

Click - a - Class

A new way to interact in class

Internet of Things

Interaction Design Course 2018/2019

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*" I love taking an idea...
to a prototype and then
**to a product that millions
of people use "***

Susan Wojcicki, YouTube CEO

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Executive Summary

Project Summary

Click-a-Class was conducted in the context of Internet of Things Interaction Design course, in Técnico Lisboa. This course challenged the students to create an innovative project in the field of Internet of Things.

After discussing, reflecting and knowing the different materials that the course had available to choose, we immediately wanted to work with Flics - a colorful and easy to use button. Having the material chosen, we then agreed to solve a big problem in elementary schools.

Business Model Canvas

To better understand the customer needs, design products and services wanted, a Business Model was made. After this, it was possible to structure a valuable product.

User Research

In order to understand the user's needs, behaviours and motivations, a questionnaire was made focused on the end users - elementary schools' teachers. With the results, it was possible to improve the system's usability to better suit the user's needs.

The problem that **Click-a-Class** aims to solve can be summarized as:

"how can lecturing elementary schools be motivating and fun at the same time for both students and teachers?"



Background

Team

We are a team with 5 members: Tomás, Diogo, Filipa, Matilde and Daniela. As master students in Computer Science, we are always searching for something new, striving to be better.

Our **Project Manager** was **Filipa Rocha**. She was the one responsible for delegate and monitor the project as well as making sure each tasks was being done as intended.

The **Development Team** was composed of **Tomás Jacob** and **Diogo Martins**. They were responsible for the backend, frontend and how the application looked like for the end users.

The **User Research Team**, **Matilde Nascimento** and **Daniela Tinoco**, performed the questionnaires, mostly with elementary school teachers, to get feedback.



Motivation

We once were elementary school students. We know that, at that age, all we want to do is paint and have fun. With this, the teacher's job becomes even more complicated and hard with unmotivated and unfocused students. Because the elementary school's learnings are core for a good base of knowledge for the future, this subject is very important. Also, since we are in an era where technology is everywhere and in everything, makes sense that it is used to improve this area. With that, our motivation is to have the best of both worlds: improve learning while having fun.

Challenge

Our challenge is to fulfill the existing gap in elementary school, more specifically, for students that get easily distracted. Improving the student's engagement and attention in classes, and also helping the teacher's job at the same time - with interactive and user-friendly tools - can further get students more interested and consequently better grades.

**Aligning fun and playful methods to teaching facilities
can make learning become (even more) fun!**

Schedule

Throughout the semester, Click-a-Class was subdivided into the following monthly planification:

-
- The diagram features a vertical timeline on the left side. At the top, 'SEP' is written vertically above a circle. Below it, 'OCT' is written vertically above another circle. Further down, 'NOV' is written vertically above a third circle. On the far left, 'DEZ' is written vertically above a fourth circle, with '2018' written horizontally to its right. At the bottom, 'JAN' is written vertically above a fifth circle, with '2019' written horizontally to its right. A vertical line connects all these circles. To the right of each circle, a list of project components is provided.
- SEP** ○ Value Proposition Canvas
 - OCT** ○ User Research
Low Fidelity Prototype
 - NOV** ○ Minimum Viable Product
Research Questions
Metrics and Tasks
Functional Prototype
 - DEZ**
2018 ○ **Fully Functional Prototype**
Concept Video
Presentation
 - JAN**
2019 ○ Usability Testing
Evaluation
Report

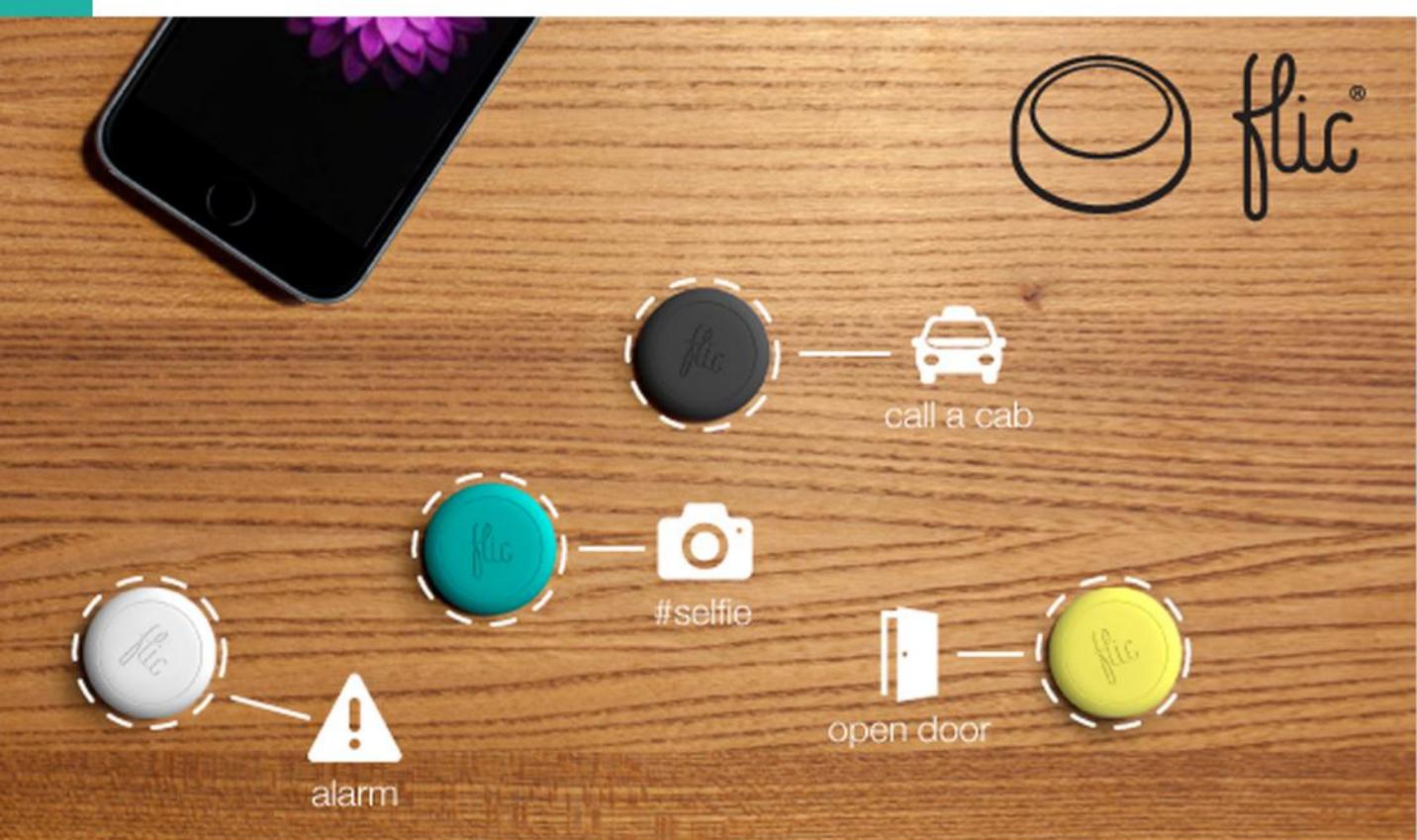
Overview

Click - a - Class

Click-a-Class is a product made for elementary schools, so students can improve learning and promote engagement in class, and make the teacher's job easier. This system allows the teachers to create classes (and add students) and connect a specific class to the room where it is given, as well as an updated statistical record for each class. The classes become more dynamic with personalized quizzes and exercises by the teacher, and an automated attendance system.

