A mobile app for developing visual literacy on in-service teachers.

Catalina Huilcapi-Collantes
Pontifical Catholic University of Ecuador
cahuilcapi@puce.edu.ec

Azucena Hernández Martín
University of Salamanca, Spain
azuher@usal.es

Juan Pablo Hernández Ramos
University of Salamanca, Spain
juanpablo@usal.es

ABSTRACT

Visual is a mobile app that promotes Visual Literacy (VL) and it was created as a resource for a VL training course for in-service teachers. The VL course performs through blended learning approach and *Visual* app allows users to experience learning-on-the-move [10] and ubiquitous learning thanks to affordances of mobile technology.

The *Visual app* presents its content in six short units, which are related to the VL course content. Each unit has ten activities, for teachers to do them. Performing activities helps teachers to improve the understanding about the course topics. Each activity shows immediate feedback to users by evaluating if the response was correct or incorrect.

Visual app was designed based on user-centered design methodology. This project aims to achieve an effective integration of mobile technology into the teaching-learning process for in-service teachers training in VL.

CCS CONCEPTS

• Human-centered computing~User interface design

• Applied computing~Interactive learning environments

KEYWORDS

Visual literacy, mobile learning, mobile technology, educational apps, teacher training, mobile apps, user interface design.

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1. Introduction

Teachers are involved in countless activities every day, both inside and outside the school. Their busy schedules leave them little time for training as much as information society requires. Here, mobile technology stands as a potential way to support teacher's professional development, because its features as ubiquity and permanent evolving process, allows them to access digital learning content anytime and everywhere. Indeed, through mobile devices teachers can access a large amount of updated educational content and tools for their own training and teaching. All of this is possible across different contexts because mobile technology is absolute affordable in digital age and many teachers own a mobile device [15]. Hence, mobile technology can solve some specific in-service teacher's training needs, as becoming visual literate, which helps them to become well-qualified teachers, key factor in students success [14].

VL training initiative for in-service teachers pretends to increase education quality. The fastest track to better education is better teachers [15], so they must know how to communicate through the different languages and media that people use in digital era, as visual language. Here, visual literacy is perceived as the most crucial literacy for 21st century education [7] because we live in a visual world [16] and all of us are image users that create and actively contribute to visual communication [8]. Besides, visual aids are widely used in classrooms and teaching materials [16] in synchronous or asynchronous classes because they are a strong learning enhancers [1]. Thus, the visual literacy course proposal aims to help teachers to improve their communication skills through visual language.

In order to fit the visual literacy course with teacher schedules, the course was designed under blended learning approach. *Visual app* is a specific resource for asynchronous learning that takes place after face-to-face class. By doing the app activities, teachers can improve the understanding of visual literacy topics, which are based on graphic design principles.

VL course was designed following RASE pedagogical model, a student-centered learning approach that enables the integration of educational technologies[3, 4]. Hence, *Visual App* should be designed by a related concept as User-Centered Design (UCD) that, as a methodology, philosophy and an approach of design,

places the user as the design process core. As a result, UCD process allowed us to get to know teacher's needs, their context and features like future users of this educational app.

It is important to note that when we refer to students and users, we are talking about in-service teachers, because they are our participants.

2. Design process

In order to follow UCD methodology, *Visual app* design process began with previous research that helps to make the app design effective. It includes two aspects: analysis of educational inspiring mobile apps and user research. Through this research, it is easier to identify app functionalities, and it helps to know and define the user, and the app usage way across different scenarios.

2.1 Analysis of educational inspiring mobile apps

Four mobile apps were analyzed, each one seeks for users to achieve different goals, which are related to some specific learning. To illustrate, the first app teaches users how to code, the second helps users to achieve some level of knowledge in any language, the third allows users to play while learning, and the last one offers users to exercise the brain by doing some intellectual activities. Inspiring mobile app analysis focuses on kinds of activities, common icons, steps to perform each task, activities and tasks duration, standard interface elements and feedback screens. This analysis was essential because on app market, there were no apps for visual literacy or related, so it was not possible to study a specific app for this purpose.

