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Classroom Orchestration Prototyping and User Testing

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Introduction

Classroom Orchestration represents an area of great interest within the learning sciences. As a way of structuring classroom sessions, it helps us establish connections between learning activities and the actors involved. Making use of technology to our advantage, it is possible to not only define these activities and actors in a system but also obtain meaningful data during and after the session.

To better understand this field, we need to first establish the different aspects of which it is composed. Prieto et al. (2011), subdivide this field in a design/planning phase and a regulation/management phase among other phases, where design/planning refers to the idea of preparing ahead the learning activities to be performed and regulation/management to the actual orchestration process during the session. We will be focusing on the latter.

In order to represent Classroom Orchestration in an organized and structured way, orchestration tools such as FROG help us picture and control the workflow of the session with all the functionalities it provides.

In this report, we will go through three stages in order to effectively redesign the user interface. As mentioned in Martinez Maldonado et al. (2015), we will start by defining the problem to be addressed and identifying the requirements for the interface. More specifically, we will be observing the interaction with the application in a real environment, followed by the definition of personas (i.e. the most representative users of the system). From that information, we will design storyboards (i.e. imaginary situations) for the personas to be followed to study their behaviors. After that we will be able to envision the structure, designing five low-fidelity prototypes that will be then evaluated in usability tests. Finally, after several iterations, we will apply the necessary changes and add the details to effectively address the users' goals and expectations in a high-fidelity prototype.

The report is structured as follows:

1. Current Session Interface and key elements
2. Classroom Observation and Building Representative Users (personas)
3. Creating scenarios (storyboards)
4. First five prototypes brainstorm and first two usability tests
5. Two prototypes and third usability test
6. Final prototype and last usability test
7. Conclusions
8. Greetings
9. References
10. Appendix

1. Current Session Interface and key elements

As mentioned before, the interface that we focused on is the one that allows us to control the session after the graph has already been designed. This interface includes several elements, but we have grouped them into 5 sections to easily identify them:

1. **Orchestration buttons:** Includes all the elements that allow us to control the progress of the session (i.e. play/pause button, next button, etc.)
2. **Time/Progress representation:** Includes the element or elements that represent the progress of time during the session and/or the time left
3. **Dashboard:** Includes the dashboard elements and/or the dashboard window (e.g. progress/completion graph)
4. **Projector view:** Includes the button to project the current activity to the classroom
5. **Opening activities:** Refers to how the user can access the contents of the activity (e.g. via clicking on it, opened automatically, etc.)

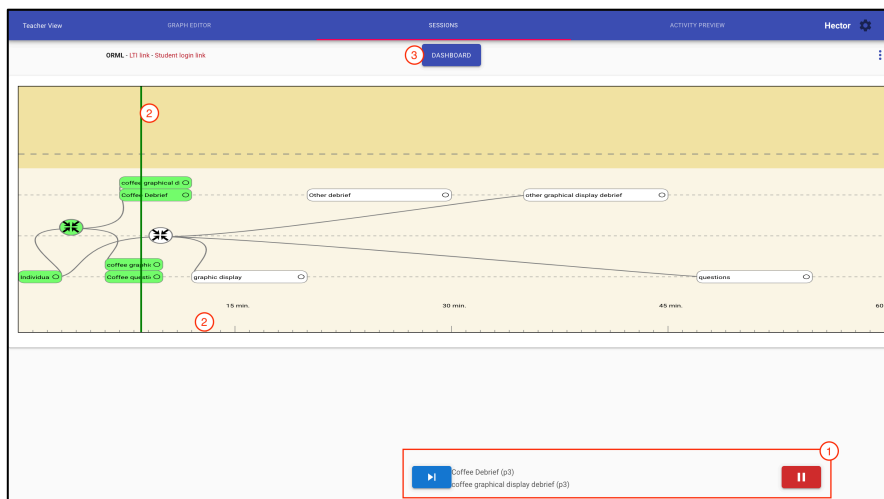


Figure 1: FROG Session Interface in graph view

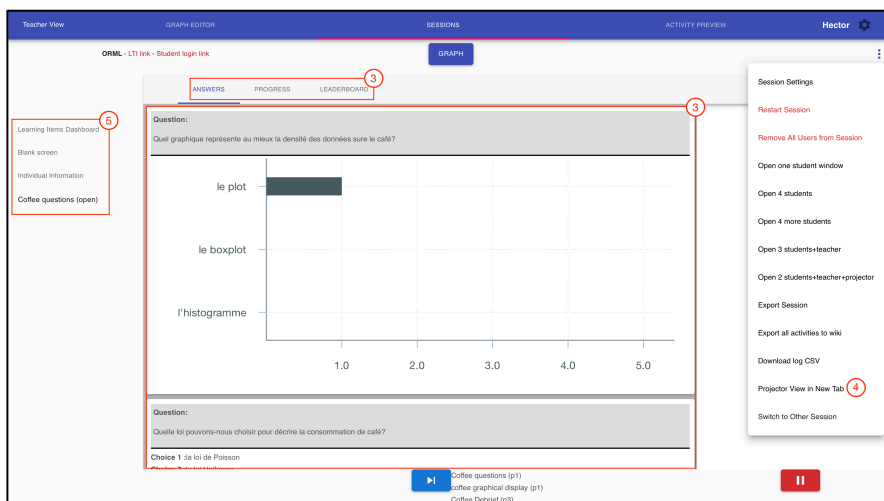


Figure 2: FROG Session Interface in dashboard view

We found some issues with this interface that we thought needed to be addressed. That is why we decided to analyze the interface in the first place, so to find ways to improve it. One of the main problems that we saw was that teachers were never completely aware of where they were inside the application, thus resulting in either getting lost in the interface and start moving around or opening several windows. Also, we considered that the interface had loads of content for the user that could make the interaction a bit confusing. That is why we thought that the best way of tackling this problem would be to provide the teachers with a simple interface with just the essential elements and making them feel in control of what they were doing.

2. Classroom Observation and Building Representative Users (personas)

In order to properly address our users' goals, we needed to not only understand them but also find which are their most representative characteristics. The first step of the process was observation, and the best way we could do that was attending a lecture where FROG was used in real time.

In this lecture, the teacher showed some slides at the beginning of the session to introduce the topic for that day. Afterward, he started to orchestrate an active learning activity composed of five different activities and spanning 3 social planes (class activity, group activity and individual activity) with a duration of 20 minutes approximately. While doing so, he was projecting FROG to the class. Analyzing the behavior of the teacher and the students during the quiz, we drew some important conclusions: the interface was not providing the necessary affordances to the user in order for him to clearly identify how the activities were supposed to be projected, and it was not clear what was being projected or not. Also, the elements of the interface were not clearly distributed so to be easily found, thus the user was moving between the tabs. During the activity, the students that finished it first started to talk and they switched to other activities. This made the classroom environment a bit louder and thus the teacher realized that soon it would be necessary to go to the next activity.

After analyzing the information, we defined three personas that helped us have a clearer idea about our main target and that were necessary for the following phases of the analysis. Each one of these personas included a brief background, their goals and motivations, and relevant information regarding their knowledge about collaborative tools among other things. Although FROG is designed for online use, we primarily focused on the use in physical classrooms as we had observed that making orchestrations in front of students increased the load on the teacher that had an impact on the orchestration. Therefore, we defined two university teachers and one primary school teacher, and all three personas had different levels of knowledge about collaborative learning tools, ranged from beginner to advanced. Having a diverse set of users helped us cover a broader range of situations whilst trying to find in which things they coincided.

