesfull

### Personality

Jim is an always busy father who values education highly. He loves technology and strives to achieve the best in everything he does.

### Frustrations

- no time to teach his kid himself
- no private lessons available in his area
- unsure what to do

### Goals

Jim values his child education. He belives being good at math is an important skill to have, and thinks learning it properly from a young age is best.

### Design needs

- visually pleasing
- informative
- memorable
- motivating
- 

## DOUBLE DIAMOND:

**Discover** - During the discovery phase a data gathering has been done by publishing a survey in which potential users gave us more information on our idea.

The five key issues for a successful data gathering session were considered as follows:

- *Setting goals.* The goals for the survey were decided in a way that results would give the most amount of information needed. Most important achievements were to find out more about possible users as well as their educational level and their interests in educational mobile applications.
- *Identifying participants.* The study population was identified through random sampling, participants to be included in data gathering were chosen from a list of close friends and family members as well as groups of people on the internet (local reddit parents' group) which were specifically chosen to meet the criteria for the survey goals to be reached.
- *Relationship with participants.* The purpose of the study was made clear from the beginning for all participants to understand, no sensitive data was requested or needed from users, and it was made clear as well that all data will be used only for this study and none of it will be made public or shared to third parties.
- *Triangulation.* Data was extracted from different people from different geographical places but also from different types of individuals, kids, parents, or both answering together which meant that the resulting data was drawn by using a form of triangulation.



- *Pilot studies.* The main survey was created after a pilot study ran on four individuals. The pilot study was conducted as an interview that later helped shape the main survey questions.

Below is presented the survey which was constructed following the successful data gathering aspects.

## Educational game for kids - learn Math

*\*All data resulted is used only for this study and none of it will be made public or shared to third parties.*

First, tell us a little bit about you. What grade are you going into next?

<input type="radio"/> 2nd grade	<input type="radio"/> 3rd grade
<input type="radio"/> 4th grade	<input type="radio"/> 5th grade
<input type="radio"/> 6th grade	<input type="radio"/> 7th grade
<input type="radio"/> 8th grade	<input type="radio"/> Other

Next

One more question about you, and then we'll move on.

<input type="radio"/> I'm a girl	<input type="radio"/> I'm a boy
----------------------------------	---------------------------------

Back

Next

1 2 3 4 5 6 7 8



Do you have any difficulties in learning math?

☐ Have difficulties

☐ Some difficulties

☐ No difficulties

**Back**

**Next**

Do you play mobile games?

☐ Always

☐ Usually

☐ Sometimes

☐ Rarely

☐ Never

**Back**

**Next**

How interested would you be in learning math by playing a game?

☐ Really interested

☐ Interested

☐ A bit interested

☐ Not interested

**Back**

**Next**



Would you be more interested to play an action-adventure type of game or a pick and choose options game?

☐ An action-adventure game

☐ Pick 'n' choose game

☐ Other

Back

Next

We want to reward players for completing each game. What kinds of rewards would you like?

☐ Ability to play at a harder level (leveling up)

☐ Badges

☐ Scores that might appear on a "high score" board for others to see

☐ Medals

☐ None of the above

☐ In game currency

Back

Next

[Optional]

Do you have any ideas in what you would like to see in this game, what might attract your attention?

Enter text here

Back

Finish





## Problem statement

After receiving and analyzing survey results a problem statement has been raised - how can learning new mathematical topics be made more interesting for children?

**Define** - going through the discovery phase a briefer understanding has been gained about the project's needs from the user's perspective by the help of the data gathering phase. And the requirements for the application have been decided on ->

### Requirements:

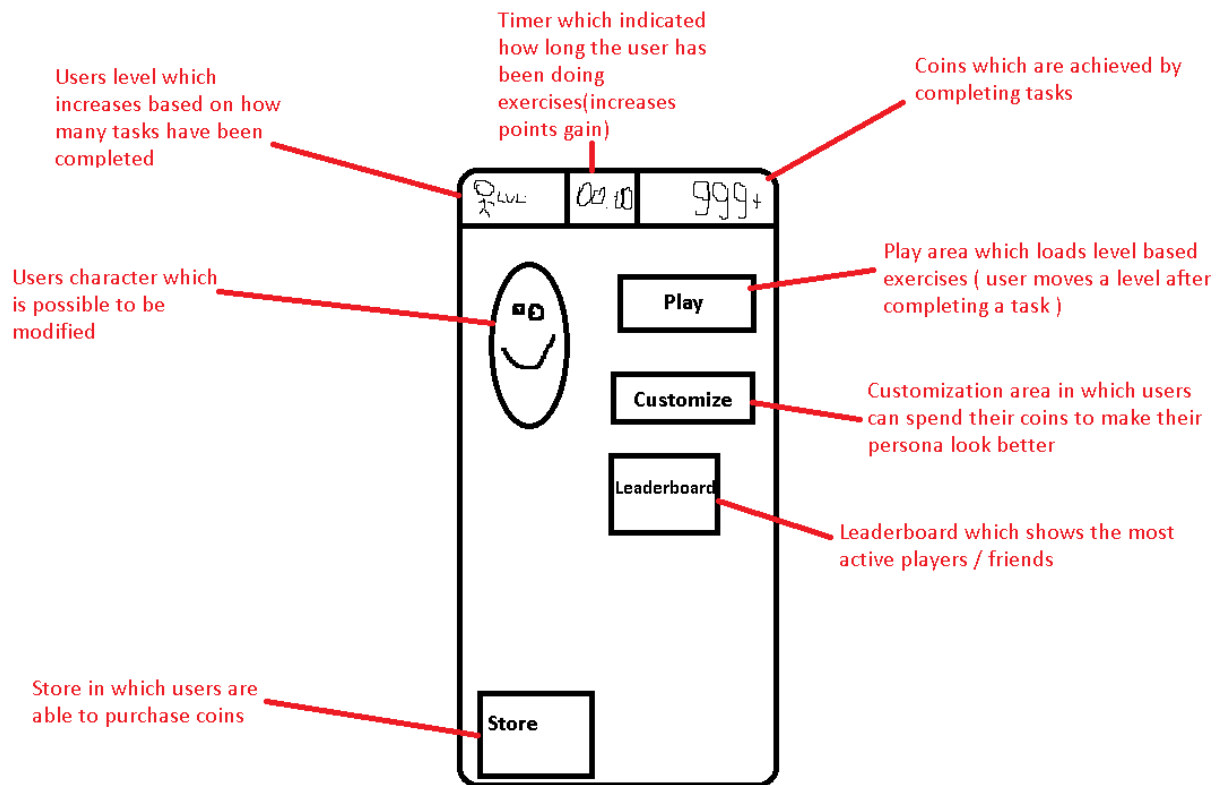
1. Users should be able to easily create an account (without an email).
2. Users should be able to select a custom character and customize it.
3. Users should be able to play the math game in a level-based environment.
4. Users should be able to play a challenge-based mode in which they are given a random task based on their grade and exercise type.
5. Users should be able to interact with other animated game models during play time.
6. Users should be able to see a leaderboard with top friends.
7. Users should be able to access a store in which a game earned points can be used.

**Develop** - During the development phase our group has decided to follow an Emotional Design concept that would evoke emotions which result in positive user experience:

- On the Visceral level design, we have come up with that the UI has to be colorful and playful to attract children's attention as well as prompting with daily notifications with various tasks that are waiting to be completed.
- During Behavioral level design it has been decided to have multiple different games/challenges to give the users more options to choose from and to keep them entertained.
- Reflective level design helped us in deciding to have a leaderboard in our mobile app, which displays the most consistent users as well as having a reward type-based system.