Each student has a colored **Flic button** that allows them to interact with the teacher and the systems. It can be used to take the attendance, to ask a question or to answer a quiz.

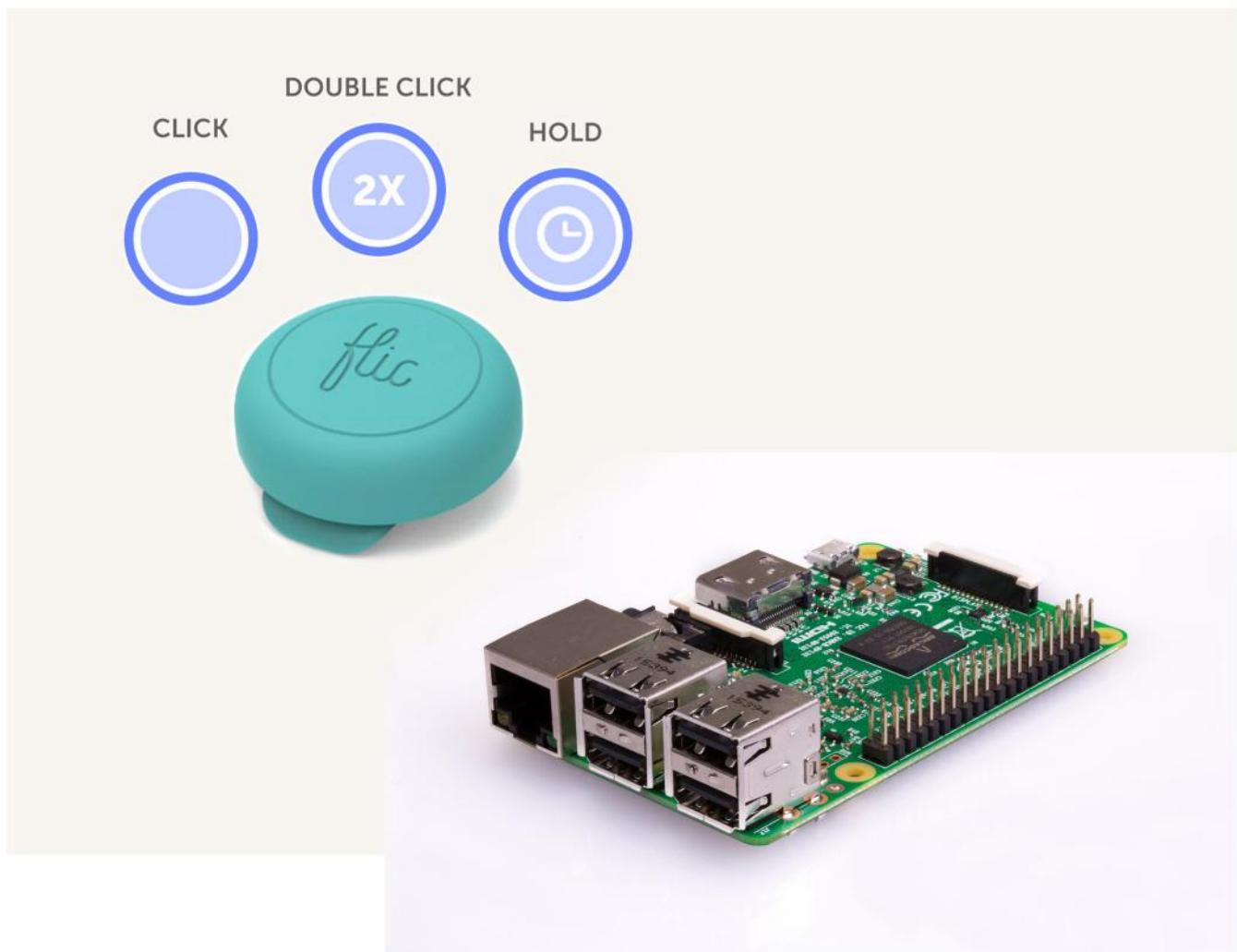
*"Flic makes your favorite apps and functions accessible at the push of a **physical** button "*



Material

Flic buttons

Flic button is a wireless button that can be connected to a wireless device. Its functionalities can be defined by the user, in any way wanted. It also has three different interactions: **click**, **double click** and **hold**.



Raspberry Pi 3+

To make the connection between the computer and the flic buttons, it is used a Raspberry Pi 3+.

Each classroom requires one, because each room is associated with one raspberry. This helps with the logistics of the material, so the teacher does not have to carry extra-hardware from class to class. Each raspberry has a corresponding ID, so, in the setup of each class, the teacher inputs the corresponding ID (it is only required that to input the ID during the class' setup).

Functionalities

To better understand the end-users needs - i.e. the elementary schools' teachers and the students - a user research was made in the beginning of the project. After 25 teachers had answered the questionnaire, it was possible to retrieve which type of dynamic functionalities they thought were the more appropriate for class.

The popular answers were, **using a Flic button**, to:

- 1 click to check the attendance,
- 1 click to notify that the student have completed an exercise,
- 1 click to answer a quiz.

Giving into account this, we made 5 distinct functionalities:



Personalize Classes



Attendance Checking



Interactive Quizzes



Quick Questions



Student's Statistics



Personalize Classes

To get used to the system and to start the school year with the right foot, the first interaction with our system (after creating an account) is to Personalize classes.

Before the beginning of the school year (or even during), the teacher can create and personalize his/her classes. Each class can be identified by its name - for example "4th grade C" - and a brief description. It is also possible to add students by typing the student's name. At any moment, it is possible to add or remove a student to a class.

[Ver Turma](#)
Adicionar Alunos
Terminar

Adicionar aluno
3º A

Escreva em baixo a informação do novo aluno
Alunos já inscritos na turma:

5
Nome do Aluno
José Rodrigues # 1

André Fonseca # 2
Inês Almeida # 3

Roberto Noronha # 4

[Adicionar Aluno](#)

Attendance Checking

In class, to check who's attending, it is possible to do an interactive and automated attendance checking. Each student has a Flic button in their desk, and when his/her name appear on the board, the student just needs to do a simple click on the Flic.