Paul Moeller

Paul is a Math teacher from the Freie Universität Berlin who has never used Classroom Orchestration tools. He has always relied on slides for the lecture, and now is considering using FROG in order to improve his students' attention span and to help them understand complex concepts in an easier way. The main features Paul is looking for are: Ease of use, default templates or some kind of default session mode, and a thorough guide to use the application.

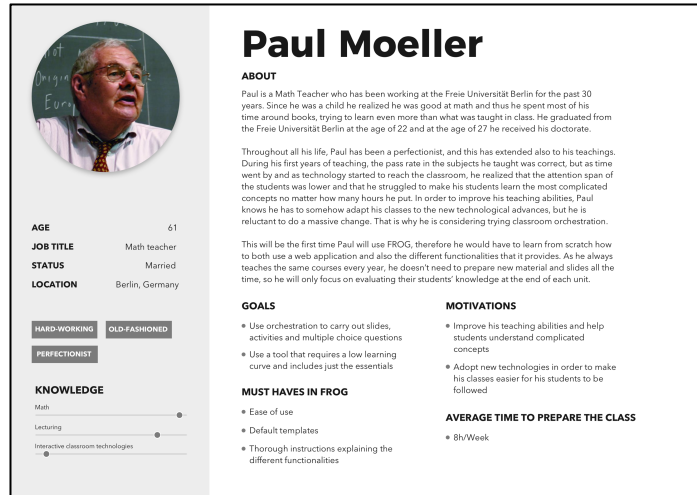


Figure 3: First Persona

Upasana Hayer

Upasana is a physics teacher from the Royal Institute of Technology in Stockholm who has learned with video lessons throughout all his student life, but she is lecturing the classical way at university. Therefore, she wants to add more content to the lectures by using videos and other graphical elements in order to improve the engagement of the students with the subject. The main features Upasana is looking for are: the possibility to add videos, prepare exercises, and track the progress of her students while doing the exercises.

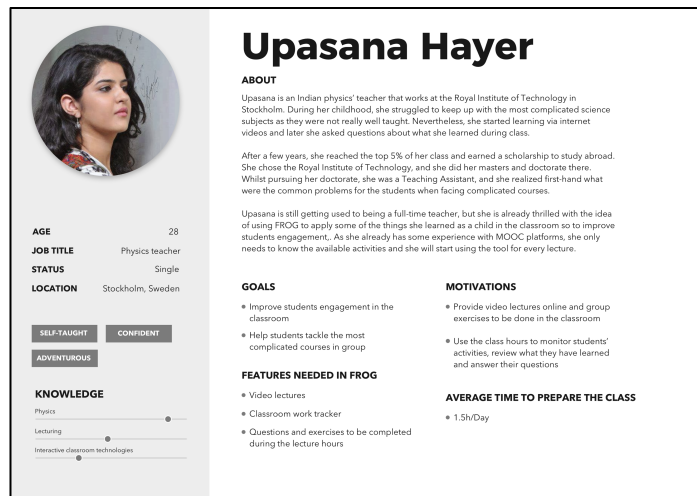


Figure 4: Second Persona

Celio Fidalgo

Celio is a primary school teacher from Lisbon who was really interested in educational sciences since he was a child. That is why now he wants to improve the experience in his classes by introducing more collaborative activities. He has tried some tools in the past, but he is looking for a web application that offers a broader range of capabilities in order to properly recreate the scenarios he has in mind. The main features Celio is looking for are: advanced customization of the session to be in complete control of the activities and also automation capabilities such as commands or shortcuts.

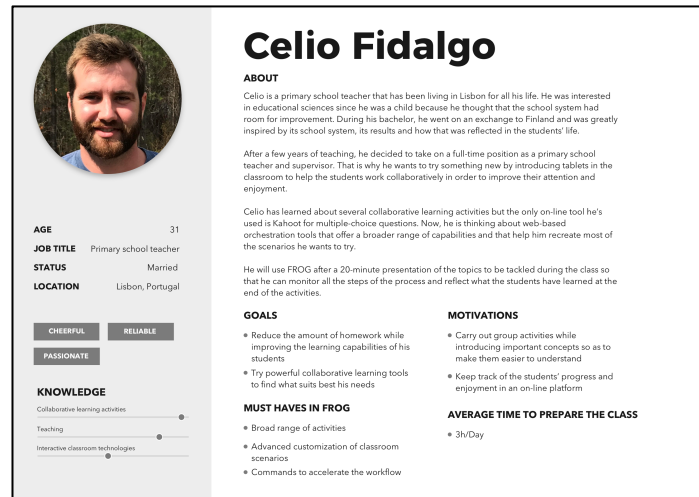


Figure 5: Third Persona

With these representative users we were able to start thinking about which things could they struggle with while using the application, their expectations and also empathize with them. This also helped us clearly segment our users, based on their previous knowledge with collaborative tools and also helped us maintain the focus always on a user-centered approach to the design of the interface.

3. Creating scenarios (Storyboarding)

While knowing more about the users and defining their goals proves to be really useful, we still need to study how they respond in different situations when using the tool. This way we are able to have a clearer picture of their behaviors and struggles. Therefore, the next step in the process was build imaginary situations around the personas that we previously designed and try to understand how they would respond.

The technique we used was storyboarding. The main idea behind storyboarding is to represent a situation in several scenes and to add a brief description explaining what is happening. We designed three storyboards, one for each persona, and each one of them composed of six scenes:

Paul's storyboard

In Paul's storyboard, we wanted to reflect that he had prepared well in advance in order to avoid any error during the lecture. But, based on his experience with collaborative tools, we also wanted to reflect some kind of error of which he was not aware at first, like not connecting two activities with a product operator. A product operator is used to work with the data obtained from one activity to which is connected and maybe sent it to the following activity transformed in some way. He solved the situation by relying on what he knows best, the classical way of lecturing and using FROG to only show results from previous activities.

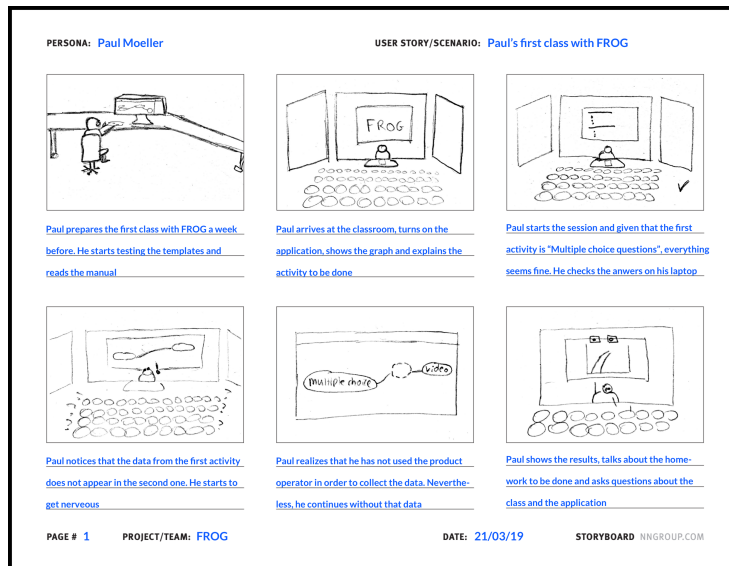


Figure 6: Paul's storyboard

Upasana's storyboard

In Upasana's storyboard, we wanted to reflect that she prepared the day before because she already knew what she wanted to use for the session and that she did not struggle to understand how to work with the application. She spent more time preparing the video than preparing the actual session in FROG because the scenario she wanted to represent was not that complicated. Therefore, she finished the session without a problem.