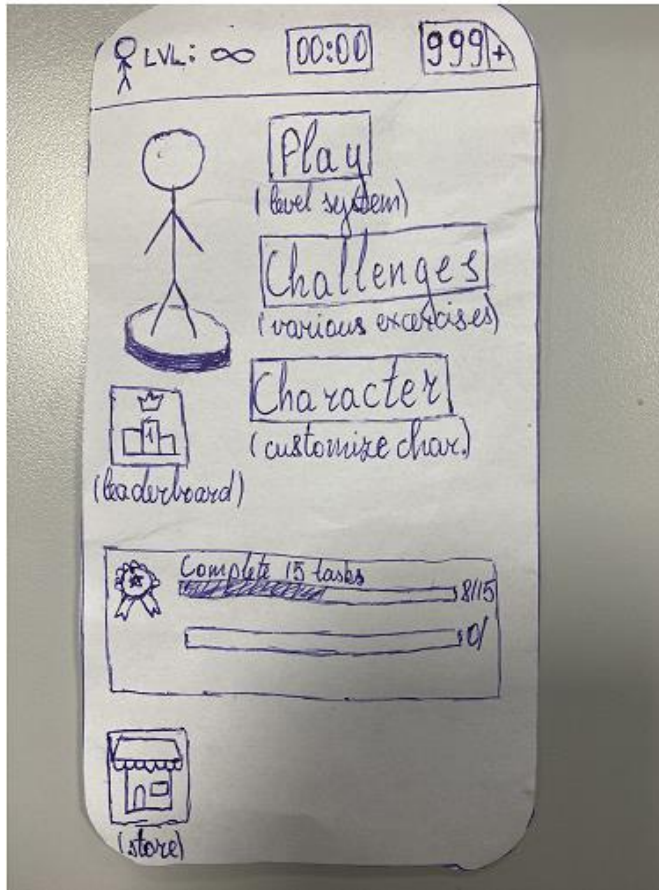
To add to the Emotional Design concept that was followed, **Anthropomorphism** was one of our focuses during the development process as well by adding objects with personalities and other human-like attributes to make the application be more enjoyable and fun to interact with.

Secondly the **Persuasive technique** found a use in our development as it plays an important role in making users want to keep coming back and play the game. This is done by gathering data about their daily usage and sending notifications with how much they have improved their skills, what they could gain if they would keep playing or rewards if they would have a constant usage of the app.

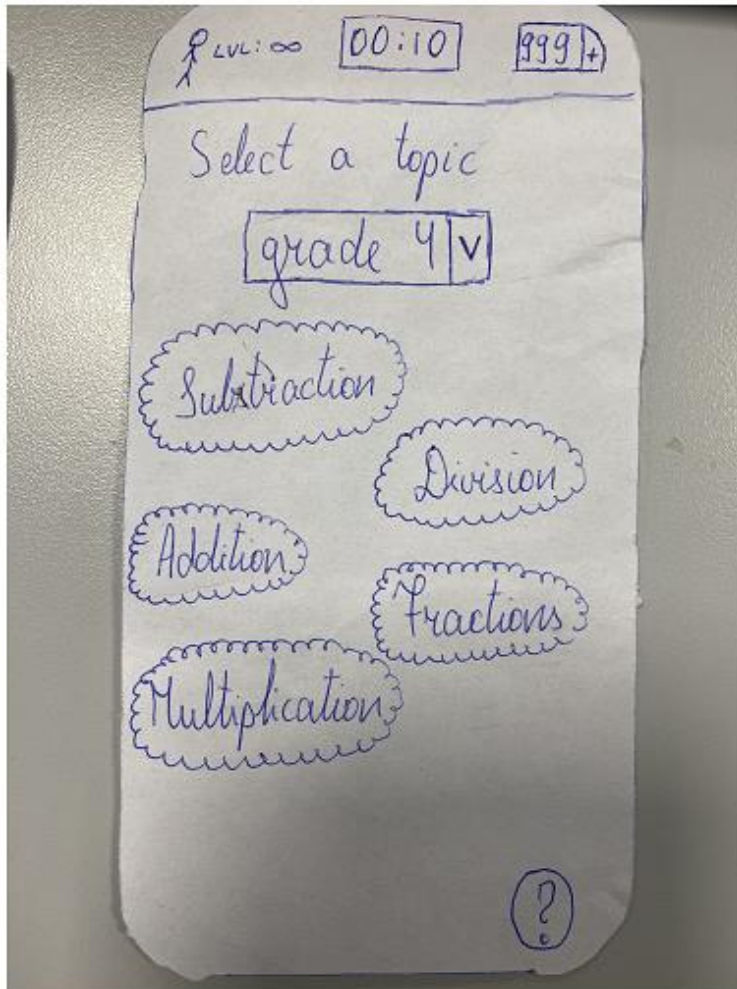


Creation of the first design sketch provided us with more ideas on how the app could be improved - design and functionality wise, which let us in designing our first prototype.

Main screen of the application holds the content of the whole application with a thought of trying to keep the layout simple as well having all of the content/features on the same screen.

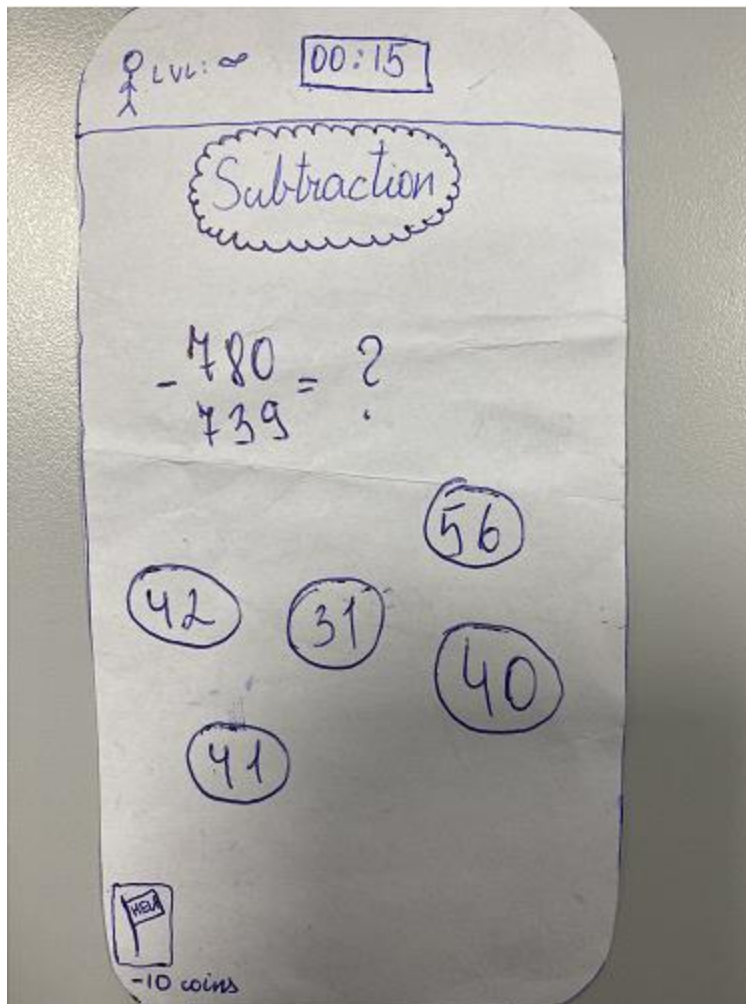


Following the survey answers a "**Challenges**" feature has been added in the application, in which users can go through different type of exercises and improve their knowledge on their selected topics ->

