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Mobile Application Design with Augmented Reality Triggers

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ABSTRACT

Mobile applications developed for educational topics are a playful contribution to the teaching-learning process. The objective of this research is to present a mobile application generated from participatory design and user experience. This study exposes the construction phase of the concept, the theoretical foundation of the proposal focused on human-computer interaction, in addition to the methodological process that allowed obtaining a final product framed in a research project that was articulated to a community outreach project. A total of 189 children from public and private schools in the cities of Quito and Ambato, Ecuador, aged between 6 and 8 years, participated. The research defined the scope of the application, its structure, requirements, use and web browsing power. Unity was used for the development of the prototype, for the generation of the video game and its functionalities. On the other hand, Cinema 4D was used for 3D modeling, together with the Vuforia SDK for augmented reality. In addition, Adobe Audition was applied to generate the audiobook, complemented by Adobe Photoshop and Adobe Illustrator in the graphic theme. The app was built for Android and IOS mobile platforms. For the design of the augmented reality triggers, illustrations with colored frames were used, which allows clearly recognizing which pages the mobile device should be used on. The project is in the final evaluation phase and it is expected to conclude with a test in the participating schools.

Keywords: Mobile app, User experience design, Augmented reality, Mobile application human interaction computer, Audio book

INTRODUCTION

The appearance of Covid-19 has generated a change in all activities worldwide, in which information and communication technologies have allowed these activities to continue (Guevara, 2020). In this context, mobile applications of digital games or interactive children's educational games are widely used as a complement to the teaching-learning process (Salvador-Ullauri, 2019).

In the last decade, several investigations have been dedicated to explain these technological tools and their use as a complement in early childhood education. These applications do not always collect data that can serve as a

guide in making decisions about the content, types and level of games that should be created as digital tools for training (Alcivar et al., 2019). The results based on learning experiences when using mobile applications have made possible to develop unique profiles for these educational applications, identifying the learning experience in combined spaces as an opportunity for the design of mobile applications; in addition, embodied cognition, the device as a discovery machine, open playful design and mobile system thinking are other elements of the uniqueness profile of mobile technologies for learning. (Shafriri & Levy, 2018).

The integration of mobile devices into an educational framework that promotes a more active engagement with creativity and digital technology, through the lens of complex thinking and a constructivist, student-based approach to teaching, can create better learning. (Forget, 2019). In this sense, Augmented Reality has the ability to modify the location and time of the investigation, adding new, additional forms and methods. (Borja-Galeas & Guevara, 2021). The capabilities of augmented reality technology allow classes to be more interactive and knowledgeable. Students will have a 360 degree view of real world entities, interacting with those and generating a better understanding of the concepts. Thus, the learning curve decreases by increasing the productivity of the brain. With the development of smartphones, augmented reality is applied to a wider range. Augmented reality can turn an ordinary classroom into an engaging experience (Roopa et al., 2021).

In this context, participatory design may appear similar to other participatory practices, such as co-design, but it differs in terms of the processes of interaction, or in the wording of the 'mechanisms' of program theory used and how the effects and its support are conceived (Hansen et al., 2019).

The objective of this research is to present a mobile application generated from participatory design and user experience. The construction phase of the concept is exposed, the theoretical foundation of the proposal focused on human-computer interaction, in addition to the methodological process that allowed obtaining a final product framed in a research project that was articulated to a community outreach project.

This article is structured as follows. Section 2 presents the materials, tools and methods used as a fundamental basis in the proposal. Section 3 presents in detail the proposal for the generation of the mobile application based on the design of the user experience. The results of the proposal and a comparison with some related works are presented in Section 4. Section 5 presents the conclusions obtained from the results and future lines of research.

METHODS AND MATERIALS

With the information obtained from the participatory design instruments (observation sheets, interviews and surveys), which were applied to the participants (n = 180) who were in an age range between 6 and 12 years old, we proceeded to carry out prototypes and their approval in stages.

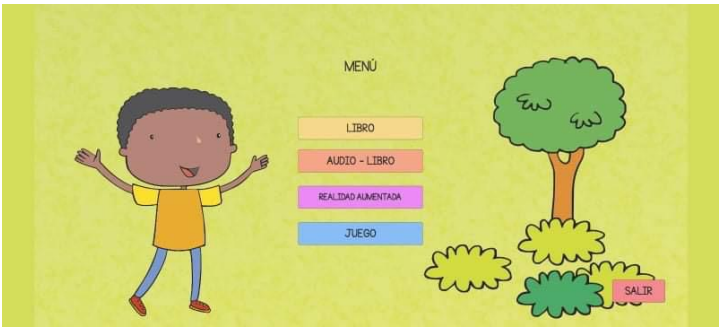

Figure 1: SuperNatu SuperNatu app home screen (Carlos Borja).

Stage 1. Prototype Design

The application's artwork was illustrated with Adobe Photoshop and subsequently exported in various formats (Murrell et al., 2020), scenes were vectored and structured in Adobe Illustrator to improve prototype fidelity (Morita, 2020). For the production of the 3D material, Cinema 4D was used to model the main character in 3D and generate multi-motion renderings (Lee et al., 2020). A sound product was built for the application, in which the language, music and sound effects were edited in Adobe Audition in its multitrack environment. (Murrell et al., 2020). Using the existing elements, animations were made in both 2d and 3d, level construction, game mechanics, augmented reality, user interface, sound integration, programming codes and everything related to the construction of the video game.

Stage 2. Application Development

The different phases of the video game were structured in Unity as a multiplatform engine (Fritsch & Klein, 2018) and with the Vuforia SDK, augmented reality triggers were generated for mobile devices, taking advantage of its computer vision technology that recognizes and tracks flat images and 3D objects in real time (Koca et al., 2019).

A PROPOSAL DEVELOPMENT

This section describes the development of the mobile application with augmented reality triggers.

The theme of the developed application addresses the issue of environmental care and recycling. The mobile application has 4 sections, as shown in Figure 1.

In the first section, an illustrated story with 2D animation is presented, as can be seen in Figure 2. The second section contains the audio book, in which a speaker and some children participated.

The third section presents animations with augmented reality of the main character of the story, as we can see in Figure 3. The application is accompanied by a printed document in which there are colored boxes, which are the triggers of augmented reality.

In the fourth section of the application, a video game was developed according to the theme of the story, as shown in Figure 4. It consists on 3 levels, all

Figure 2: SuperNatu app audiobook screen (Carlos Borja).

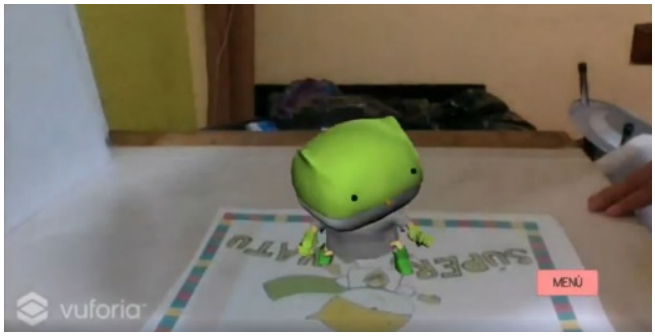

Figure 3: Screen of one of the levels of the video game of SuperNatu application (Carlos Borja).

Figure 4: Screen of one of the levels of the video game of SuperNatu application (Carlos Borja).

focused on reinforcing the theme of recycling and garbage classification in a playful way. The player who achieves 100 points in each level will be able to get a diploma for his great work in recycling, this can be personalized and printed.

CONCLUSION

The problems generated by the Covid-19, forced to modify the development of the study, plus the methodology of participatory design allows

to adapt to the new environments that have been generated in this time of pandemic.

The development of the mobile application based on participatory design and user experience, considering the context and the public to which the product will focus, applying the morphological and compositional theoretical principles as requirements to address the issue of recycling in participants of 6 to 8 years, using augmented reality, has made possible to identify their needs and gradually modify the prototype.

Limitations: It was planned to continue the evaluation process in the participating schools, but due to the COVID-19, the final evaluation is postponed.

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