Figure 7: Upasana's storyboard

Celio's storyboard

In Celio's storyboard, we wanted to reflect that he wanted to do a very complex session and really specific collaborative scenarios. Even though he managed to finish the session without a problem, we also wanted to show what he was doing while the students completed the activity. As he might want to make improvements for future sessions, he decided to take notes during the exercise activities.

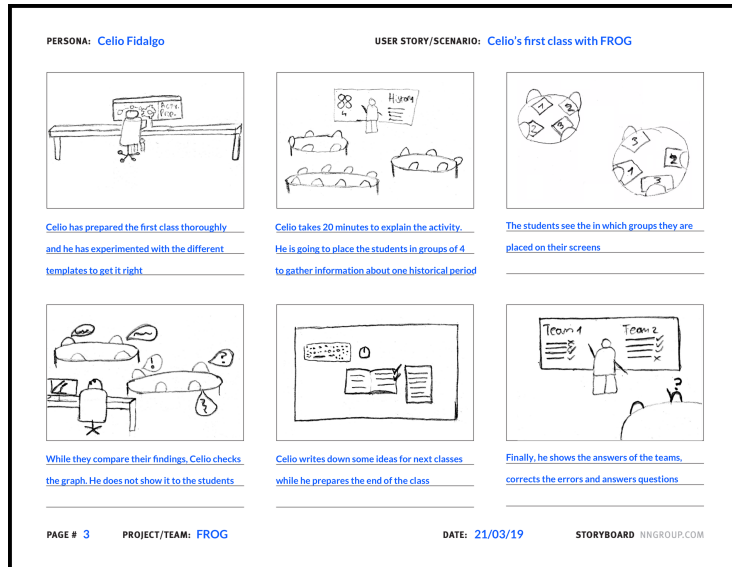


Figure 8: Celio's storyboard

We can clearly see that all the personas start interacting with the system in a similar way, by designing the graph in advance, but they start to differ based on their previous knowledge and the difficulty of the scenario they are trying to represent. In Paul's case, this even leads to an error during the lecture. However, even though the storyboards helped us get ideas about real situations, we found that they could have provided even more information if we designed more diverse situations and behaviors. For future phases of the analysis, we will need to address their goals and needs in order to minimize as much as possible errors during the lectures.

4. First five prototypes brainstorm and first two usability tests

From all the information we obtained after building the different personas and studying their struggles and behaviors in the storyboards, we had to start thinking about possible solutions to those aspects taking the current session interface as a base. Therefore, we decided that from the brainstorming session we needed to obtain a broad range of solutions that could help us push our users in really different directions. By better understanding where their boundaries were, we were able to not only discover things we did not even consider at the beginning, but also to find solutions that the users were not pleased about and that we should completely avoid.

What we did first was elaborate on their goals and classify them to start thinking about ideas that could tick all the boxes. As stated in the book About Face 3: The essentials of interaction design, goals are divided into 3 categories:

- Experience goals: Express how someone wants to feel with the product or the quality of their interaction with the product

- End goals: Express the user’s motivation for performing the tasks associated with using a specific product
- Life goals: Express personal aspirations of the user beyond the context of the product

Here we provide a table with their goals and needs:

	Paul Moeller	Upasana Hayer	Celio Fidalgo
Experience goals	Feeling of being in control and not overloaded with functions	Feeling of being in control. Similar interactions as the ones found in a video platform	Feeling of being in control. Sensation of using the application as fast and automating as many tasks as possible
End goals	Explain important concepts in an easier way. Help his students understand the topics	Teach their students the same way she learned when she was a child. Use videos during the lecture to explain complicated concepts with infographics and then ask questions about them	Recreate collaborative learning scenarios in the classroom with a web application and keep track of the progress of his students
Life goals	Be a professor who adapts to new technologies	Avoid old-school lecturing and find new ways of using technology to her benefit and to their students'	Contribute to their students' well-being and happiness.
Needs	Default session, ease of use and instructions to use the application (via video or with a text manual)	Video activities, exercises and work tracker in the classroom	Broad range of activities, advanced properties for those activities and keyboard shortcuts

After organizing their goals, there was one more step to be followed before starting with the brainstorming session. We decided to group the different elements of the interface as it was shown in section 1 of this report. This way of grouping elements was obtained from the main struggle that was present during the observation session in the class and in all three personas: the need to be in control of the tool. Elaborating more on this, in order to make the users feel like they were in control, it was not only necessary to provide a manual or predesigned session, but make it easy for them to always know:

- The state of the session at any given time
- Where they were in the interface and how they could move around
- How to keep track of the students’ progress
- How they could access to the activities’ information
- How they could be aware of which content was seen by the students or not

From these ideas, we grouped the main elements of the session interface and we started thinking about different approaches for each group.

Now, before starting the prototyping process, we decided to choose the prototyping tool. We needed to use a tool that allowed us to design both low and high-fidelity prototypes. Therefore, taking into account the learning curve and previous experience with the tool, we chose Sketch, a vector graphics editor.

Then, we started to look for inspiration by searching for collaborative applications and applications that included time management elements. We found inspiration in how the layouts were implemented, giving more importance to the actual content than the tools to interact with it and also a common trend of flat colors and elements with rounded shapes:

- Trello: We based the design of our activities on the activities in Trello. We also considered to add elements like the attachments or icons inside the activity box.
- Final Cut Pro X: We based the design of the graph view and specially the timeline on video editing applications such as Final Cut Pro X
- Creately.io: From Creately.io, we took the ideas for the navigation bar and how to arrange icon buttons with text

The prototypes and the applications in which we inspired our designs are available in the appendix at the end of this document. All the prototypes are meant to represent a real scenario that we prepared before doing the usability tests so that the teachers could properly imagine the situation. Also, they are built in such a way that the user can interact with them and go through all the screens like in a real application.

To easily identify the differences between the prototypes, we have included a table with the previously mentioned groups and how that specific prototype tackled that issue.