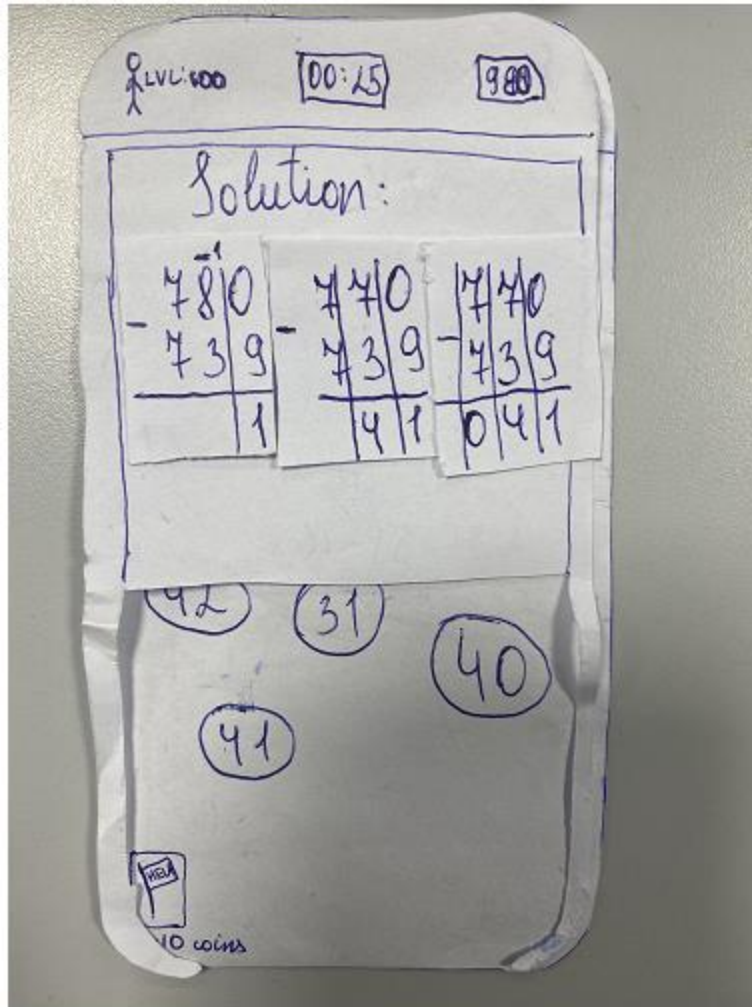


Users have a choice to select their education level by using the drop down list and choosing their grade (from 2nd till 8th grade) after which mathematical topics based on the selected grade level appear.

User selects "**Subtraction**" and proceeds to the challenges window ->



Users are prompted with randomly generated questions and multiple answers that they are able to choose from. The current user does not know the answers and clicks on the **"HELP"** button which prompts a solution window (also costing them 10 coins of in game currency) ->



Solution window has been designed in thoughts of providing users step by step walkthrough of how the exercise is solved.

### Test of the prototype nr1:

Our first test of the prototype was done by letting one of the VIA students interact with the prototype. The scene was set by letting the user (student of VIA) try and understand how the application works by themselves, without providing any instructions, in order to see if the application will be understandable to the younger audience.

Picture of the test process can be found in the [Appendix](#) marked with [number 1](#).

Each user's click resulted in the change of the UI, which let the test user feel how the application works. During the first test session only the "Challenge" feature has been tested to perfect the features one by one.





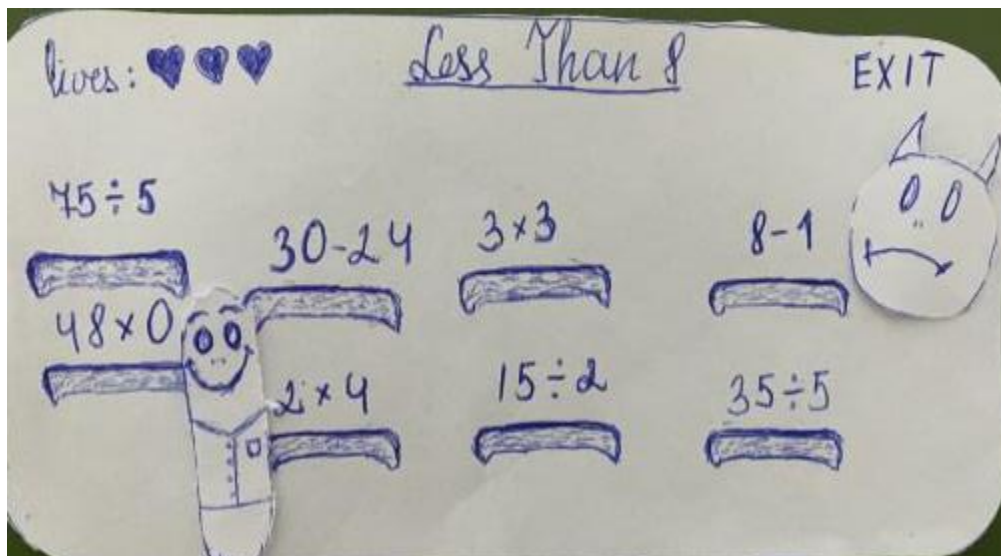
## Deliver

During the Delivery stage the final ideas for the product have been accumulated by doing more research on younger audience focused applications as well as trying to figure how our math game can be separated from the rest of the educational application market.

Having a wider game option, allows users to stay interested in the application, which led us in creating different types of game style for different features of the game. “Challenges” game mode is created in a Pick’n’choose game style and “Play” feature holds more of an Adventure type of game style by letting users move their character as well as interact with other objects/entities.

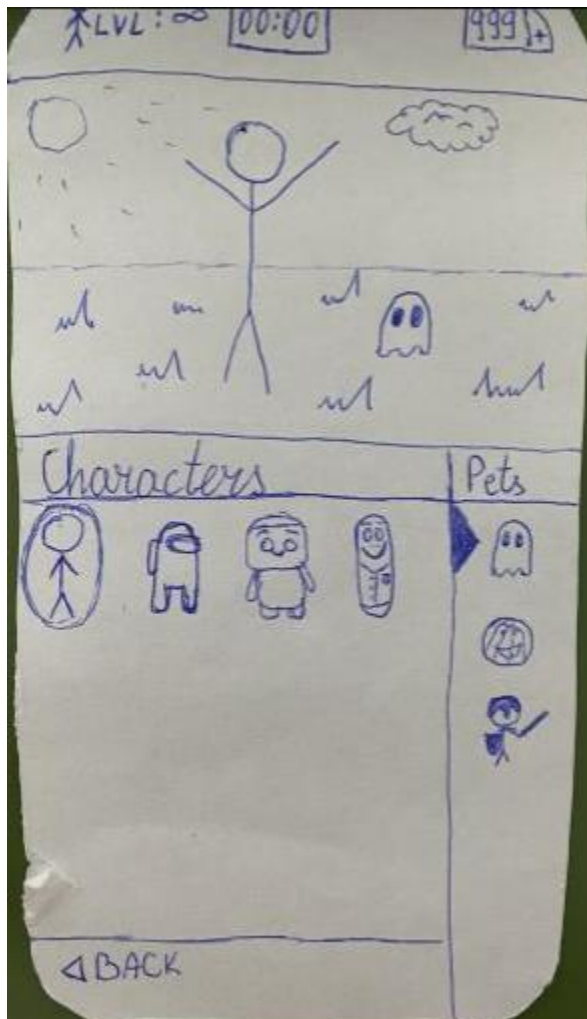
Final prototype of the project resulted in a few more different feature implementations: “Play”, “Character”, “Leaderboard” and “Store”. As well as minor changes to the “Challenge” feature which had flows that were pointed out in the first test of the prototype.

Starting with the “**Play**” feature, it has been designed to let a user move their character in the direction where the answer to the question is placed. By successfully choosing the right tile (a platform on which answer options are being placed on) the opponent (AI) takes damage and requires 3 right answers to be taken down after which the user is free to pass to another level.





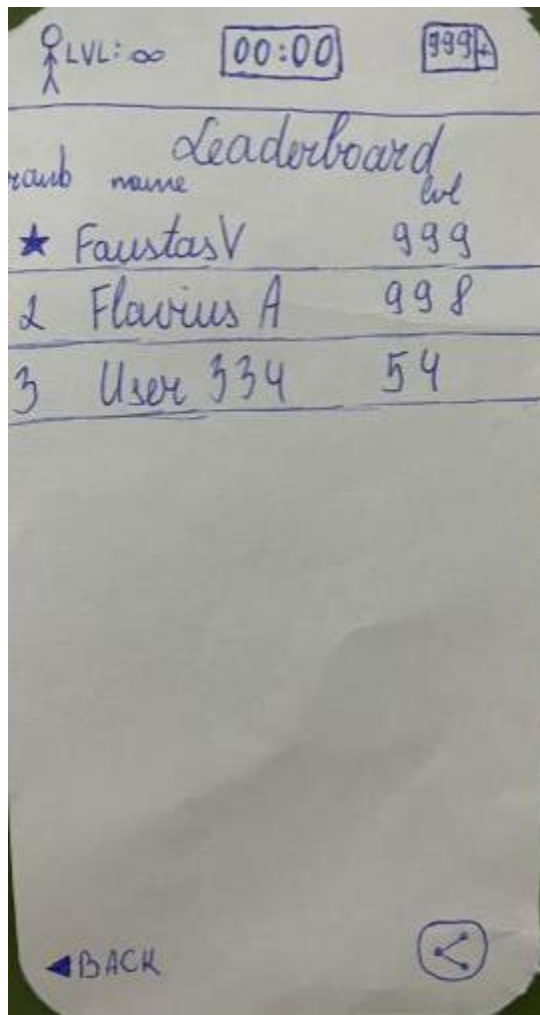
**“Character”** feature screen holds users' characters and pets, which they can choose from. New characters/pets also appear in this window when the user unlocks a new one.