The Flics are not associated to a specific student. Instead, because students tend to change their position in class (or just change according with the subject that is being lectured), the association is made during the attendance checking, independently for each class.

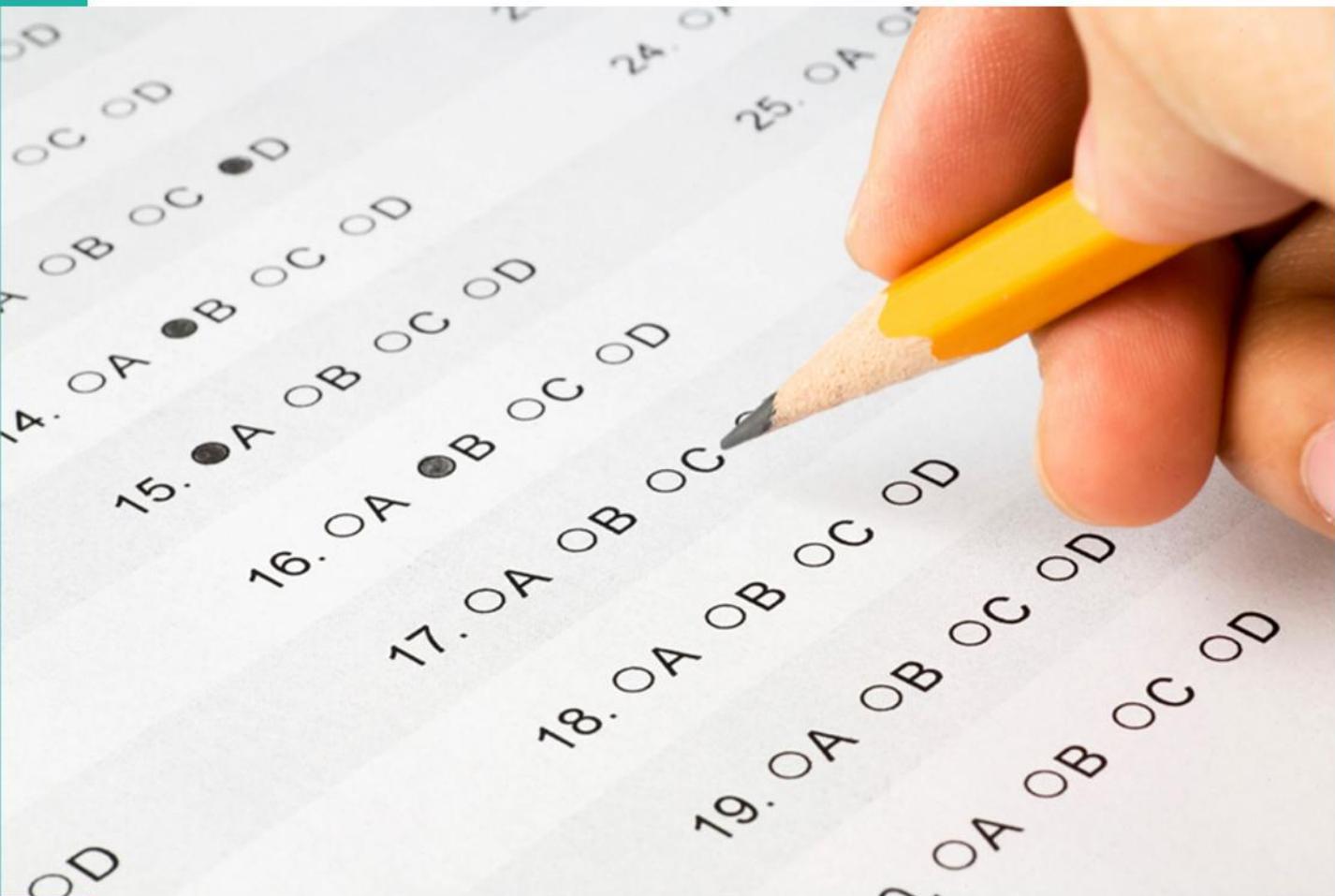
Is also possible to keep an update attendance record, to get an overview of the attendance flow during a specific period.



Interactive Quizzes

At anytime during class, the teacher can start a quizz. This can be created and personalized before class, adding questions (and three answers) according with the lectured subjects - Maths, Literature, Science and History.

The teacher shows a question, and the students have to correctly answer using the three possible interaction with Flic: click, double-click and hold. When intended by the teacher, the correct answer appears on the screen. In the end of the quizz, it is possible to see the top 3 students that have correctly answered the questions.



Quick Question

To understand if the students are paying attention and understanding the subject that is being lectured, the teacher can spontaneously do a Quick Question.

The flow is similar to the quizzes: the students have to correctly answer using the three possible Flic interactions.



Student's Statistics

The 5th and final functionality is the Statistics. With this, it is possible to have a record of the student's attendance and answers from the quizzes and quick questions.

Having this and the student's grades, it is possible to make an evaluation of the school year, according with each subject, and also too understand if certain topics are harder/easier to understand, for example.



Process

*"Good design is like a refrigerator:
when it works, no one notices,
but when it doesn't, **it sure stinks.**"*

Irene Au

Value-Proposition Canvas

To start this project, the first step was designing a Value-Proposition Canvas, establishing what are the Gains, their Creators, the Pains and their Relievers, the Product & Services, and the Costumers' Jobs.



Pains

- Lack of interest
- Lack of resources
- Attention deficit
- Noise
- Class entropy