Prototype 1.1				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
Play, pause and next buttons in the lower part of the screen and help and settings buttons on top. Icons only	Green time bar, highlighted activities and clock with time left. Only visible in graph view	Dashboard window accessed automatically after clicking on the “next button”. Dashboard buttons on top. Icons only	Button with an eye icon to be easily associated with the action of showing and hiding the content to the class	Opened automatically after clicking on the “next” button

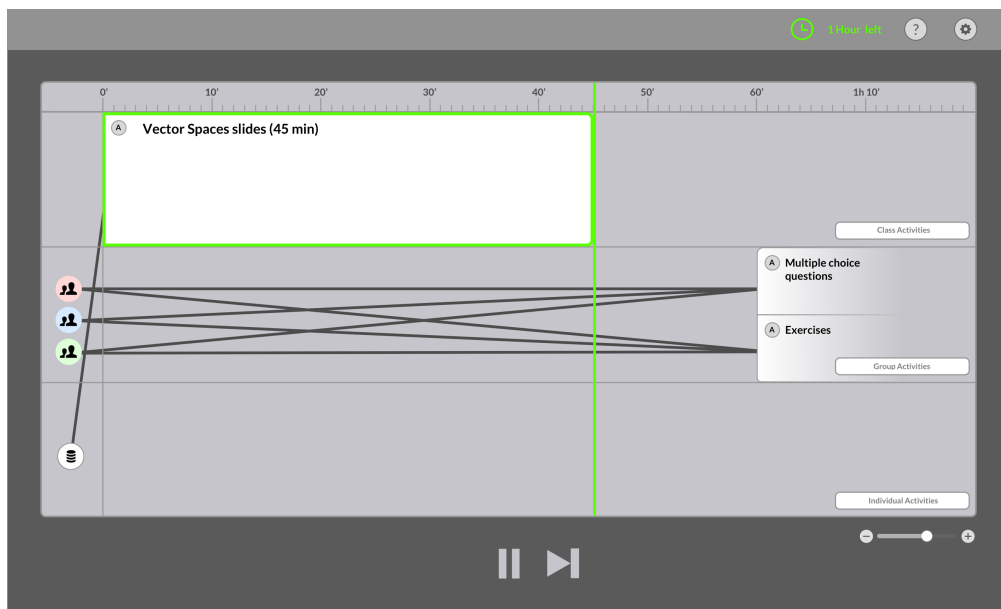


Figure 9: Prototype 1.1 intermediate screen showing that an activity has finished

Prototype 1.2				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
Play, pause and next buttons in the lower part of the screen, with help and settings buttons on top. Text only	Green progress bar inside each activity both in graph view and maximized activity view	Dashboard window accessed via clicking on an activity. Dashboard buttons below. Text only	“Show screen” button in the top left corner that switches to “Live” when pressed	Clicking on the activity opens a maximized view of that activity

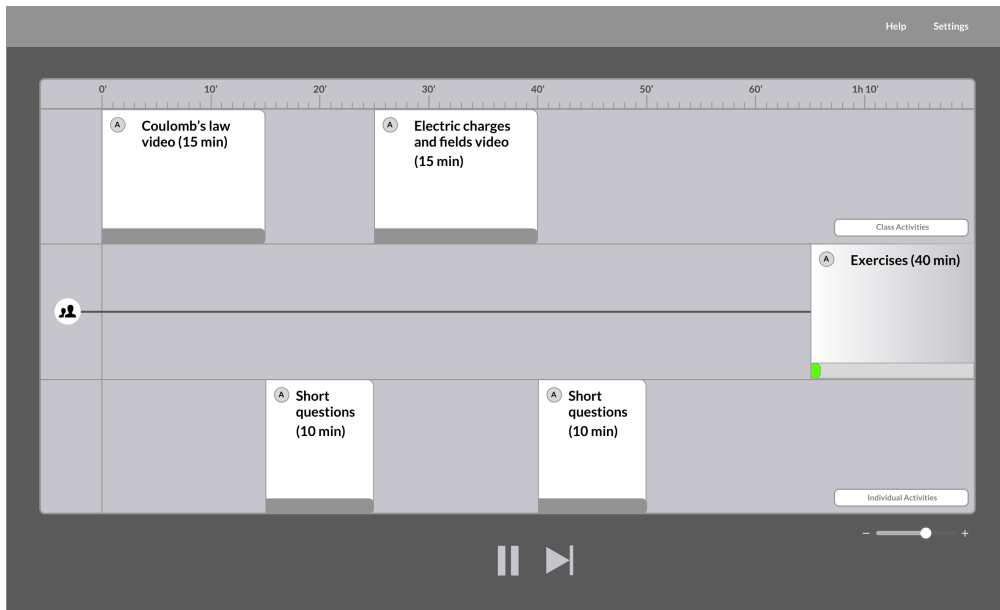


Figure 10: Prototype 1.2 intermediate screen showing that an activity has started

Prototype 1.3				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
All buttons on top. Icons only	Green circles around each activity that disappear following activity's progression. Visible in both graph view and in maximized activity view	Dashboard window accessed via clicking on an activity. Dashboard buttons on the side. Icons only	Accessed from the advanced options button and then by clicking on “projector view in new tab”	Opening an activity to be projected is done from the advanced options menu. Opening an activity to see the dashboard view is done via clicking on the activity

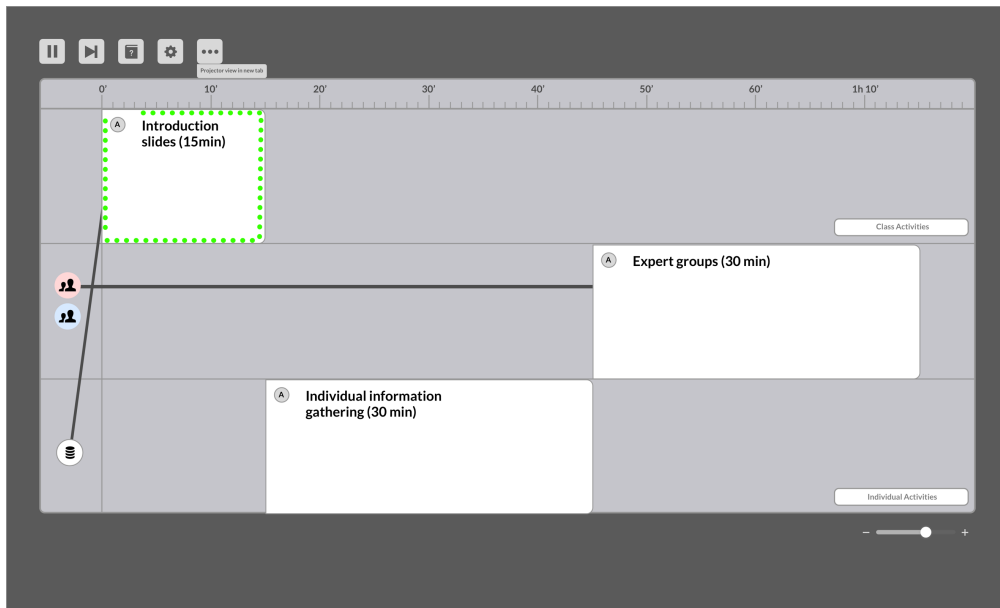


Figure 11: Prototype 1.3 intermediate screen showing a started activity and the advanced options menu

Prototype 1.4				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
All buttons on the side. Icons only	Pie-like timer that is completed following the activity's progression, and total duration of the session above. Both visible in graph view, timer also visible inside the activity	Dashboard window accessed via clicking on an activity. Dashboard buttons on the side. Icons only	Accessed from the icon on the sidebar. Opens a new tab with the projector view	Split-screen layout. Upper side shows the graph view and lower side shows information about the activity and the dashboard