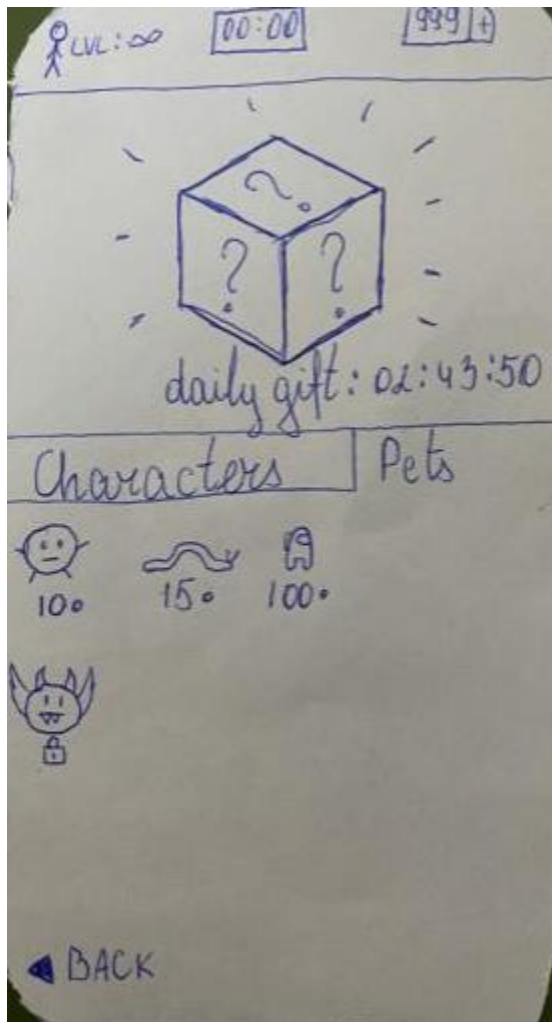
**“Leaderboard”** feature contains a typical leaderboard that displays the highest-level users in Your friend list. To add to that a share button can be seen on the screen with which the user can share their leaderboard position to their friends (through Facebook, messenger... etc.)





“**Store**” window features a daily gift box that the user can open every 24 hours with a chance of unlocking a random character or a pet, which can be accessed in the “Character” window.

To add to that, micro transaction will not be included in this application as it is solely focused on educating the younger generation.



Changes to the “**Challenges**” window have been done for the final version of the prototype by introducing a BACK button.

Final prototype can be also found on Figma in which the design of the application has been created to gather more data about the design choices.

Figma - <https://www.figma.com/file/eoCD7Hlx535QkTPrZaHO7Z/Untitled?node-id=0%3A1&t=al1PRLEQtxNAUTG8-0>



## Test of the prototype nr2:

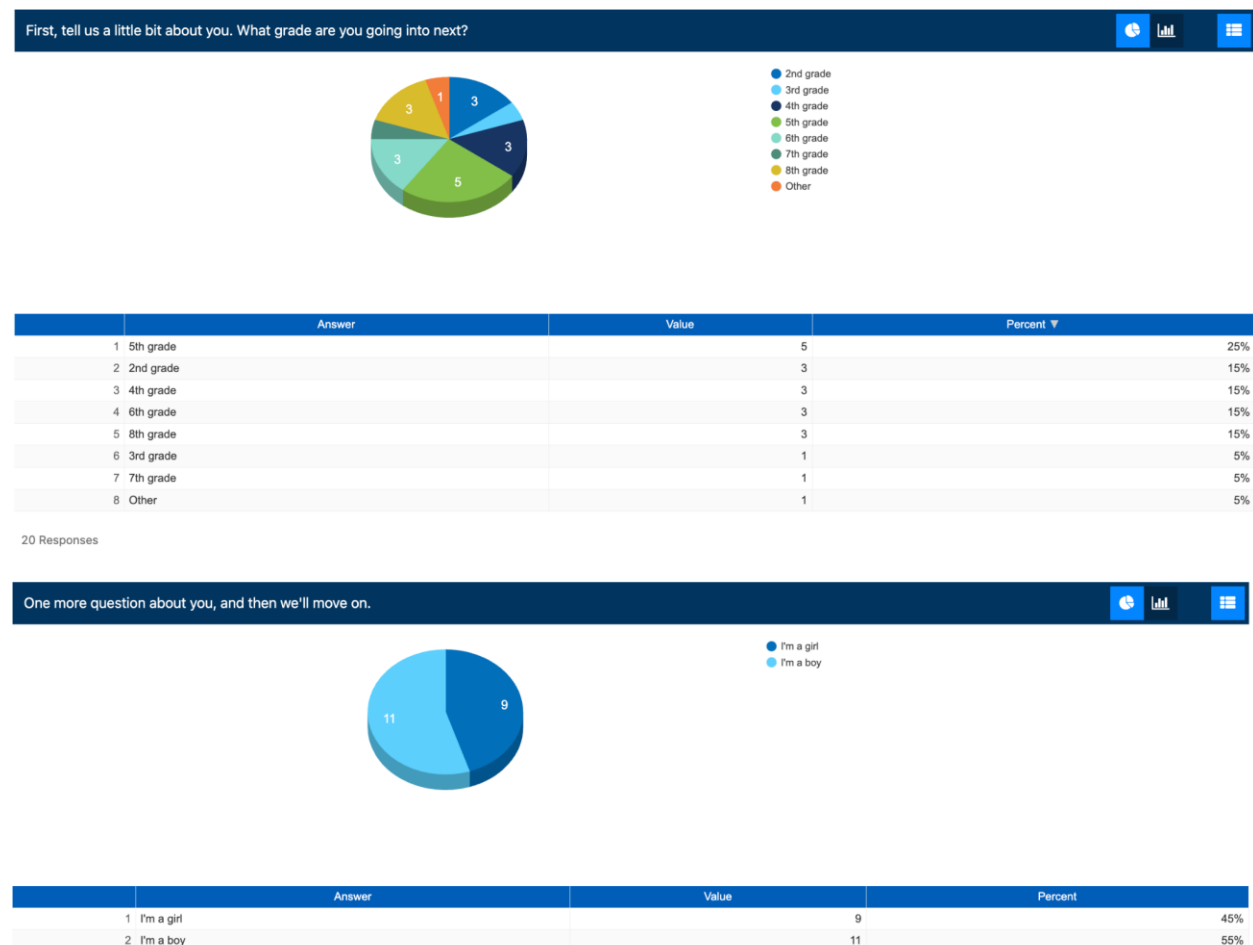
Last test of the prototype was done by letting a student try out the prototype with full functionality. The user had a full freedom of going through all accessible features on the physical version as well as the digital one using Figma

Picture of the test process can be found in the Appendix marked with [number 2](#).

## 3. Findings

The start of the project design process began with the data gathering with the help of the survey. During which we have gathered more information about the potential users, their educational level as well as more information about their interest in mobile applications.

The results of the survey gave meaningful information from the potential users of the app, details about them and their preferences, if the product is something that they will be using and how can it be improved if necessary. These findings will shape the form of the final product, emphasis is then placed on creating a design that solves the users' needs and is inclined on the majority resulting from the survey.





First, tell us a little bit about you. What grade are you going into next?

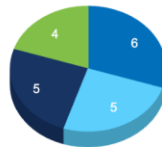


- 2nd grade
- 3rd grade
- 4th grade
- 5th grade
- 6th grade
- 7th grade
- 8th grade
- Other

	Answer	Value	Percent ▾
1	5th grade	5	25%
2	2nd grade	3	15%
3	4th grade	3	15%
4	6th grade	3	15%
5	8th grade	3	15%
6	3rd grade	1	5%
7	7th grade	1	5%
8	Other	1	5%

20 Responses

Do you play mobile games?