Gains

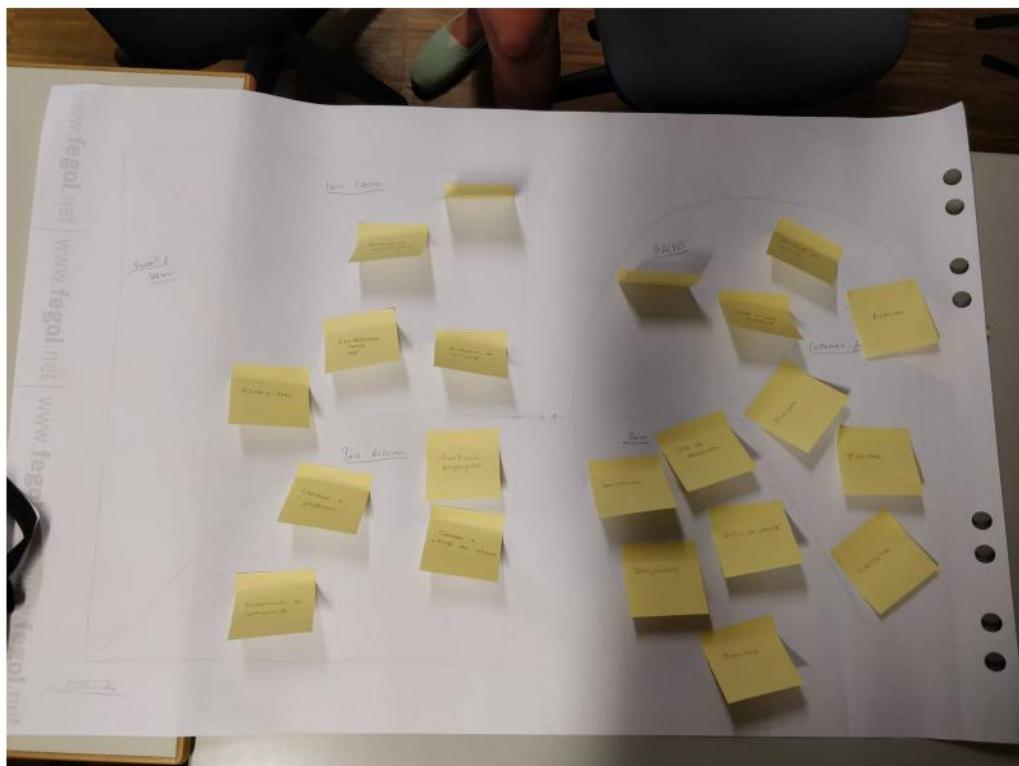
- Optimize learning
- Increase attention
- Keep the class interesting



Pain Relievers



- Calling the teacher
- Timed questionnaires
- Grab the students' attention
- Optimization tools





Gain Creators

Grab the interest/attention
Increase interactivity
Easiness in organization
Centralized in an app



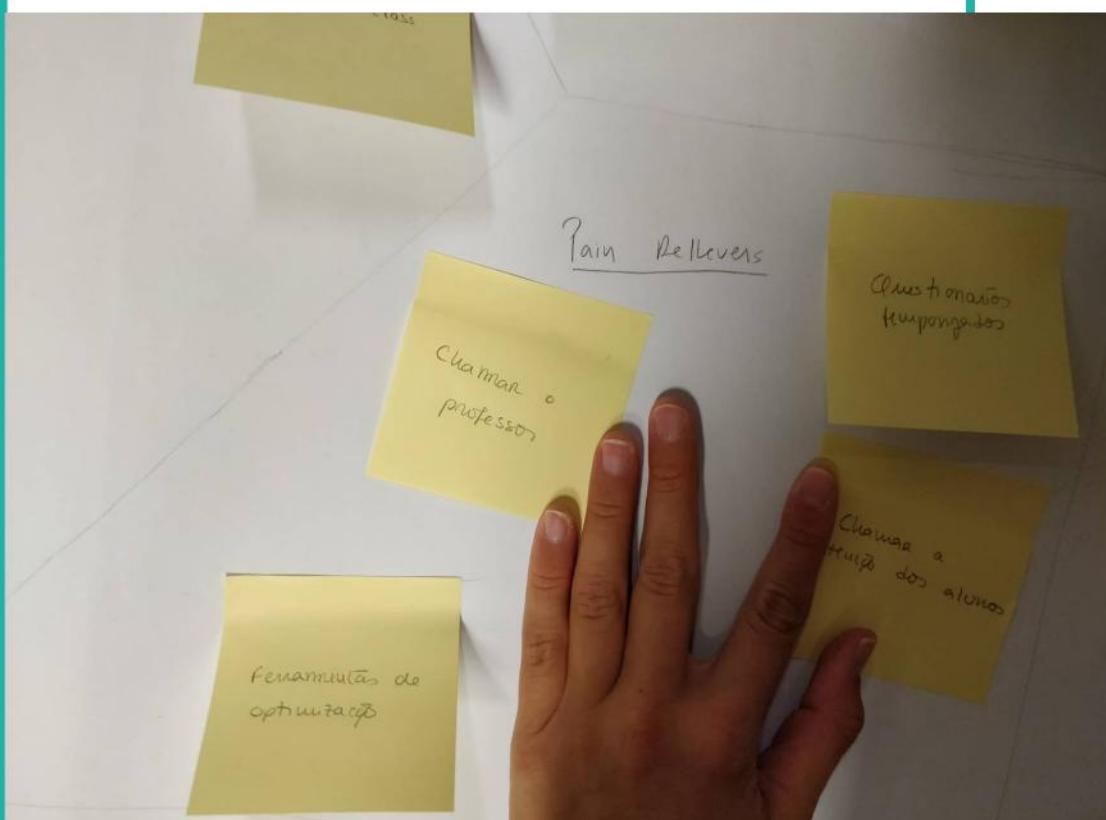
Costumers' Jobs

Evaluate
Teach
Coordinate
Educate



Products & Services

Click - a - Class



Initial Concept

Initially we had to understand how the *Flics* worked. When we found that logs recorded which and when it was clicked we instantly thought of a BUZZ! - like game that tested the children's knowledge.

We brainstormed ideas that we were going to include in this project, mainly features that could be useful for both the teacher and the student, and that would help the children improve their grades and more actively engage in their classes, while at the same time helping quiet down disorderly classes, using the *Flics*.

Quizzes

Inspired by the Kahoot platform and the BUZZ! video game series, the idea of questionnaires seemed logical as a competitive game where the children feel motivated to play and win, and to do so they should pay attention to class.

Attendance

Marking the children's attendance at the beginning of the class is a recurrent action taken by the teachers. When we learned that the flics needed to be pressed individually to synchronize with the server, so to us it seemed natural and convenient to include this feature.

Going to the bathroom

Children need to go to the bathroom as often as they get bored, but there's no need to stop class just to let teacher know that they need to go to the bathroom.

Timed Exercises

Another BUZZ! - inspired feature applied to the classroom, this is like a regular test but timed: if you are one of the first and answered the exercise correctly, you win! We think that gamification in class is an effective pedagogical tool, especially amongst children and teens.

? Doubts

What if several students have questions to make to the teachers? Instead of raising their hands (and the inevitable following disputes of "I raised it first!") the flics could provide an order to which the teacher would address the students individually.

Student's Statistics

This is more of a teacher-oriented feature. We thought that teachers would like to follow their students' progress, like if they have some kind of difficulty in a certain topic.

Quick Questions

But what if we wanted to be sure the children was paying attention to what the teacher just said? Flash questions could be inserted in the mid of the class without starting a quizz, just to see if there was any doubts after a certain topic.