As a result, inspiring mobile apps analysis helps us to make a features list to design *Visual app*:

- Common activities: the most common is select and identify the correct answer to respond a question. It could be from a multiple-choice list. The interface must display only one activity per screen.
- Steps to perform activities: (a) select activities module, (b) after displaying activities, identify and select pretended correct answer, (c) verify answer by touching bottom, (d) display feedback screen where there are: next bottom, try again bottom or restore bottom.
- Toolbar essentials: learn icon, profile icon (my achievements, my score).
- Common amount of activities per learning module: ten
- Duration of ten activities: 2 minutes by answering correct all of them.
- Common interface features and elements: (a) content list to learn or practice, (b) progress bar on each activity, (c) progress section to show score, challenges and achievements. (d) Exit, close or pause bottom or icon, (e) colorful and flat design, (f) profile section and settings icon, (g) common icons that users already know, and (h) simple toolbar with three or four icons.

2.2 User research

The next step on previous research was to interview in-service teachers that was made by following guidelines for user experience research [13]. This user's interview was crucial at the beginning of the design process because at this phase we defined app functionalities based on user mental models [17]. The interview helped to refine the ideas about app design [11]. Five in-service teachers were interviewed. They are the future users of *Visual app*. Through the interview method, we explored opinions, motivations, interests, difficulties, frustrations and aspirations of teachers regarding VL and mobile learning.

Interviewees work on private and public institutions in two countries, and they work at elementary school, high school, university and a training center. Interviewee's age is between 30 and 52 and all of them use ICT in their teaching activity. They have an own mobile device, internet connection at home and work, and most of them pay a data plan to stay connected all time.

2.2.1. Interview objectives:

1. Determinates teacher's predisposition to learn by using a mobile educational app.

2. Investigates if teachers show some interest and knowledge about visual literacy.

3. Identify the problems that teachers face when preparing teaching materials due to the lack of visual literacy.

After the interviews, the results revealed that teachers: (a) are prone to use technology with educational purposes, (b) are aware of their lack visual literacy and would like to learn and improve it, and (c) admit that visual literacy influences on teaching work. Indeed, we learned that teachers already have specific needs on VL and mobile learning subjects, which they have identified along their teaching work.

Additionally, the interview uncovered some ideas for Visual app:

- *Visual app* should help clarify visual literacy definition.
- *Visual app* should help teachers to expand their criteria when choosing visuals for developing instructional material.
- *Visual app* should have content and activities that tackle composition and visual elements.
- *Visual* app activities should be evaluated immediately so that teachers receive feedback and understand associated concepts.
- *Visual app* must help teachers to improve and develop skills to create visual material.

Finally, the interview helped to empathize [13] with users, so it was easier to build user profiles and describe the scenarios in which they would use *Visual app*.

2.2.2. User profiles

Define users or create *personas* [6] is important because it gives a clear and deep image about who the user is, based on previous research. Also, user profiles help to make decisions about design and functionalities. In this case, the interview disclosed details about their training, lifestyle, interests, values, attitudes and

behavior patterns. The following description illustrates one of them, a male Hispanic in-service teacher.

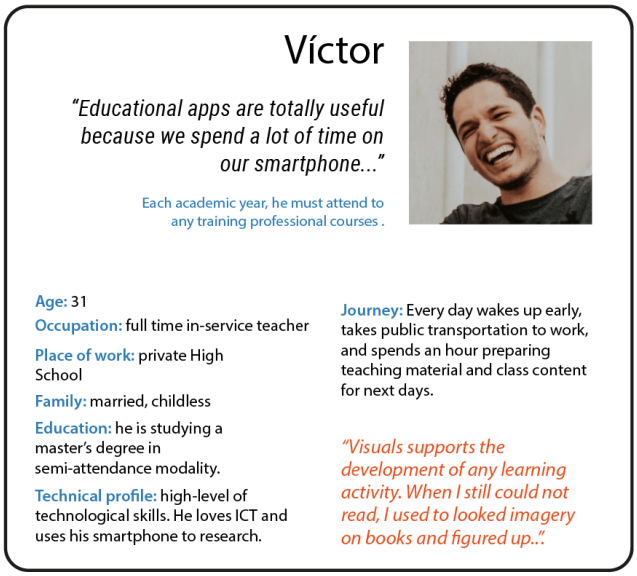

Figure 1: Example of user profile.

2.2.3. Define scenarios

Scenarios describes fictitious situations where users are using *Visual app*. These are useful to describe the context in which teachers will do the activities. The following scenario example relates to the previous profile.