- Always
- Usually
- Sometimes
- Rarely

	Answer	Value	Percent
1	Always	6	30%
2	Usually	5	25%
3	Sometimes	5	25%
4	Rarely	4	20%
5	Never	0	0%

How interested would you be in learning math by playing a game?

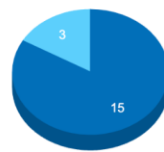


- Really interested
- Interested
- A bit interested
- Not interested

	Answer	Value	Percent
1	Really interested	4	20%
2	Interested	6	30%
3	A bit interested	8	40%
4	Not interested	2	10%



Would you be more interested to play an action-adventure type of game or a pick and choose options game?



- An action-adventure game
- Pick 'n' choose game

	Answer	Value	Percent
1	An action-adventure game	15	75%
2	Pick 'n' choose game	3	15%

We want to reward players for completing each game. What kinds of rewards would you like?



- Ability to play at a harder level (leveling up)
- Badges
- Scores that might appear on a "high score" board for others to see
- Medals
- None of the above
- In game currency

	Answer	Value	Percent
1	Ability to play at a harder level (leveling up)	9	24%
2	Badges	4	11%
3	Scores that might appear on a "high score" board for others to see	9	24%
4	Medals	8	21%
5	None of the above	2	5%
6	In game currency	6	16%

[Optional]

Do you have any ideas in what you would like to see in this game, what might attract your attention?

I'll like to play together with my friends

Want to have a level based gamemode and practice gamemodes

no

I would like to be able to customize my character if it is an adventure game

Having a leaderboard to see all my friends

5 Responses

Followed with the data gathering a problem statement has been raised - how can learning new mathematical topics be made more interesting for children? And learning new mathematical skills can be made more interesting by letting users choose between few options: which in our situation is Pick'n'choose type of game mode called "**Challenges**" as well as adventure / level-based game mode "**Play**" in which there are colorful and playful design, reward-based system, which keeps users motivated in finishing their tasks, as well as a leaderboard feature in which users can show off their dedication in learning.



Going over to the requirements, they were set as a goal from a user perspective of what is needed in an educational application to keep children interested in learning new math skills through a mobile application. Going over each design process “step” we had successfully followed and implemented all user requirements.

Having our requirements set, a first sketch has been made for a purpose of seeing how the design could look like. It was decided to keep the general format of the application as it looked simple but at the same time everything that was needed was on the main screen of the app. After confirming the sketch between the team members, a first prototype has been created with only one functionality - **Challenges**, as it was one of the main features of the application that focuses on creating various tasks for users depending on two factors: education level and type of mathematical task the user wants to improve.

After the first prototype was created it was time to test it out. With the help of other VIA students, we were able to put our prototype to work. The user was not given any instructions apart from getting introduced to the application and working features.

After the test has been concluded the user had few things to say about the application: firstly, the user was disappointed that the application did not have a Back button which our team has forgotten about and was added after the test has been completed, secondly he complemented our challenge system by dividing the challenges into different topics by the users educational level. To add to that the user did not have too much to say as our first prototype only included one of the main features of the application.

By successfully evaluating test users' comments we had corrected our prototype as well as added the rest of the features: Play, Leaderboard, Character and Store. Followed by our last test of the prototype before the launch.

The test has been conducted in VIA by providing the physical as well as digital prototype to our User who was able to go through all the features of the project. The user was only provided with basic instructions of the application, which one of them was a “?” button that tell the user what he should do from there (Challenges feature explaining how the user should proceed: selecting their grade and the topic).

During the test user was asked to express his opinions loudly for us to get more information about our product:

- “I would like to have a time limit for completing a level, without it being too competitive”
- “The character window is promising and looks great “
- “I like that you do not have micro transactions”
- “I would expect to be able to choose a level”
- “Having different themes for levels would be a good idea”
- “The app itself looks nice, would be cool to see it work properly”

After the test was completed, we had come up with a few additional changes to our “Play” feature by making the monster change its position, eventually forcing the user to pick an answer, otherwise losing one life. As well adding a timer, forcing the user to pick an answer.



## 4. Discussion

Starting with the data gathering part of the project, we should have spread our survey even more as our total of answers only reached around 20 users, even after sending it to “reddit”. I think that by having more answers we could have accumulated more ideas as we did have an optional part in which survey users were able to input their own opinion on this idea.

Going into the development phase we had chosen an Emotional Design concept due to it going well with our project idea as well as being the most applicable when creating a product for children. As well as making the design of the application simplistic without having too many interactable buttons on the main screen, which could distract the user from the main features of the Math game. Followed by the first sketch creation, which we had done in paint, and it helped us to see how the design looks and how it could be improved.

Something that could be added to the design would be addressing kids in the first person since this can make them feel more at ease and reduce their anxiety. Similarly, interacting with screen characters like tutors and wizards can be more engaging than interacting with a dialog box, this idea was used in the design, but it could be improved in future updates.

First prototype of the project has been created based on our sketch that was made beforehand, for which we decided to keep a similar layout but with better button placements for it to look more appealing, which in our opinion we succeeded. To add to that, during the creation of our prototypes we had been following the design on “Figma” website to see if the element placement would not be out of place on mobile devices.

Having a first prototype done, it was time to test it out with a real user, who was one of the VIA students (one of our classmates). Before the test began, we informed the user that we will not be providing him with the instructions, instead only letting him know what functionality is implemented in the prototype. The test user did not want to be filmed so we took a few pictures of the test process (that can be found in the developing phase). For the future tests we would prepare more features to be done, even though the user was not disappointed in this experiment, he did express his thoughts of wanting to have more done before letting the user test it as he seemed interested in what other game modes could look like.

Finishing up with the test of our first prototype we began a Delivery phase of the project by creating more ideas as well as gathering more data on how the other features of the project could look like, which was one of the more interesting parts of this project. Following the prototype in a mobile design application gave us a broader view of how the application will function. Followed by our second test case which was performed by another student of VIA. This test case lets the user fully test out all features of the project: from going through one level of Adventure type game mode (“Play”) to Pick’n’choose (“Challenges”) feature as well as checking out the leaderboard, store, and character features. To add to that the test user was able to test a demo prototype on a mobile phone using the “Figma” website, which let him min-max the testing process. The last test gave us good feedback about the application being entertaining as well as offering few additional features that could be added in the future. Few things we would change if we would go through the whole process again, by doing more tests of the prototype as each test in our case provided us with great feedback and new ideas.



The result reached our expectations, taking into consideration that this was our first UX design project that focuses mainly on the design instead of the functionality of the product like in our other lecture projects.

The end result reached our expectations, we completed all of the set requirements as well as gained a better understanding on what goes on in the designing process of an idea. It made us look into this project from a wider perspective and not just as a software engineer, as it was focused on the UX design instead of the functional aspects of the project.

## 5. Conclusion

Next step that could be taken in a future iteration of development would be to strictly follow the material taught in school and have a similar learning curve to the one desired in the school curriculum. Similar incremental steps for each mathematical exercise can be had in the game with those presented by teachers in class. The design and the whole functionality should be something that could have the approval to be a serious educational tool recommended by teachers and regarded by parents.