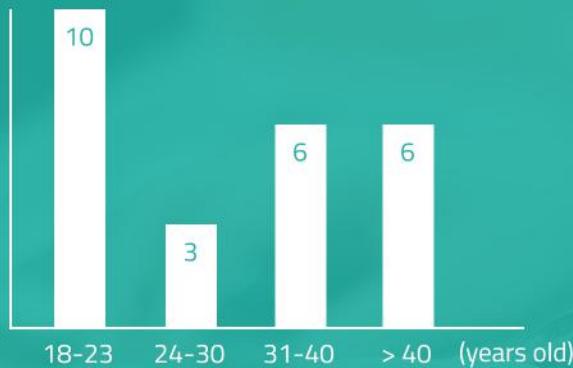
These features would be implemented in a digital platform. We considered a web or native application, coming to the conclusion that, as a web app would be simpler to implement and be accessible through web browsers across all platforms, it wouldn't make sense going the native app route.

After choosing the topology, we chose the **Meteor** development framework as it is a complete bundle that provides easy management to front-end, back-end, database and testing components, apart from some familiarity from elements of the team.

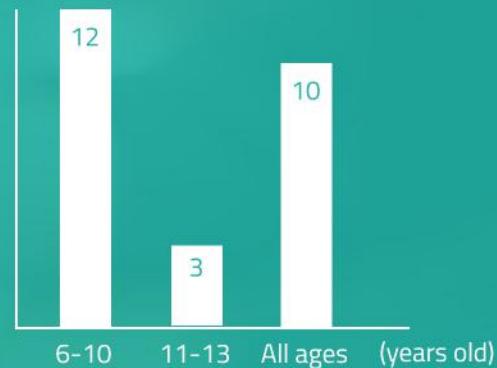
First User Research

We conducted a first user research to understand what the users, in this case the teachers, thought of certain features and suggestions to what would they like to see implemented. This questionnaire was conducted online by 25 teachers that teach 6-13 year old children.

Respondents Age Group



Students Age Group



Electronic Devices used during a class:



Can you keep students attentive through a class?



How much would you use the following tasks in a class?

(ranked by task with the most 'a lot' answers)

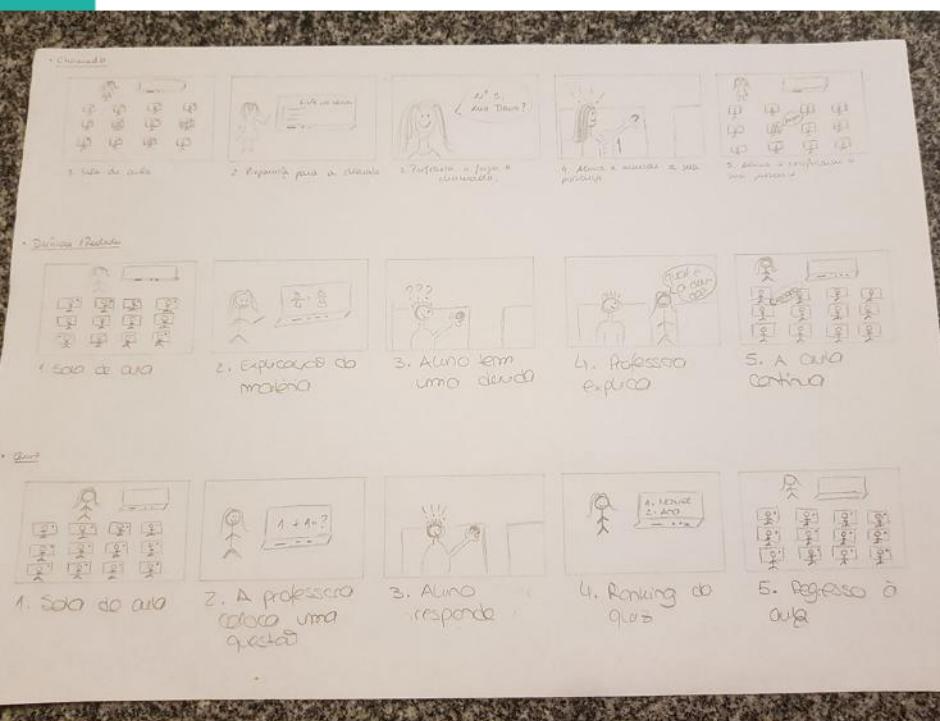


In the end, we concluded that only the "Going to the bathroom" feature was not welcome by the users, so we decided to not implement it.

Low-Fidelity Prototype

A Low-Fidelity Prototype made out of paper was constructed, with the design focusing on the front-end of the application for each feature. However, as this was to be presented in a class critique, we were not only considering feedback for the front-end design, but also for the whole experience regarding the included features.

We decided not to include the login, the teacher account registration, the class creation, and the "Quizz" creation for time-related issues, as in the critique each presentation had a very limited time, and it was impossible to show the whole application, so we thought the features would be the most important to get feedback.



First, we sketched a storyboard with three situations:

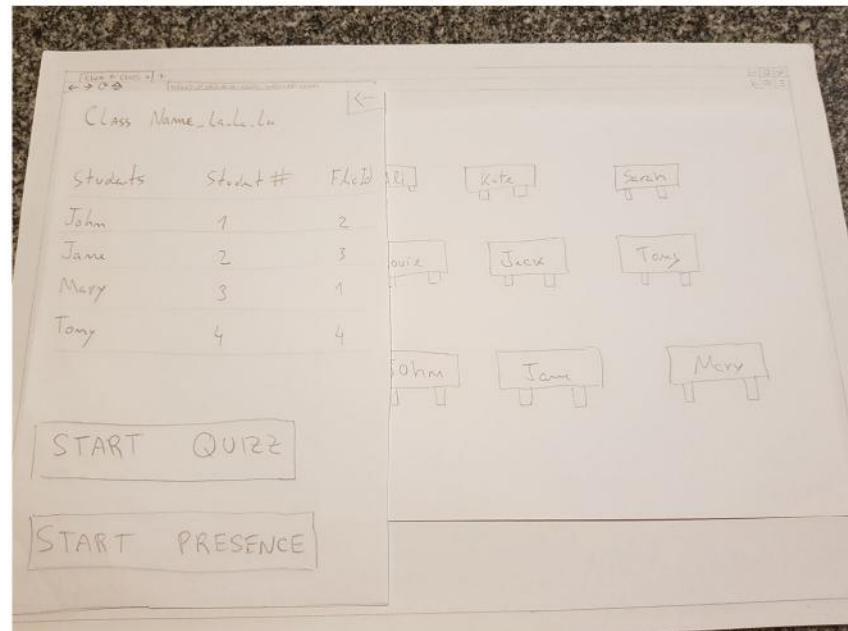
The teacher marks the class' attendance. The student clicks his Flic to confirm his/her presence.

Student has a question/calls the teacher. Clicks his flic to get the teacher's attention.

The teacher makes a quiz. The students clicks their flic to answer it. A leaderboard appears.

For the app "Home" page, we thought of having in the foreground the disposition of the class' desks with the students names written on it. When a student clicked in his flic his desk would blink on a different color.