Victor is on the bus, and he is going to work. It is going to take 30 minutes to arrive at high school, so he decides to use Visual app to review the contents of VL course. Victor is standing inside the bus for over 15 minutes and then he sits down. When he has to get off the bus, Victor needs to stop the activity that he was doing in the app.

It is possible to describe several scenarios that help to write user stories before starting the design.

2.2.4. Users Stories

User stories describe something that users want to accomplish by using the app [18] and are necessary to decide how to design each app screen and each element on it. For example:

Users stories	***App functionalities***
*"As a user I want to know how to **use the interface immediately** because I don't want to spend time learning how to use it."*	Easy to understand icons and simple, intuitive and familiar interface.
*"As a user I want to **stop doing activities and not to lose them** because I use apps when I am waiting for something or someone".*	Do not incorporate a countdown counter in activities.
*"As a user I want to **get immediately feedback** to my responses".*	Activities must be evaluated immediately and show a feedback.

Once the detail research finished, a flowchart was created to structure the app content and visualize the steps in the process.

3. Flowchart

The flowchart shows the main elements, actions and the flow between sections and screens. See Figure 2.

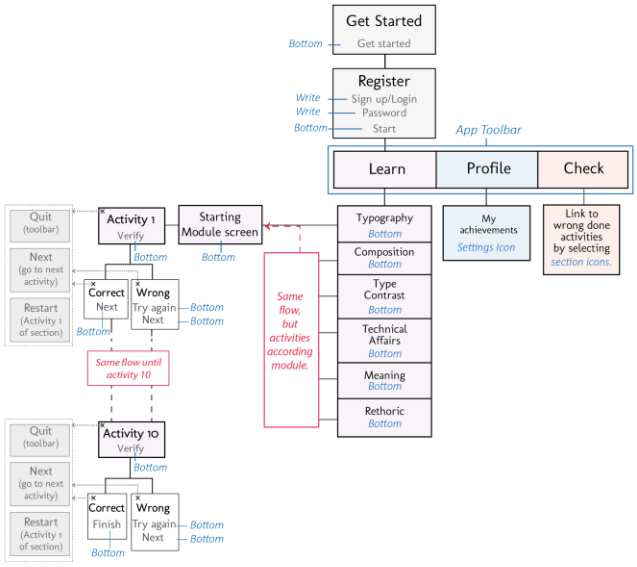

Figure 2: Flowchart of *Visual app*

Visual app will have six main topics, which relate with all topics that users will learn on face-on-face classes during VL course: Typography, Composition, Type Contrast, Technical affairs, Meaning and Rhetoric. Each unit or module have ten activities to do sequentially. Users can do all ten activities without

stopping, or they can stop any activity if they want or need to. The toolbar will have three tools: *LEARN* that displays the six topics, *PROFILE* where users can see correct, incorrect and undone activities, and *CHECK* where people can find the mistaken activities of all topics to do again.

4. Wireframe

Based on flowchart, the wireframe was created, which is a bare-bones depiction of all the components of *Visual app* screens and how they fit together[6]. Wireframe and previous flowchart show an example of one activity and its flow. Visual app will have 60 activities, so the flow will be the same for all of them. See Figure 3.

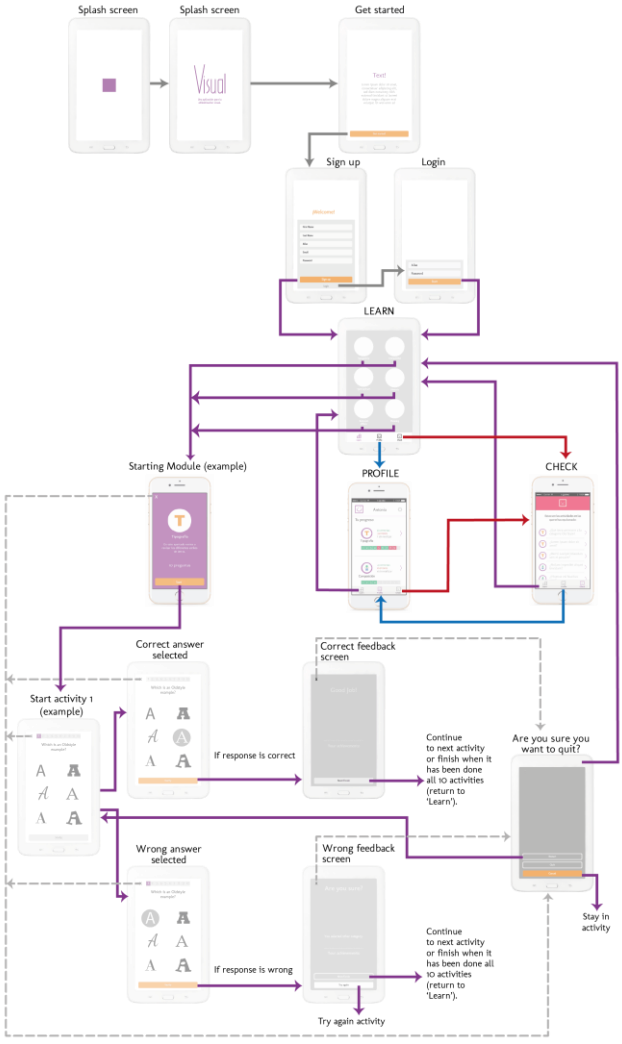

Figure 3: Wireframe of *Visual app*

5. Proposal design

Visual app wants to promote VL on in-service teachers by doing learning activities. It encourages them to continue doing each activity through icons and friendly textual expressions. It helps to create a pleasant and close user experience. *Visual app* is displayed only on portrait format because it is easier to use with a single-hand and while the user is moving. Moreover, portrait format is accessible and comfortable to thumb zone and facilitates multi-finger tap. All the screens below display details of Visual app prototype for iOS smartphone, specifically iPhone 6.

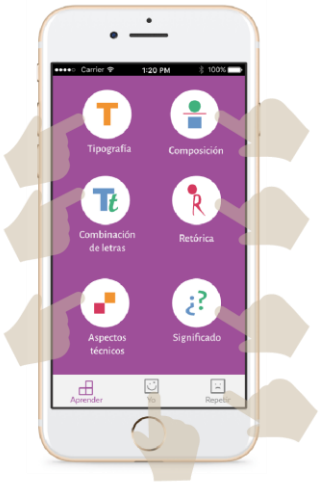

Figure 4: LEARN screen of *Visual app*

LEARN is the main screen after register. It displays Typography, Composition, Type Contrast, Technical affairs, Meaning and Rhetoric icons, see Figure 4. When a teacher selects one topic icon, it shows a starting module screen. A short text explains what the module is about and it shows a start bottom. See Figure 5.

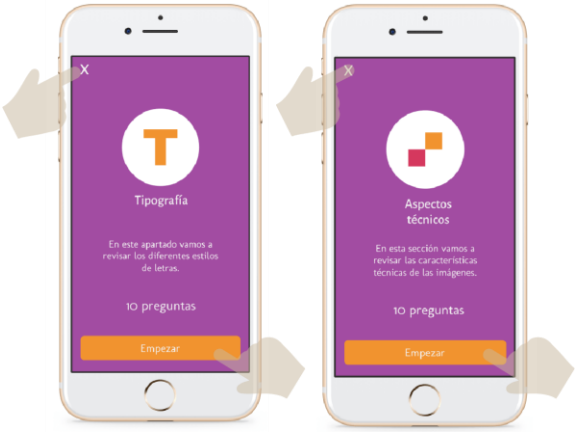

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Figure 5: Typography and Technical Affair starting module screen.

The first screen of each activity shows the question, the answer options and the button to verify. On the top of the screen, a number bar indicates in violet the activity that a teacher is performing. Number bar activities in green indicate correct activities and red indicate the mistaken ones. Next to this bar is the icon to quit. See Figure 6.

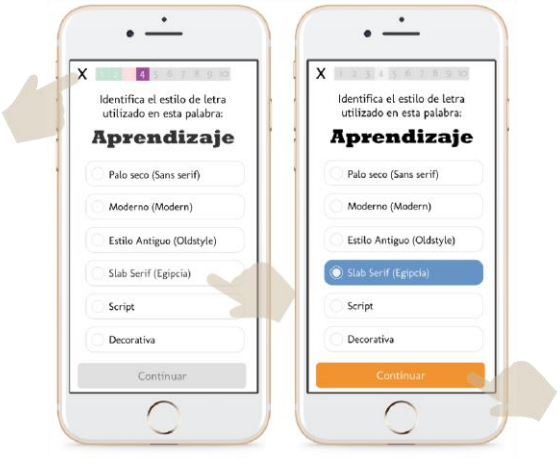

Figure 6: Example of an activity screen.

When teachers verify an activity, the feedback screen displays immediately. The correct answer screen shows a motivating phrase or word that encourages the user to continue. It also shows a smiley face icon to provide a familiar and close experience. See Figure 7 (left). Feedback screen also shows the teacher achievements. The screen is green because this color was detected as the standard to identify a successful response.

Figure 7: Feedback screens.

The incorrect feedback screen shows a phrase that suggests teachers to re-think their answer. It also displays a feedback text and user achievements. The icon is a sad face and the color is red, which is the standard color to indicate a wrong answer. See Figure 7 (right).

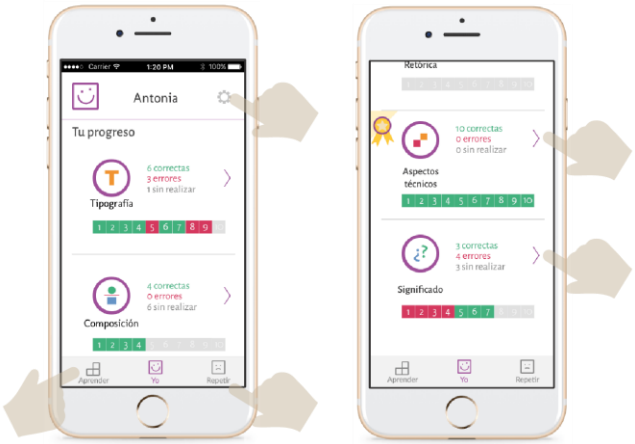

Figure 8: PROFILE screen.

PROFILE screen displays the teacher's progress on each module, correct, incorrect and undone activities. This screen allows teachers to access any module and start it again. In addition, here users can edit their profile. See Figure 8 (left). A medal of honor appears where all the activities have been completed. See figure 8 (right).

Figure 9: CHECK screen.

CHECK screen shows all activities performed incorrectly. All of them are saved here so that the user can perform them again at any time. See Figure 9.

Toolbar is displayed on LEARN, PROFILE and CHECK screens.

6. Future work

It is essential to make a pedagogical usability evaluation and an user interface evaluation of *Visual app* with CECAM, by its initials in Spanish, that means questionnaire to evaluate the quality of m-Learning apps [9]. Education and Designers experts must do the evaluation. It will help to improve the app.

Also, usability testing by users is mandatory. Although five users tested the app interface during the design process, it is necessary to test the prototype to identify flaws and remedy them [12].

Furthermore, it would be a valuable contribution to translate the *Visual app* into English, so more people can use it. Additionally, it will be a challenge to make *Visual app* an autonomous tool to promote VL. It could be a long-term goal.

Finally, a mobile app developer must do the implementation in order to keep fidelity with *Visual app* prototype. Thus, teachers will be able to download *Visual app* from Android market or they can load the *app* as mobile web on iPhone smartphones and others.

7. Conclusion

This project aims to achieve that in-service teachers will get a better understanding of VL course contents, by doing *Visual app* activities. It is clear that, the best way to teach visual literacy requires to analyze the context and learners [2]. Therefore, user research was fundamental, since it has helped to understand their insights and it has given useful recommendations when designing the app: content and interface.

In this project, teachers are users and learners, so they have been treated as the center of each process, and there has been nothing assumed about them. They were heard and there was an effort to create an app useful to their needs and their context. These is what the user-centered design approach is about, which reveals a relationship with student-centered learning.

On the other hand, it has been necessary to demonstrate that design educational apps is a process that must be well planned in order to get a well-designed result. In fact, a team of teachers, designers, developers and users should develop educational apps because mobile learning environments must display a good interface, simple and familiar to learners. The user cannot spend time learning how to use the app instead of learning with the app.

Educational apps must also display a high aesthetic level in order for users to like using them and the experience to be pleasurable. It is important to remember that app markets have such well-designed apps that users inevitably will compare. Also, aesthetics motivate learners to persist and engage in web-based learning, so it is increasingly important that educators consider aesthetic qualities when developing course materials [5].

Finally, it is necessary that teachers themselves are trained with mobile technology, so they can experience mobile learning from their own context and this encourages them to incorporate this technology into their own classes.

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