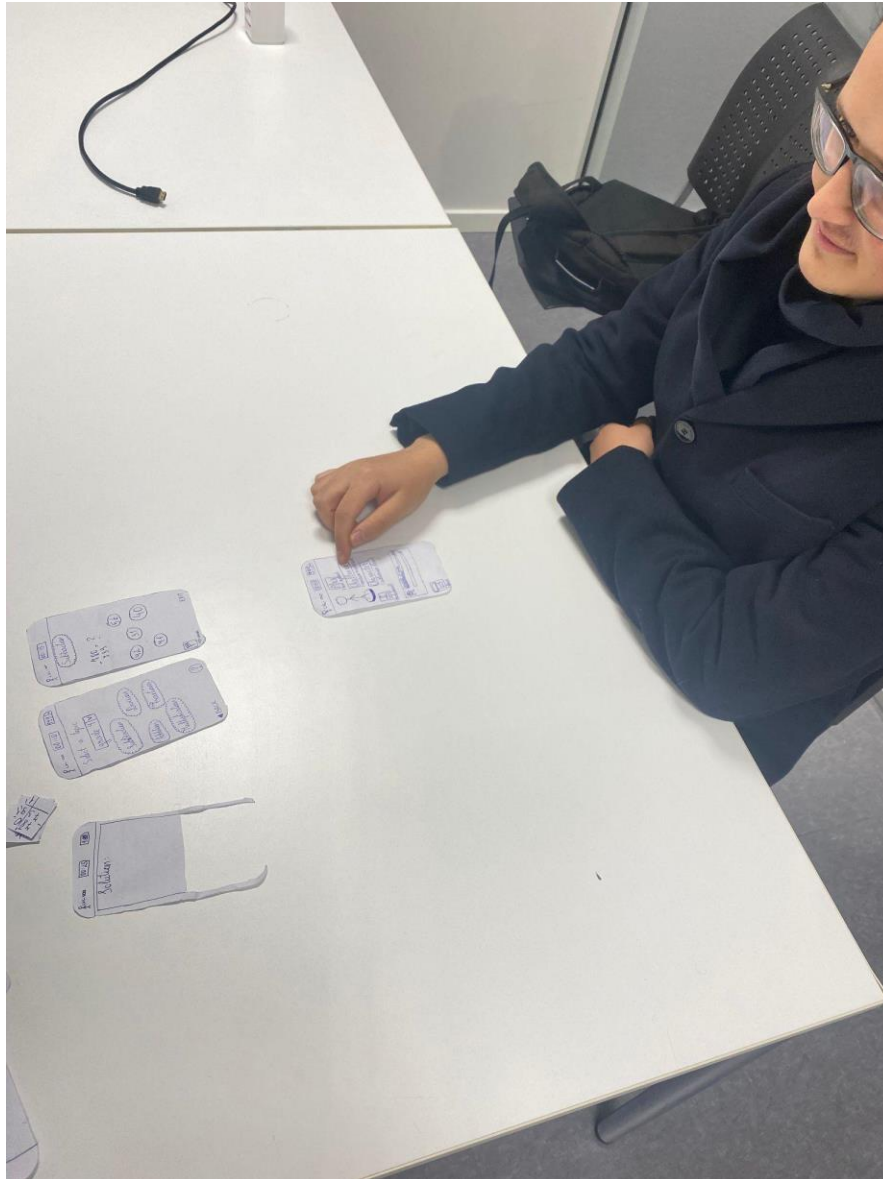
The next thing in our project would be going into the implementation phase and creating a demo version of the application, which could be tested, and more things improved.

There are a lot of points to cover if the process of interaction design would be covered closely, the analysis, design and study can be extensively expanded making this document much more comprehensive.

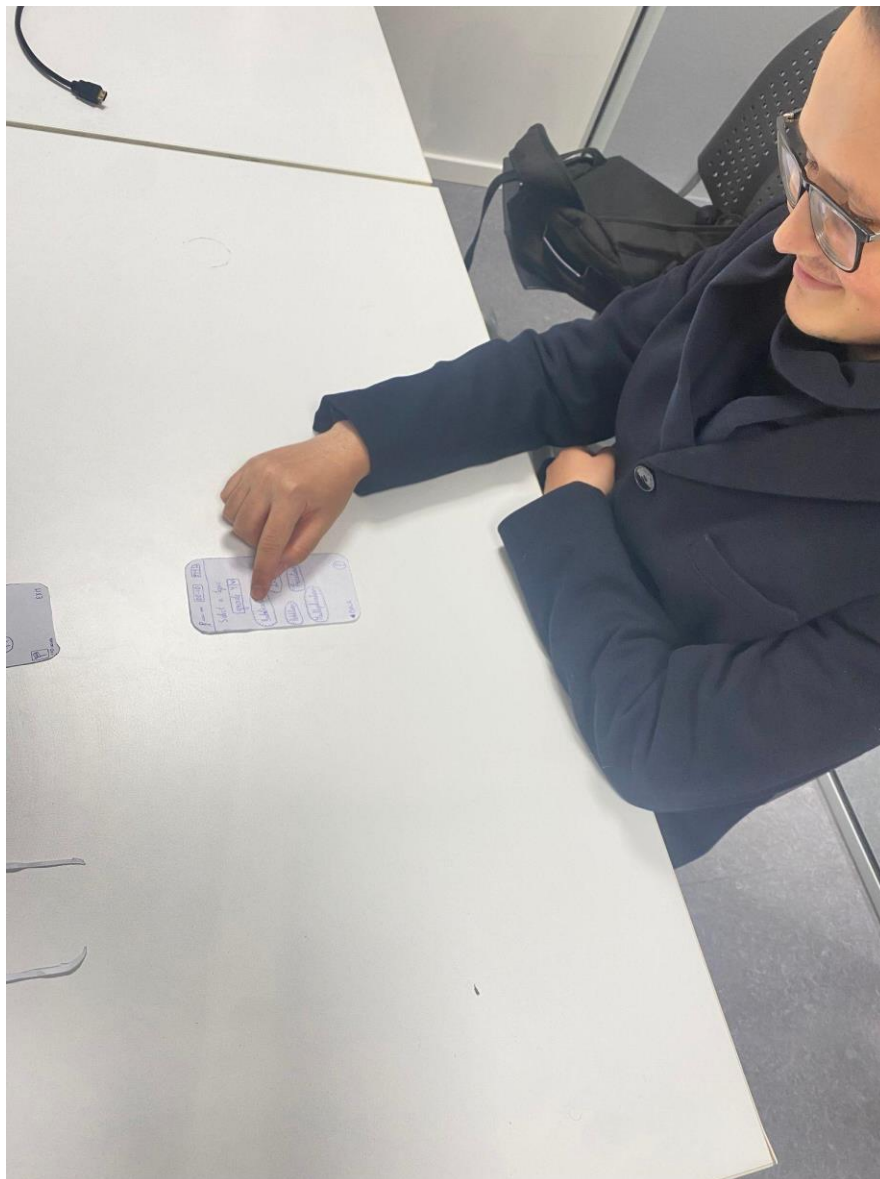


## 6. Appendix

### Test number 1



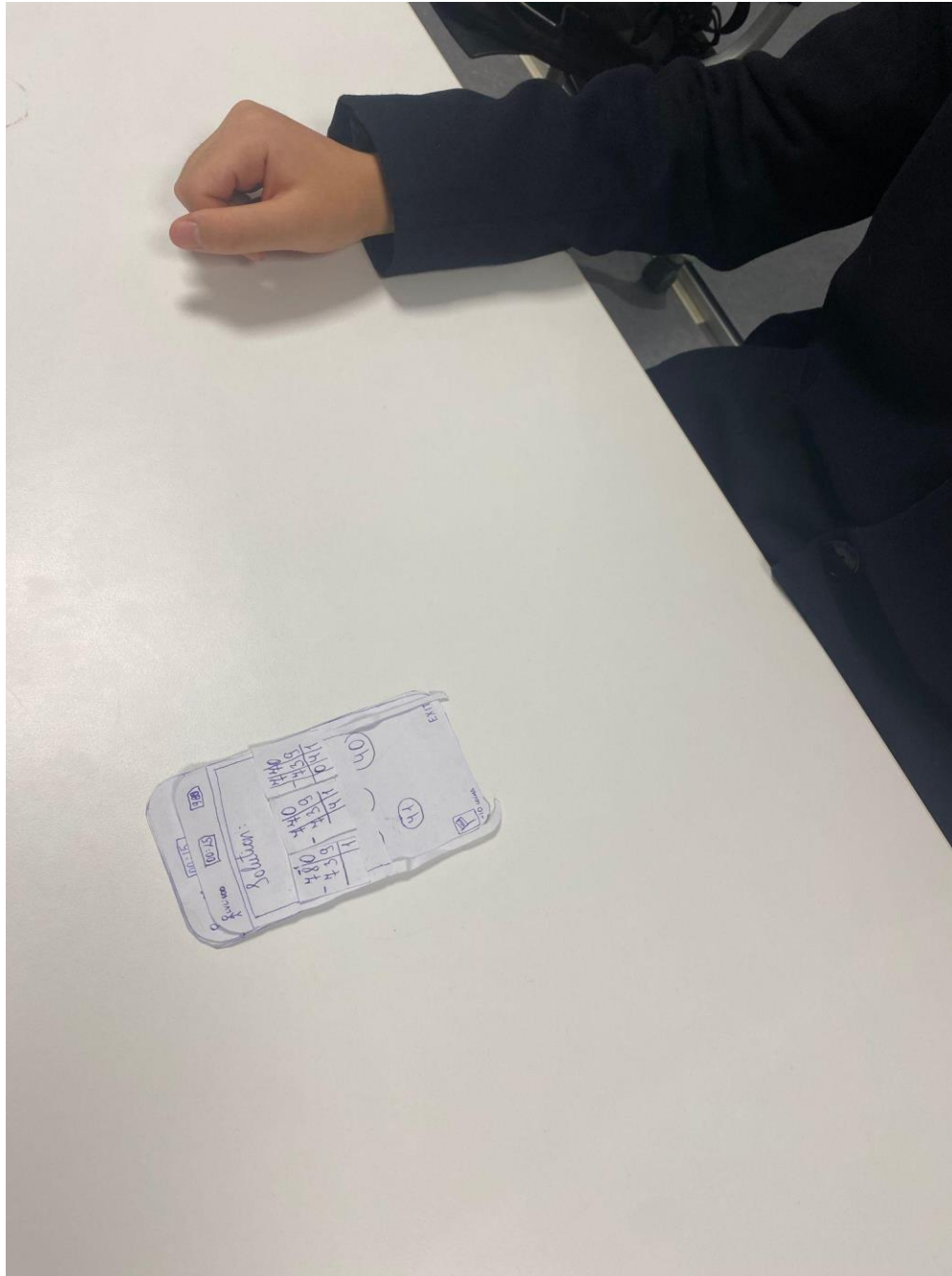
Test user selecting “**Challenges**” feature.