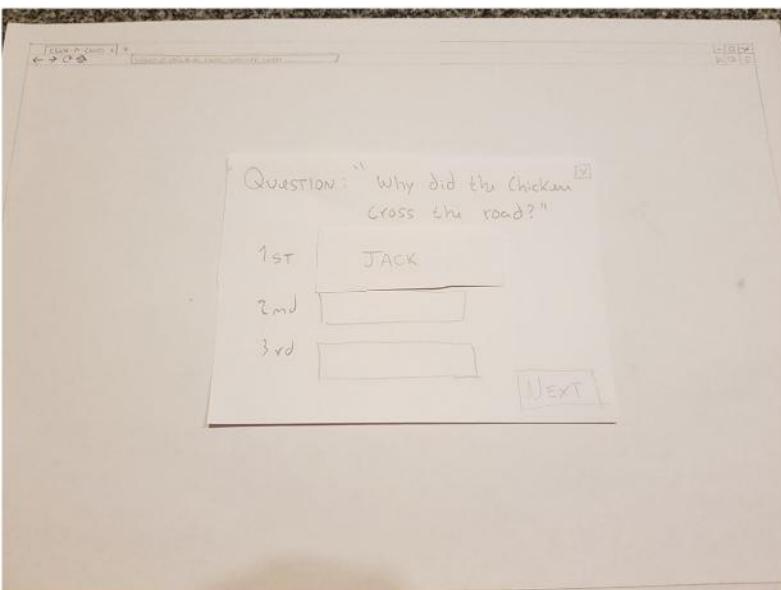
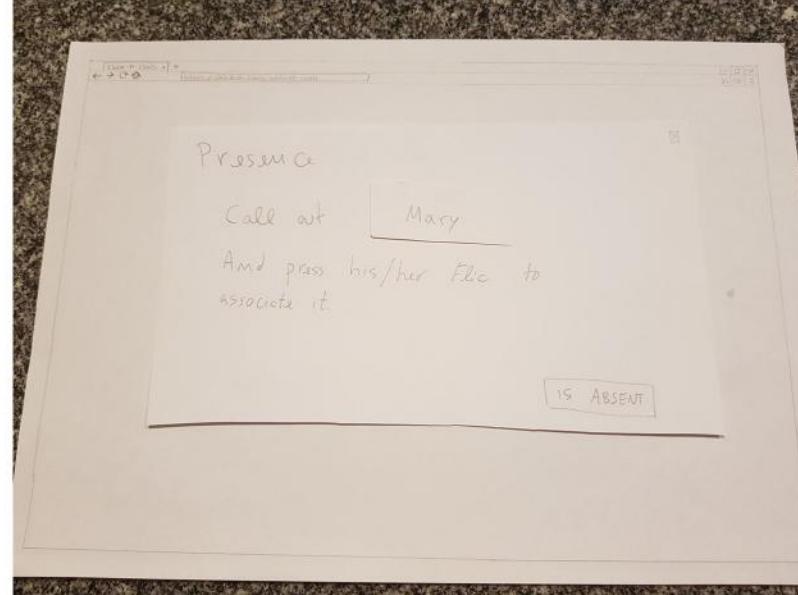
A hideable sidebar showed the list of students and their number, and allowed to start a quiz or attendance checking.



The “Presence” feature would feature just a panel with instructions for the teacher to call out the student’s name.

The teacher would call the students one-by-one and hand them their respective Flic so that others could not press their flic and disrupt the attendance process.

In case the called out student is absent, the teacher a button to skip the attendance for that student.



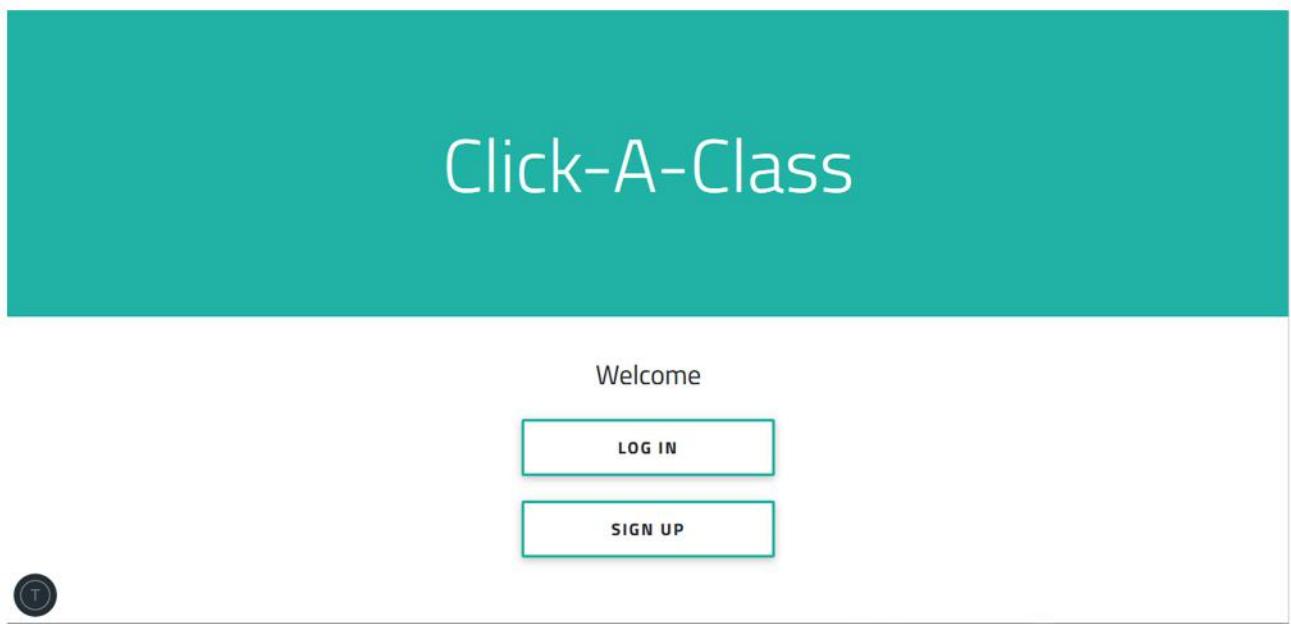
The “Quiz” would work like this:
 The question would be presented.
 The three quickest students pressing the flic would show.
 The teacher asks the first to answer. If the answer is correct, the teacher clicks his name box, otherwise asks the next to answer, and so on.
 If there's no right answer, the teacher can move to the next question.
 In the end, a leaderboard showing the students with more correct answers.

After the critique where the LFP was presented, the feedback received dealt primarily with the fact that giving the flic to each student during the presence is time-consuming and the kids could swap flics in the middle of the class. Regarding the “Quiz”, the feedback given was, instead of answering orally, using the different ways of pressing the flic to answer directly.