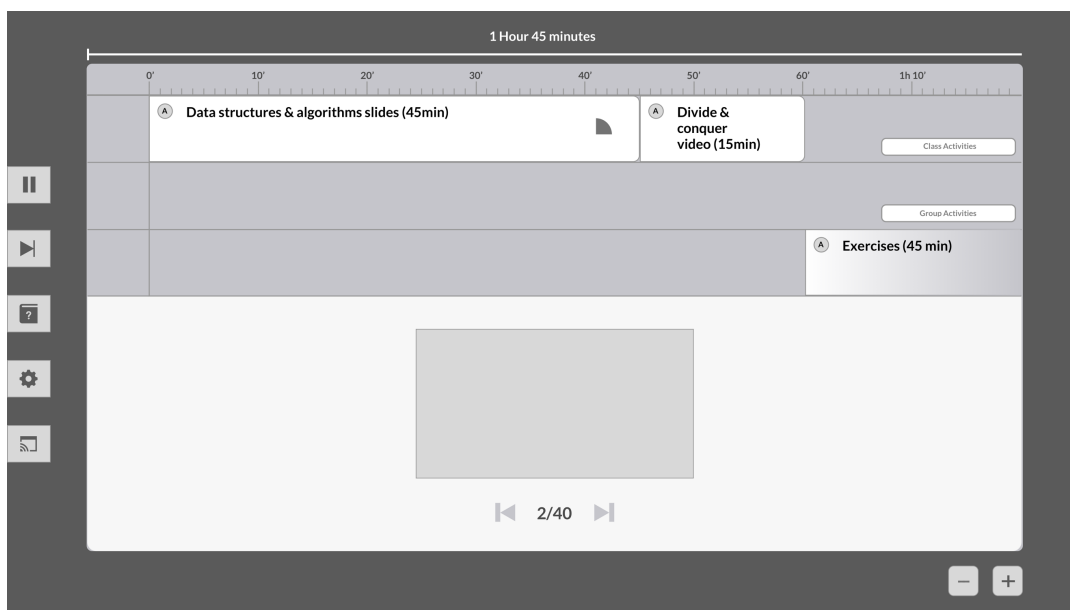


Figure 12: Prototype 1.4 intermediate screen showing the split-screen layout of an activity currently running

Prototype 1.5				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
All buttons on top. Icons and text	Session clock in the top right corner	Appears in a different window. Accessed via clicking on the button in the navigation bar. Dashboard buttons on top. Text only	Toggle button accessed from the icon in the top right corner. Appears only inside the dashboard view	Activity information appears in dashboard view. This view also provides an index with all the activities that have been completed or are currently running

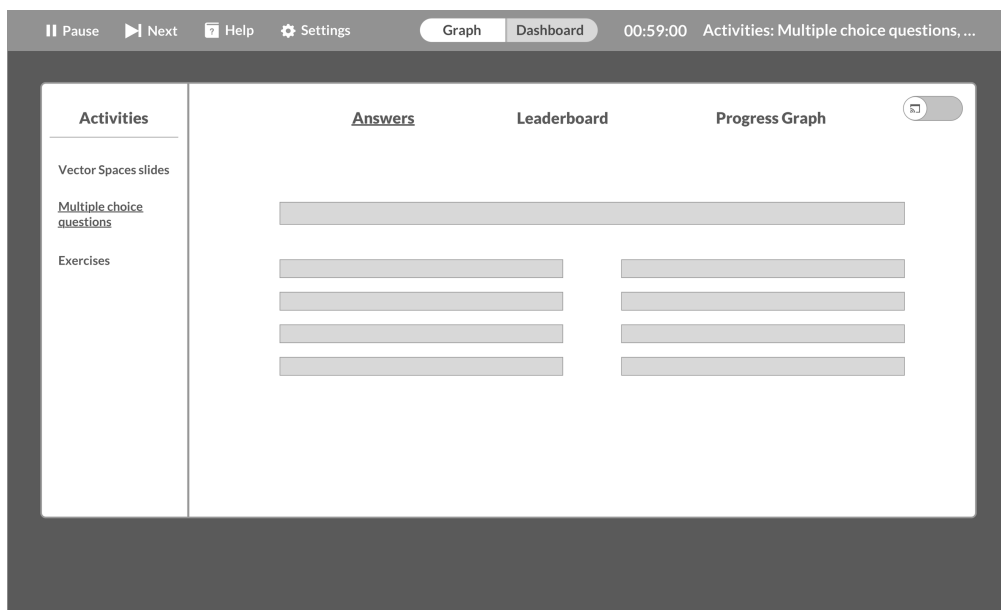


Figure 13: Prototype 1.5 intermediate screen showing the dashboard view of an activity currently running

After finishing the first set of prototypes it was time to start with the usability tests in order to obtain feedback from the users. These are the main ideas we took from the first two usability tests:

First meeting

Description of the teacher

- Really experienced with the tool and current developer of it
- Aware of the main problems and also of feedback from observation in other courses

Feedback

- Icons inside the activities might not be necessary
- In prototype 1.3, the green circles should appear after clicking on next and not before
- Proposed idea from the user: “What if instead of having a dashboard activity, the dashboard is always accessible via clicking on an activity”
- Key problem found: “Teachers are not aware of where they are inside the application, including accessing the dashboard, knowing if they are projecting the content or not, etc.)

Second meeting

Description of the teacher

- Used the tool in the past and remembered some of the features during the usability test

Feedback

- In prototype 1.1, the eye button is really helpful. It is easy to identify and to switch between showing and hiding the content
- In prototype 1.2, preprogrammed groups should not be connected with the activities that way because it might be confusing for the user
- In general, preferred the idea of using less text and more icons to represent the different buttons and interactive elements
- In prototype 1.4, the user found the split-screen layout really useful. “It makes the whole process even faster”.
- In prototype 1.5, the time on the upper right corner was “a bit stressing for a teacher to see that”
- Must haves: Wiki page from advanced options more visible

5. Two prototypes and third usability test

The following step in the process was to analyze the obtained information from the meetings, evaluate which were the most useful features and design two prototypes combining them.

Here are the conclusions drawn from the meetings to choose each of the elements that would appear in the second iteration of the prototypes:

- **Orchestration buttons:** In the second meeting, we realized that icons provided a visual representation of an element, making it easier for the user to associate it with its action, then we found absolutely necessary to include icons in both prototypes for the orchestration buttons. Also, the user mentioned that, even though those icons were easily associated with their action, some teachers might not recognize them at first. Therefore, we included labels. In order to try different ways of managing space, we chose a navigation bar on top with all the icons including text and for the second one a sidebar with bigger buttons.
- **Time/Progress:** From the first meeting, we realized that the time representation from Prototype 1.3 needed to be changed to activate after clicking the next button and from meeting 2 we understood that it might be a bit distracting. Also, we realized that the time representation in Prototype 1.4 was not easily associated with time, with the color being a bit too subtle, and from Prototype 1.5 we understood that the time was a too stressing without providing that much information about the time in the current activity.
- **Dashboard:** The dashboard representation from Prototype 1.2 was immediately discarded after the second meeting because the user considered that the use of icons for the buttons could be a better choice. But, after going through Prototype 1.5 we realized that it was not only a matter of icons or text, but also of the positioning of the elements. Even though in Prototype 1.5 the dashboard buttons were represented with text only, the user liked the positioning on top. Therefore, we decided to keep the text-only dashboard buttons if the buttons were in that position. The second implementation of the dashboard was taken from Prototypes 1.1, 1.3 and 1.4 with icons-only on top because they were easily associated with their function.

- **Projector view:** The way the projector was represented in Prototype 1.2 was discarded due to its similarities with any social media app and live streaming apps. The user from the second meeting expressed that it was not easily associated with projecting an activity, but rather, share the whole screen. The first implementation of the projector view button was taken from Prototype 1.1 and 1.5 due to the comments from the second meeting. The user expressed that it was really intuitive to have a button always accessible representing if the content of that window was shown or not. In the end, the user decided that the eye button from Prototype 1.1 was even more easily understood than the toggle button from Prototype 1.5. The projector view implementation for Prototype 2.2 was taken from Prototype 1.4, as the user told us that it was important to have the projector view always accessible, so placing it in the sidebar was also an improvement compared to the current implementation in the tool.
- **Opening Activities:** From both meetings it was clear that opening activities automatically reached the users' limits. Both users expressed that teachers should have the control all the time and that going to the next activity should be their decision. Also, the first user explained to us that as currently it is not possible to go to the previous activity inside the application because it might bring several problems regarding data transmission and storage, it was really important for the teachers to be completely sure before going to the next activity. Therefore, the Prototypes left were Prototype 1.2 and 1.3 with opening activities in full-screen after clicking on them, Prototype 1.4 with a split-screen layout and Prototype 1.5 with separate windows. From the second meeting we concluded that the split-screen layout was incredible useful, as for the user it provided an easy way to move around different activities. The implementations in Prototype 1.2 and 1.3 were also an improvement, but the user decided it was better to improve how activities were opened in the dashboard window from Prototype 1.5 and that way it would not be necessary for the user to switch between both windows as many times, making the process faster than opening and closing windows.

The next step of the process was combining the different elements in such a way that we could obtain two usable prototypes that made great use of the space, that were built with elements that complemented each other and that in the end made sense for the user to see them combined.

Combinations for Prototype 2.1

We decided to include both opening activities and dashboard buttons represented with text and divide the prototype in two separate windows, as it was represented in Prototype 1.5. By having two separate windows it was also possible to include the progress bar from Prototype 1.2 in a bigger space both in the graph view and in the dashboard view. Finally, in order to make a good use of space, we placed the orchestration buttons, the buttons to switch between the dashboard and the graph and the time in a navigation bar on top, leaving some space below to include the progress bar and space on the side for the activity index in the dashboard window. We decided to include the time in the navigation bar because the progress bar did not provide as much information of the specific time left, therefore it was necessary to address that issue.

Combinations for Prototype 2.2

We wanted to make sure that just by looking at the graph, the user would be able to understand in which stage the session was. Also, we wanted to follow the recommendations from the second meeting of using icons in the different buttons. Therefore, we decided to use a sidebar with bigger buttons as in Prototype 1.4 and leave the rest of the space to the split-screen layout. As we had less space for the graph, it was necessary to include a time representation that could be easily seen no matter the size. That is why we chose the time bar for prototype 2.2 and not for Prototype 2.1. For

the dashboard buttons, we decided to use the icon-only implementation from previous prototypes and place them on top, as from meeting 2 we realized that it was the most intuitive place for the users. After that we decided to include the projector view button in the options submenu, but as we will see in the last prototype, this feature is used frequently and thus needs to be easily reachable. Finally, with the split-screen layout, we kept following the same recommendations from the second meeting and providing a faster way of switching between activities.

Prototype 2.1				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
All buttons on top with icons and text (From Prototype 1.5)	Green progress bar inside each activity both in graph view and maximized activity view, and session timer in the upper right corner (From prototype 1.1 and 1.2)	Appears in a different window. Accessed via clicking on the button in the navigation bar. Dashboard buttons on top, text only (From prototype 1.5)	Button with an eye icon to be easily associated with the action of showing and hiding the content to the class (From prototype 1.1)	Activity information appears in dashboard view. This view also provides an index with all the activities that have been completed or are currently running (From prototype 1.5)



Figure 14: Prototype 2.1 intermediate screen showing the dashboard view of an activity currently running

Prototype 2.2				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
All buttons on the side. Icons only (From Prototype 1.4)	Green time bar and highlighted activities (From Prototype 1.1)	Dashboard window accessed via clicking on an activity. Dashboard buttons on top, icons only (From Prototype 1.1)	Projector view button found in sidebar (From Prototype 1.4 with some modifications)	Opened via clicking on the activity (From Prototype 1.1 and 1.2)

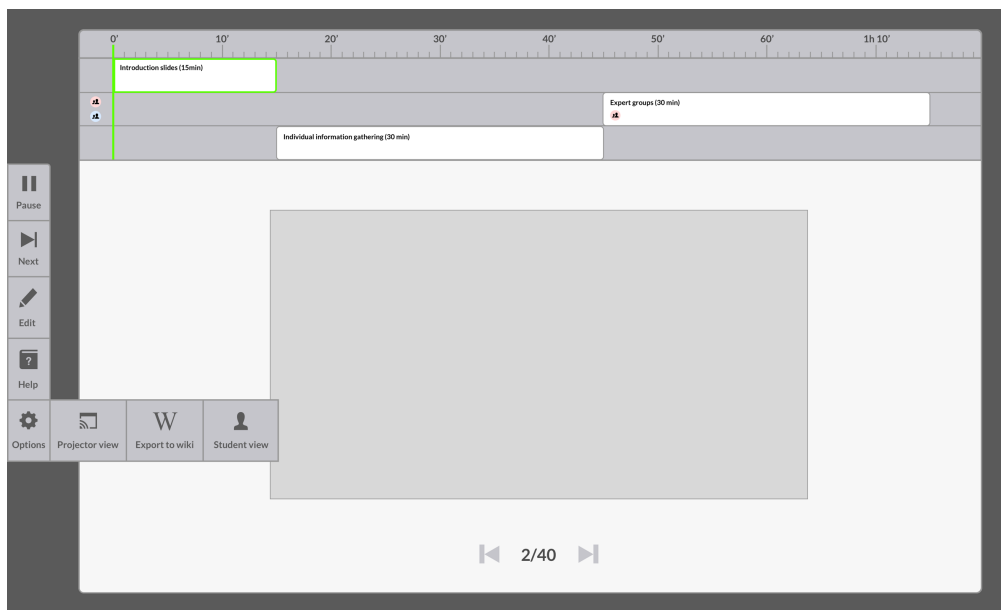


Figure 15: Prototype 2.2 intermediate screen showing the split-screen layout and the advanced options menu

Now, from the third meeting we obtained the necessary feedback to prepare the final prototype

Third meeting

In this case, we had the opportunity to run the usability test with two teachers at the same time

Description of the teachers

- Used the tool in a single course for multiple sessions across two different years

Feedback

- In prototype 2.1, the eye button, if included, should be bigger. It is not easily perceivable when it is activated or not with just the dash line
- Idea for time in prototype 1: Instead of having a progress bar and the time left on the upper side, have the actual time left inside the progress bar and the current time in the upper side
- Idea for additions in prototype 2.1's dashboard view: The users expressed that it would be useful to have a comment section below each activity so that the teacher has some private notes to do the presentation. Also, they said it might be interesting to have a preview of the

next 2 activities in the lower right corner, not having to go back to graph view to check the next activity

- In prototype 2.1, they mentioned that it might be interesting to have an indicator of the purpose of each section in the graph view (classroom, group or individual activities). This idea appeared in the first 5 prototypes from the brainstorm sessions.
- In prototype 2.2, they mentioned that the font was a bit too small and they proposed a solution by removing or rearranging the elements inside the activity to fit a bigger text
- In prototype 2.2, they mentioned that for them was really useful to provide more information with graphical representations of the data instead of text or tables
- Must haves: Comment section and preview of next activity/2 next activities

6. Final prototype and last usability test

After the third meeting, it was clear what our users were looking forward to in the last prototype. That is because, when analyzing the feedback and also their reaction during the meeting, we understood that even though they found both prototypes equally useful, they implicitly found some elements from Prototype 2.2 more useful than the equivalent element in Prototype 2.1:

- **Orchestration buttons:** They liked both implementations but were implicitly worried about the spacing in both prototypes. That is why we decided to place the orchestration buttons in such a way that we could use as much screen as possible for the actual content and make the orchestration buttons still reachable. Therefore, we placed them on top and reduced their size.
- **Time/Progress:** The time progress representation was clear. The progress bar did not provide as much information as the time bar in the graph view, the only solution would have been to add the time for the activity inside the progress bar. After analyzing how users would like to see time reflected in the application, we understood that they needed to both see a graphical representation and the clock. Also, they wanted to be able to compare the current time with the total time of the session. Therefore, we chose to use the time bar for the graphical representation and place the clock in the top center of the screen including the time spent in the session, close to the total time.
- **Dashboard and Opening Activities:** Accessing the dashboard and opening activities was really important for the users in order to be able to track the progress and check the content of the activities, and they wanted to be able to check it as fast as possible. That is why we wanted to maintain the benefits of the split-screen layout for accessing also to the Dashboard. Basically, what we did was provide all the information the teacher could need in the split-screen layout. We added a comment section below each activity, and we decided that when opening an activity, the user would see either the content (e.g. PDF presentation activity) or the dashboard (e.g. Multiple-choice questions activity). Thus, depending on whether an activity allows to track progress or not, different content will be shown, and the user could be sure that all the necessary information would be found just by clicking on the activity
- **Projector:** Finally, for the projector view we decided that having one window for all the content and needing to make good use of space it was not necessary to place a button outside the navigation bar. And also, as during the meeting the users expressed that the button would need to be bigger, it would have been a problem to fit that button inside the graph and still

leave the necessary space for the split-screen layout. That is why we chose to add the projector button on top and outside of the advanced options menu, as we thought that it being a really important feature it was necessary to have it always reachable.

Some additional decisions were made. For example, we decided that as the content is the most important aspect of the session and because of how content is read (from top to bottom), it was necessary to move the graph to the bottom and put the content on top of it. Also, as our users pointed out, the elements indicating the purpose of each row in the graph were useful. Therefore, we added almost transparent elements that did not affect the visibility of the graph and that when hovered with the mouse, will show the information.

Prototype 3.1				
Orchestration buttons	Time/Progress	Dashboard	Projector View	Opening Activities
All buttons on top with icons and text (From Prototype 2.1)	Green time bar, highlighted activities and clock with completed session time and full session time. (From Prototype 2.1 with some modifications)	Dashboard window accessed via clicking on an activity. Dashboard buttons on top, icons only (From Prototype 2.2)	Projector view button found on top in navigation bar (From Prototype 2.2 with some modifications)	Opened via clicking on the activity (From Prototype 2.2)

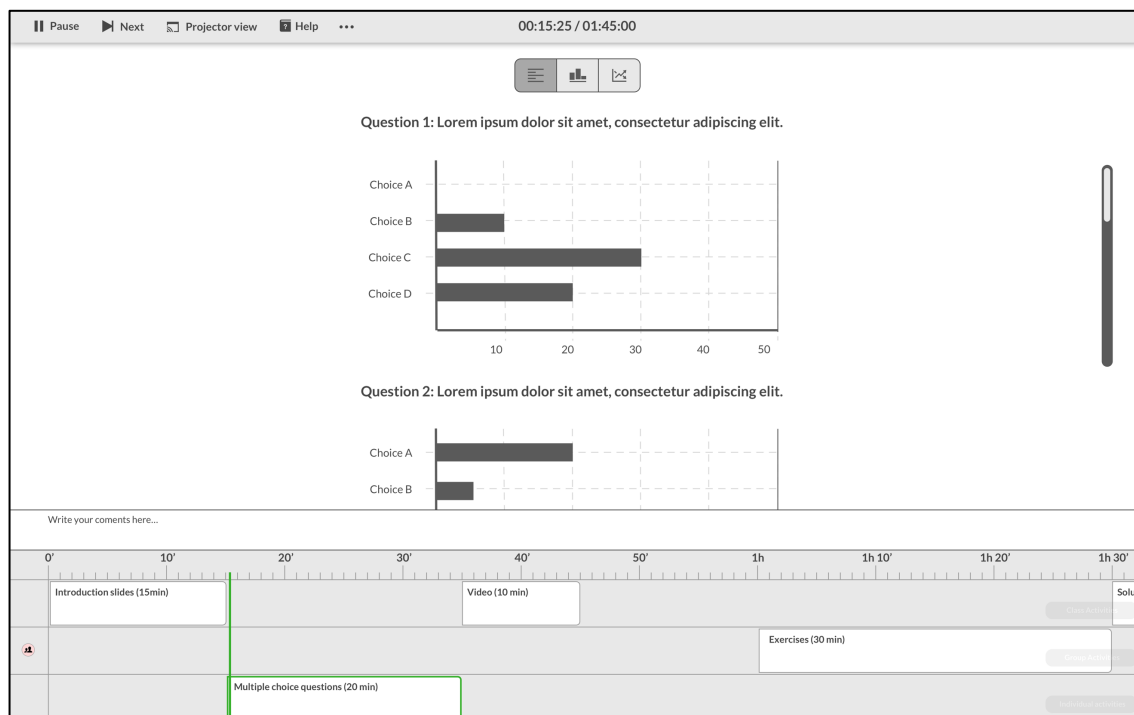


Figure 16: Prototype 3.1 intermediate screen showing the split-screen layout with an opened activity

Last meeting

Description of the teacher

- Used the tool last year in some courses

Feedback

- Activity content should only be seen after starting the session
- Add tooltips to the elements of the interface for understanding their purpose
- Modify the name of the button in the navigation bar to “Next Activity” in order to avoid confusion with the next button in some activities (e.g. the PDF presentation activity)
- Inside the PDF presentation activity, it would be useful to provide symbols, specially more specific ones and that maybe the teachers are able to add their own ones in order to add notes or exercises during the session to the PDFs
- Having two time bars (one for the current activity and one for the actual time of the session) might be useful for the teacher, but we also consider that it could make the teacher get stressed trying to not lag behind
- It could be useful to provide a side menu for the teacher to write the script for the session (this could also be a different implementation of the comment section). As an example, the user mentioned Google Drive’s comment sidebar but with the purpose of writing the script and all the notes of the teacher to properly do the presentation
- Provide a Stop button to finish the session and go directly to the beginning of it
- Provide more integration with moodle and specially with Expériences en auditoire
- Must haves: Tooltips, symbols and sidebar

7. Conclusions

After analyzing the context of the problem, defining our target users and going through several iterations improving the solutions we proposed, we have obtained important conclusions.

First of all, we confirmed that indeed the teachers had problems being both in control of the application and also aware of where they were while using it, where to find some elements, etc. Also, we have obtained useful feedback regarding possible future implementations and additions to FROG that could improve our users’ satisfaction. Finally, we have validated with our users the elements to be included in a final prototype based on assumptions that we previously considered after defining our most representative users and imagining scenarios for them to go through. We think that these modifications can heavily contribute to the overall usability of the application and to the users’ long-term memory to easily associate the elements of the interface to their affordances.

8. Greetings

I would like to sincerely thank Jennifer Olsen for his involvement, help and feedback during all the steps of the project. I would also like to thank Stian Håklev for his involvement and help understanding the tool and to Pierre Dillenbourg for giving the opportunity to develop a semester project in the lab. Finally, I would like to thank all the teachers involved in the user testing process for the precious feedback and recommendations to improve the tool.

9. References

Prieto, L. P., Dlab, M. H., Gutiérrez, I., Abdulwahed, M., & Balid, W. (2011). Orchestrating technology enhanced learning: a literature review and a conceptual framework. *International Journal of Technology Enhanced Learning*, 3(6), 583.

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Alan Cooper, Robert Reimann, Dave Cronin, About face 3: the essentials of interaction design, John Wiley & Sons, Inc., New York, NY, 2007

10. Appendix

Links:

- Personas
 - Paul Moeller: <https://sketch.cloud/s/O2LD2/a/Dvvg5k/play>
 - Upasana Hayer: <https://sketch.cloud/s/O2LD2/a/ajjK5r/play>
 - Celio Fidalgo: <https://sketch.cloud/s/O2LD2/a/Azzyq5/play>
- Storyboards
 - Paul Moeller: <https://sketch.cloud/s/mMz4w/a/kmm2yg/play>
 - Upasana Hayer: <https://sketch.cloud/s/mMz4w/a/o00jxY/play>
 - Celio Fidalgo: <https://sketch.cloud/s/mMz4w/a/RnnGqy/play>
- Prototypes 1-5: <https://sketch.cloud/s/PKlZx/a/zGGjM/play>
- Prototypes 2.1 and 2.2: <https://sketch.cloud/s/PKlZx/a/x44zLj/play>
- Prototype 3.1: <https://sketch.cloud/s/PKlZx/a/dZLA4L/play>

Ideas for the designs based on current applications:

- Trello: Design of the activity boxes

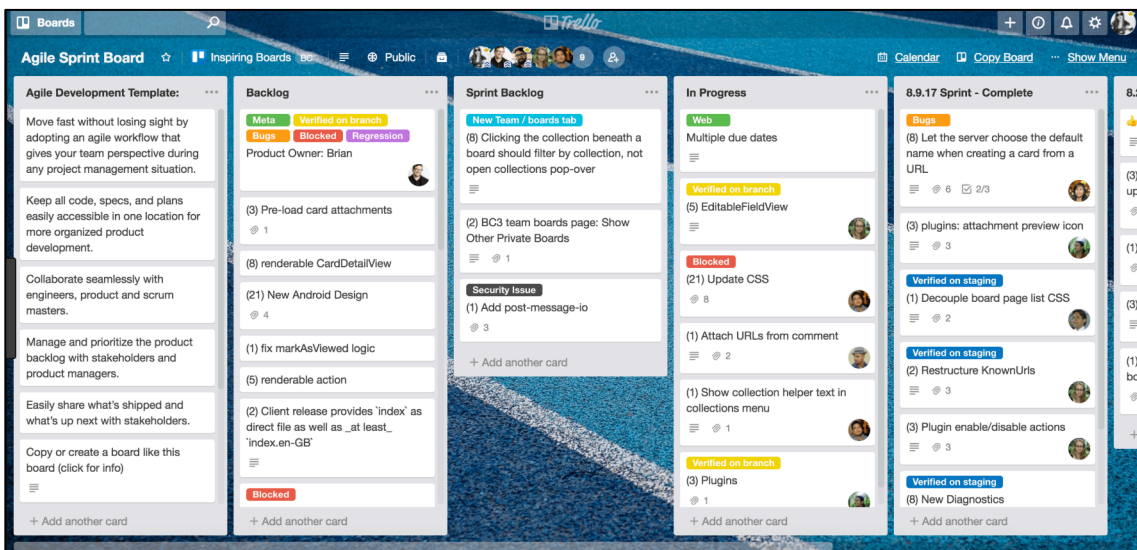


Figure 17: Trello interface inside a board

- Final Cut Pro X: Graph view layout



Figure 18: Final Cut Pro X interface with an opened project

- Creately.io: Navigation bar elements

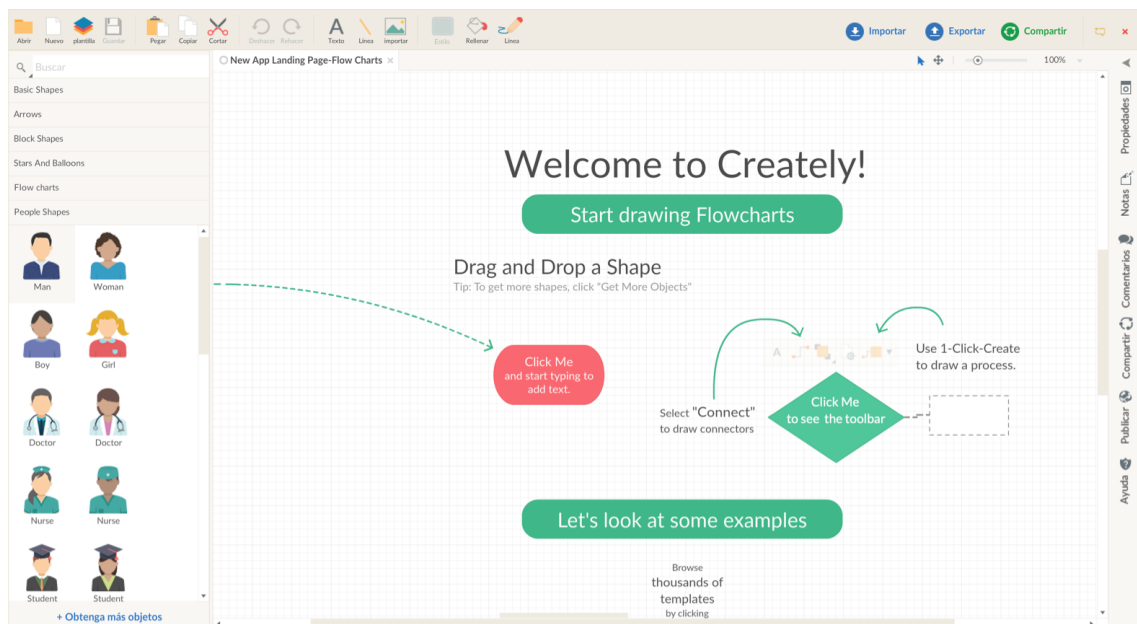


Figure 19: Creately.io's interface