Test user chooses his subject.



Test user interacting with the **"HELP"** feature.



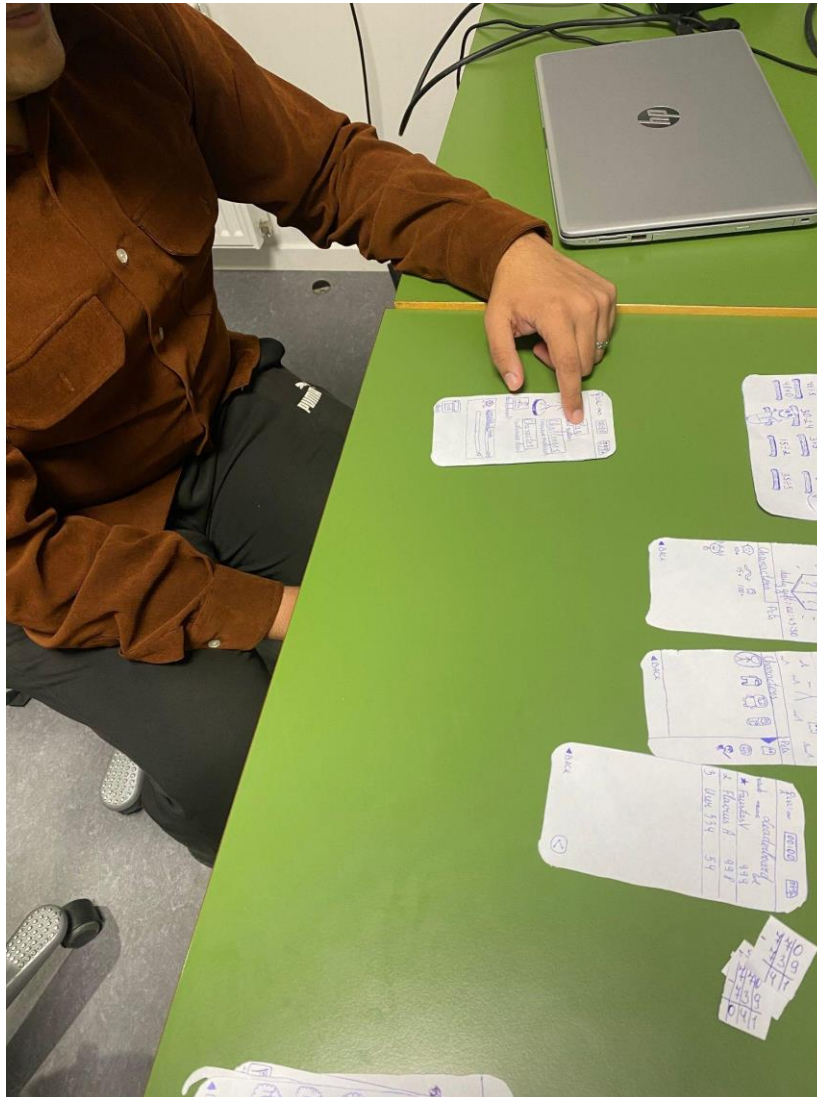
After interacting with the “**HELP**” feature a solution window appeared on the screen. Test user was stuck on this functionality due to the prototype not having a BACK/EXIT button.

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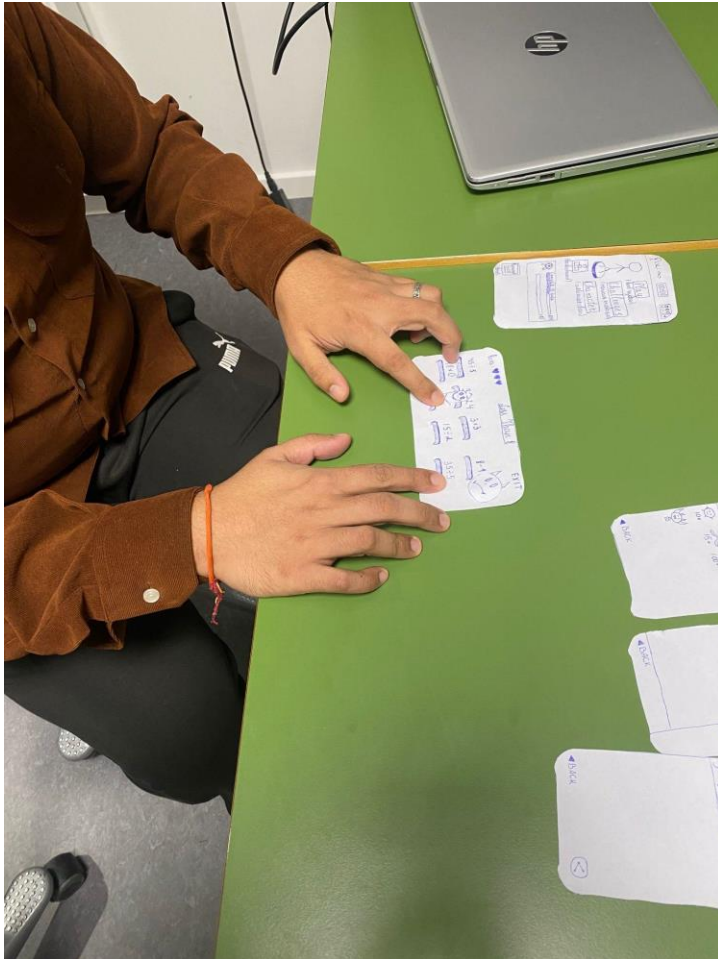


## Test number 2

Testing a final prototype begins by the test user interacting with the “**Play**” feature after which the “screen” of the application goes into the adventure type game screen, whose purpose is to Select **THREE** right answers in order to eliminate the *Enemy* and pass to another level.







Test user playing the Adventure game in which he moves his character to the right tiles holding the correct answer.