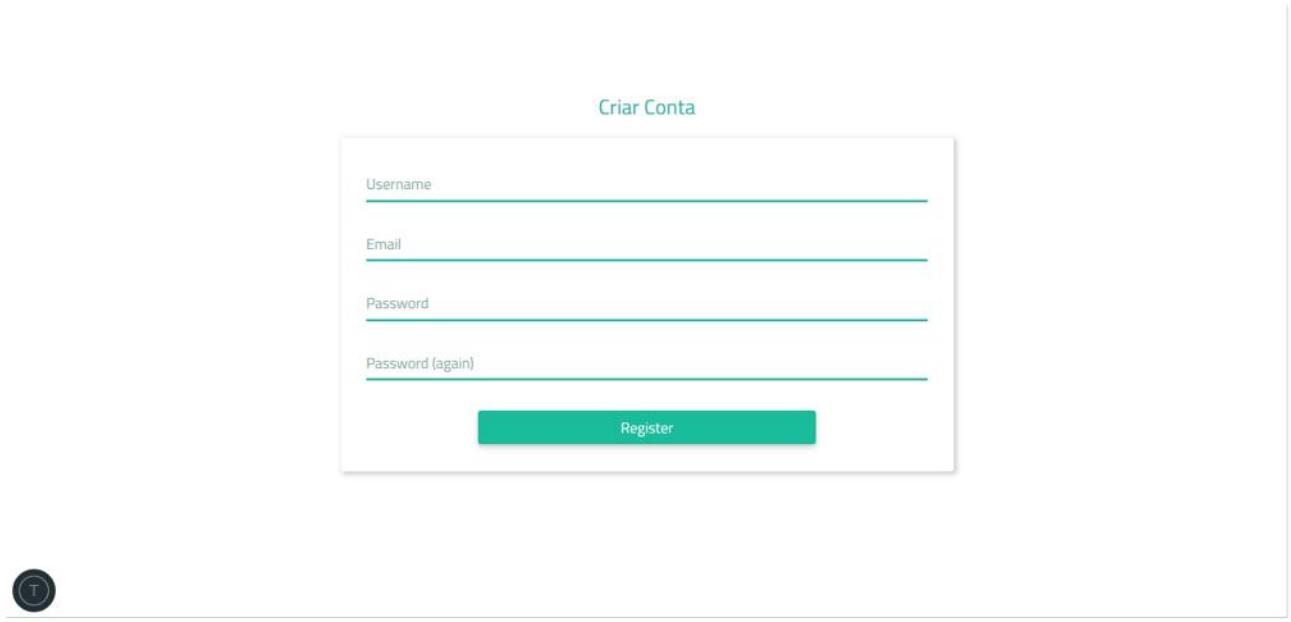
We ended up changing the way the student answered a “Quizz” question from an open answer to a 3-choice, with the choices inserted manually by the teacher when inserting the question into the system; The Presence phase also changed: the flic would now be fixed (with strong magnets) into the desk, and when the teacher called out each name, the student would press his flic. If someone else's flic is pressed the teacher can cancel that association and repeat the process.

Minimum Viable Product

In the Minimal Viable Product we implemented the login, creation of teacher accounts, creation of their classes, which are vital for the system to work, along with the three main features: the “Quizzes”, the attendance checking and the “calling the teacher/doubt” notifications. Our goal was to present a very simple and clutter-free interface. We chose this aqua-green-ish theme as it seems appealing and non-distractive.



For the login, we chose a very simple interface, consisting of only a “Login” and a “Sign Up” buttons.



Clicking in “Sign Up” leads to the above page. Again, we strive for simplicity. More informations about the teacher’s profile can be lately added in the appropriately named “Profile” page.

This is the home page when logging in for the first time:

In the left part there are some suggestions for the first-time user. Besides having the tabs we also included a quick-access style section in the right part of the screen to give users multiple ways to access that information.

The “Create Class” page. First it had the name and description in the left and the students in the right, but later we changed it to be standardized with the other pages.

When clicking in "Create Class" the class is saved and leads to the class list page:

The screenshot shows a navigation bar with tabs: Dashboard, Turmas, Salas de Aula, Perguntas, Questionários, and Perfil. Below the navigation bar, there is a search bar labeled "Todas as turmas" and a button labeled "Criar Turma +". Two classes are listed in a grid: "2ºB" and "3ºA", each with edit and delete icons.

Clicking in the Edit icons it would lead to the "Edit Class" page:

The screenshot shows a navigation bar with tabs: Dashboard, Turmas, Salas de Aula, Perguntas, Questionários, Perfil, and Logout. Below the navigation bar, there are buttons for "Cancelar alterações", "Editar Turma", and "Editar Alunos". The main content area shows the class name "2ºB" and a text input field containing "Lorem Ipsum". At the bottom is a "Guardar Alterações" button.

And clicking on "Edit Students" leads to the "Add Student" page. By this time we didn't have a way to remove the added students yet.

The screenshot shows a navigation bar with tabs: Dashboard, Turmas, Salas de Aula, Perguntas, Questionários, Perfil, and Logout. Below the navigation bar, there are buttons for "Ver Turma", "Adicionar Alunos", and "Terminar". The main content area has sections for "Adicionar aluno" (with a note to enter new student information) and "Alunos já inscritos na turma:" (listing three students: José #1, Miguel #2, André #3). At the bottom is an "Adicionar Aluno" button.

To create a classroom, the teacher only needs to input the code printed on top of the Raspberry Pi in his classroom. From here on, the teacher is associated with the classroom.

The following picture is the “Questions” page. We chose to make them independent objects so that several different “Quizzes”, or even different teachers, could use the same questions.

The colored subjects seemed to relieve from the monotonic aqua-green theme and distinguish the subjects a little better. After some time using the platform, the users no longer guide themselves by the icons, but subconsciously by the color.

Dashboard Turmas Salas de Aula Perguntas Questionários Perfil

< Voltar Atrás Criar Pergunta

Subject

Question

Correct Answer

Above is the “Create Question” page. Note that there are no cues indicating that the last three rows are where the possible answers should be. This was corrected in the next iteration.

Dashboard Turmas Salas de Aula Perguntas Questionários Perfil

Todos os Questionários Criar Questionário +

Math 1st Grade
Simple addition and subtraction

Above is the “Quizzes” page. Clicking on “Add Quizz” will lead to the “Create Quizz” page and on the “Edit Quizz” icon leads to the similar-looking “Edit Quizz” page

The screenshot shows a teal header with navigation links: Dashboard, Turmas, Salas de Aula, Perguntas, Questionários, and Perfil. Below the header, there's a back-link 'Voltar Atrás', an edit link 'Editar Questionário', and a link 'Escolher as Perguntas' with a right arrow. The main area has fields for 'Title' (filled with 'Math 1st Grade') and 'Description' (filled with 'Simple addition and subtraction'). A teal button at the bottom right says 'Confirmar Alterações'.

Clicking in “Choose Questions” leads to the “Choose Questions” page:

The screenshot shows a teal header with the same navigation links. Below it, a back-link 'Voltar Atrás', an edit link 'Escolher Perguntas', and a link 'Terminar Questionário' with a checkmark. The left side shows the 'Math 1st Grade' questionnaire details ('Simple addition and subtraction'). The right side shows a list of available questions under 'Questões Disponíveis' with a note 'Clique para adicionar ao seu questionário'. There are four filter buttons above the list: 'Filtrar' and three icons (document, chart, bell, person). The list includes four questions: 'Em que ano foi o 25 de Abril?' (orange), 'Qual a 8ª letra do alfabeto?' (blue), '2 + 2?' (red), and 'Quais são os membros inferiores?' (green).

Again, the colors seem to break off the monotony and bring a breath of fresh air. This page is a bit more full than the usual, but we trust that complexity has not increased.

The “Profile” page displays some information about the user. We did not develop many interactions between users, so this page is simplified to the essential informations, with the possibility to edit them, as shown below.

The screenshot shows a teal header with the same navigation links. Below it, a back-link 'Cancelar Alterações', an edit link 'Editar Perfil', and a teal button 'Guardar Informação'. The main area contains three text input fields with placeholder text: 'Abílio Caroço', 'Secundária de Corroelas de Cima', and 'Matemática'.

Final Product



After the MVP we decided to add two new features: the Quick Questions and the Statistics.

The screenshot shows a dashboard for a class named '2ºB'. It includes a back-link to 'Turmas', a link to 'Ver Turma', and a 'Logout' button. Below this, it displays two student profiles: #1 José and #2 André. Each profile shows favorite and disliked topics, and their accuracy rates.

Student	Tópico Favorito	Tópico Detestado	Taxa de Acerto (%)
#1 José	Mapa do Brasil	Geografia	57%
#2 André	Português	Matemática	33%

Above it's possible to see the statistics showing the topics with the most correct and incorrect answers and the correct answer rate. We also decided to change how to edit classes, making it similar to how a class is created.

The screenshot shows an 'In-Class' session for teacher John in room 1º C, multimedia room, on December 20, 2018. It includes a sidebar for students Manuel and António. The main area shows a 'Começar um Questionário:' section with 'Cultura Geral' and 'História de Portugal' buttons. Below this is a 'Pergunta Rápida' section with four questions, each with a star icon. At the bottom are buttons for 'Refazer Emparelhamento' and 'Terminar Aula'.

The questions now have a "favorite" feature where the teachers can choose their favorite questions. These are shown in the "In-Class" page, when the favorited questions are featured as a Quick Questions.

Evaluation

In this section, we will present our planning for the evaluation of our system and what would ideally give us the answers to see if we achieved our goals.

As mentioned in previous sections, our key users are teachers and students from the primary and elementary grades. Our goal in evaluating the system is answer the question we proposed, "*how can lecturing elementary schools be motivating and fun at the same time for both students and teachers?*".

To achieve this, we had to create more questions and tasks so that the users, while interacting with the system, could give us the answers to the different parts that construct our main goal. The questions, tasks and respective metrics used to evaluate the system are the following:

Question(Q): Are the students captivated by the flic buttons?

Taks(T): Click the flic button to interact with the platform.

Metric (M): Number of clicks to answer the quiz questions, exercises and to mark attendance.

Q: Is the students participation in class improving with the use of flic buttons?

T: The teacher will teach a specific subject for 15 minutes.

M: Number of interruptions to participate in class vs. Number of clicks on flic to participate.

Q: Is the web application easy to understand and use?

T: The teacher registers himself in the platform, creates a new class called "1st Class" and adds the students "José", "Maria" e "Joana" in this class.

M: Time taken to execute the task and error rate during execution.

Q: Is the web application easy to understand and use?

T: The teacher will insert questions in the platform. The first question will be "1+1=" in the "Math" category, with the possible answers "2", "3", "4". The second question will be in the "Literature" category, "What is the 4th letter of the alphabet?" with the possible answers "B", "D", "E".

M: Time taken to execute the task and error rate during execution.

Q: Are the students paying attention to the lesson?

T: The student answering correctly to the quiz questions.

M: Number of correct answers in one quizz.

Q: Are the students paying attention to the lesson?

T: The student answering correctly to the quiz questions.

M: Time taken by the student to answer a question.

Q: Is the attendance taking process efficient?

T: Student clicking the flic button to mark attendance correctly when his/her name is on screen.

M: Time taken to check attendance for the whole class and error rate during task execution.

Q: Does Click-A-Class improve the students' learning process?

T: Total system implementation in class for 3 months.

M: Grade comparison for students in the class that use Click-A-Class and the students that are in a regular class.

All of the above will help us to better develop a system that works for both teachers and students. We will learn if the flic buttons are a good tool to motivate the students to participate more or if they are just another tool for distraction. If the teachers can easily understand our platform and take the most advantage for their different classes and lessons. Overall, we want to know if the system is really motivating the students and taking advantage of the technological era children know to be living in.

Our team was not able to perform this evaluation in full because we believe it would require at least 3 months to properly evaluate the introduction of the system and the students' progress to be reflected in their grades. The teacher would also take the most advantage of the system with more time for the students' and classes statistics to be more accurate. Since this project is being conducted in the context of Internet of Things Interaction Design course and the development of the system and strategy took most of the course's time, we were not able to perform the evaluation as desired. The users necessary are children and teachers that belong to a school and to perform the tests it is necessary to have the school and the parents' permission. Our team was not able to get this permission from the contacted schools on time to carry out the evaluation on time.

Conclusion

Some elementary school teachers find it difficult to get the student's attention and focus for long periods of time and some elementary students do not pay attention to classes because they find it uninteresting and boring. Facing this challenge, Click-a-Class proposes a system that we hope that improves elementary school classes, by making them more fun and motivating.

Future Work

As developed, Click-A-Class already allows users to complete its most important features such as the questionnaires and in-class interaction. But the web platform can be improved in some aspects and more functionalities may be implemented. We received many suggestions during along the design process. The ones we considered more valuable were:

- User interaction, such as shared questionnaires and questions;
- Advanced analytics to analyse students progress;
- Parents accounts to check on their child development;
- Pre-made questionnaires;
- Collect input on the system from psychologists and other experts in education.

One possibility to explore is to package the product with some buttons, similar to the ones used, but developed by ourselves, perhaps even more fitted to the scholar environment and sell the whole package as a single product.

Acknowledgement

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Annex

Source Code

<https://github.com/TJacoob/Click-A-Class>

Initial Questionnaire

<https://goo.gl/forms/Mbon3AtZEQ4mVknr2>