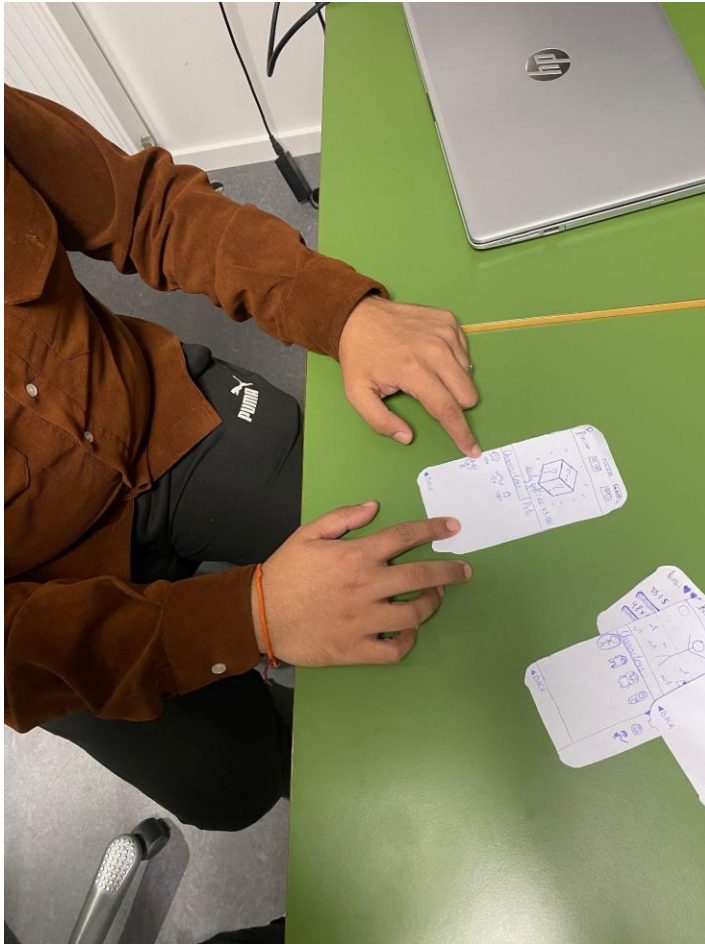


User completes the level, after which the monster goes into an upside-down animation, indicating its defeat.



User goes into the “**Store**” feature to check what he can buy for his coins.





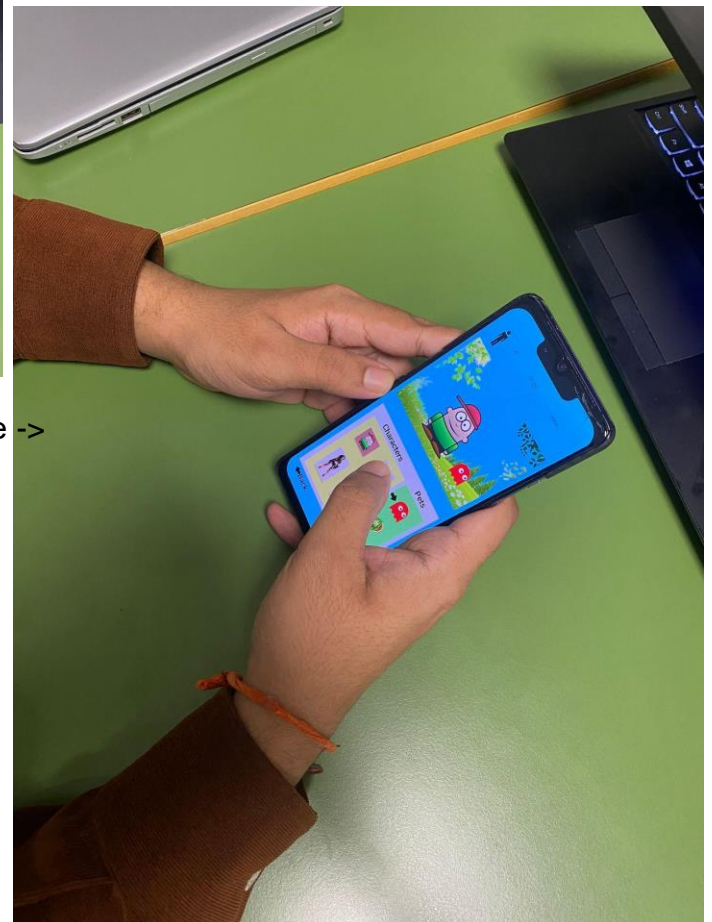
Store window presenting possible items to be bought.



After finishing with the physical prototype test user was given a prototype made in Figma with which he was able to interact with it like with a real application.

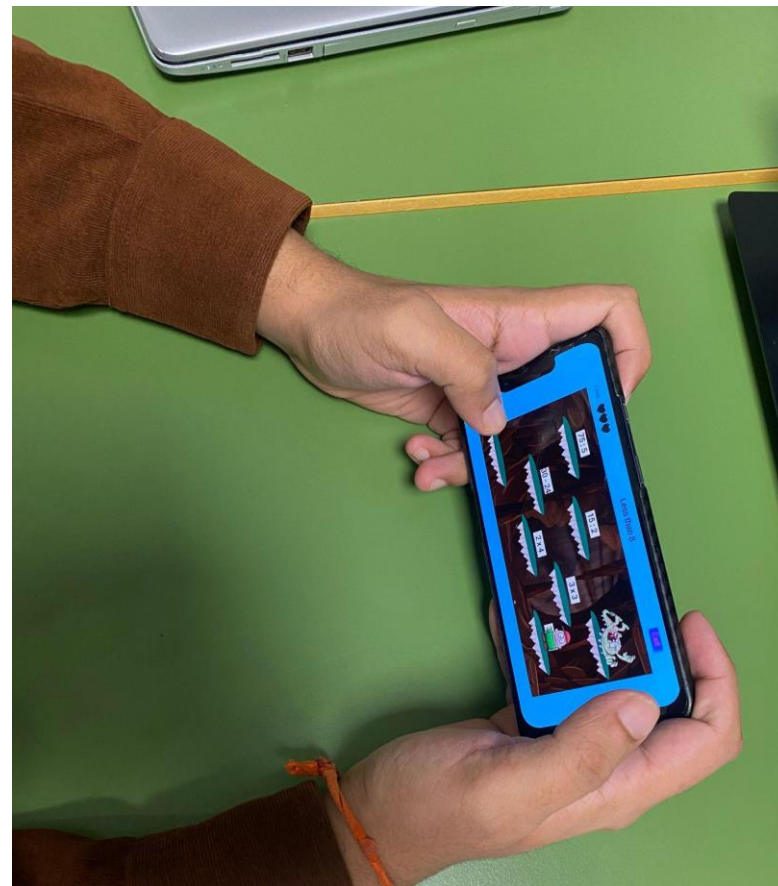
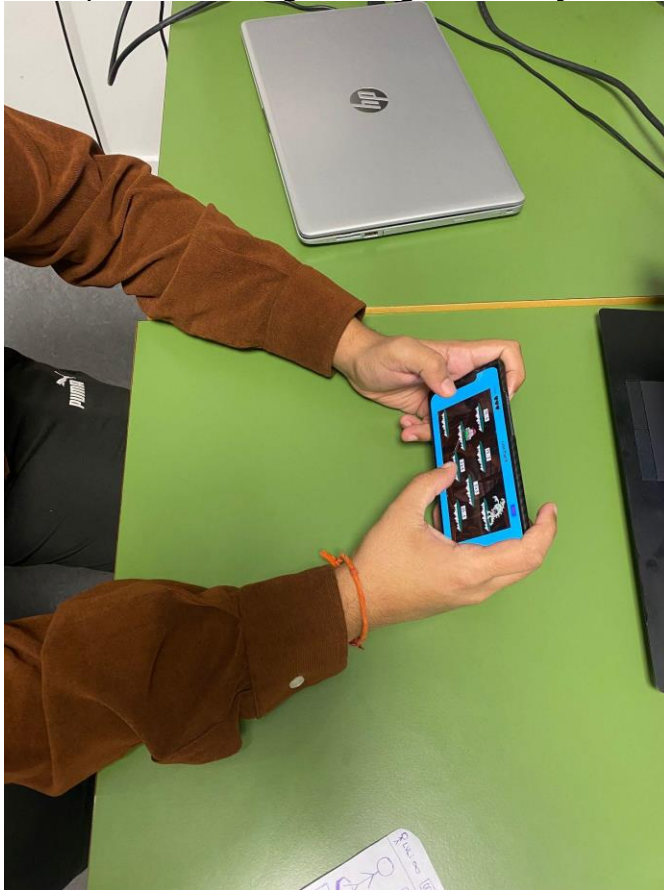


Firstly, the user checked out the “**Store**” feature ->





Then proceeded to go through the “**Play**” feature ->







Some behind the scenes pictures of the Testing process:

