

Recording the Learners' Experience and Personalizing of Teaching with Serious Games in Virtual Reality

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Abstract. *Immersive Serious Games are valuable and practical tools for providing the experience for learners. In these environments, we can monitor the practices and experiences towards personalized learning. This work created an immersive educational approach for teachers to receive analytical input, make decisions about the best learning paths, and provide personalized teaching. Despite being in an initial stage, it is possible to visualize the potential of allowing: (i) feedback profile of students through data analysis; (ii) amount of information of an individual or a group of individuals. The result of this work is a 3D lesson in a biology laboratory on a virtual reality platform, integrated into a platform for teaching management and recording the actions of individuals.*

1. Introduction

Serious games are tools based on game features beyond entertainment [Michael and Chen 2005]. Practitioners can use them for health, rehabilitation, and educational purposes. We can run games on different platforms, and in recent years they have become viable in mobile environments due to the increased processing capacity of smartphones. Virtual reality (VR) technologies have also become feasible for game goals, but with the differential of providing immersion to the user [Milgram et al. 1995]. Players enjoy several platforms for VR experiences, numerous based on smartphones. Experience API (xAPI) is an API that allows the recording of user experiences in a virtual environment and tracking of information about the player within the game.

Although xAPI is designed and used in serious games, the problem we encountered is that information about user experiences is not always available to educators in a friendly interface. In addition, we did not find a tool that allows educators to edit the content delivered in the virtual game. Therefore, this work proposes building a proof of concept of a game with well-defined missions in a VR environment, integrated with an xAPI platform and a teaching management system (Learning Management System - LMS). This integration aims to provide the educators with a tool that allows them to get to know their students through experiences acquired in serious games and will enable them to make changes to the game to personalize the student's learning. The proposed demo

will allow the audience to perform content configurations in an immersive biology lab class that will be loaded into a VR game available for experimentation.

The introduced prototype differs from the others as it is being built to become a proprietary API for game development integrated with course management platforms and the recording of experiences.

2. Theoretical Reference

The literature presents the use of xAPI for games in the literature [Xanthopoulos and Xinogalos 2018], especially for learning Analytics [Ángel Serrano-Laguna et al. 2017], the proposals tend to look for records of predefined actions in games that educators cannot edit. Tuparov et al. [Tuparov et al. 2018] present a framework integrated on an LMS similar to the one proposed in this work. However, it focused on evaluation aspects. Our proposal makes no distinction about the stage of learning. In addition, our proposal presents integration with an immersive 3D game. Educators can change the game content to enable new student experiences when they understand the student's behavior. We start from the assumption that games can connect to online platforms to retrieve content. We know content customization as the possibility for the educator to insert or edit multimedia material, such as video, images, and audio, except for the 3D game structure. Our proposal also differs in that it is integrated into a course management platform, enabling this edition by educators. Our solution makes games a probable tool for personalizing the learning process.

3. Proposed System

3.1. Architecture

The proposed system has three modules: (i) Teaching management module - It is a Learning Management System (LMS) configured on the WordPress and Learning Press platform that allows the Educator to insert lessons as shown in Figure 1.

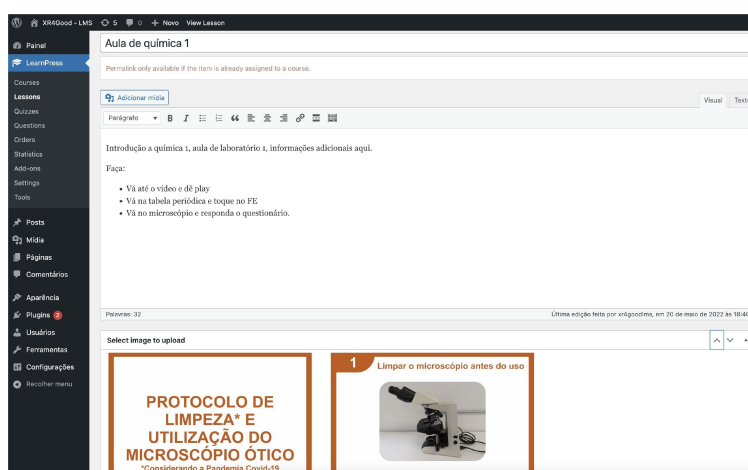


Figure 1. LMS interface for Educators manipulation.

We customized the system interface to deliver the content posted by educators into the game described in module ii. (ii) Playable module - This module is the proposed game to be used by students in pedagogical practices configured by educators. Our proof

of concept is a virtual reality game in a 3D environment that can run on platforms such as HTC Vive, Oculus Quest, and other immersive media, as shown in Figure 2. (iii) User Experience Module - This is the user API database to record a player's (learner's) actions in this context. This module has a communication interface with the others to record information on experiences provided in Module ii and course data from Module iii. The content edited by an educator on the learning management system, as displayed in Figure 1, should be loaded on the immersive game as exhibited in Figure 2.

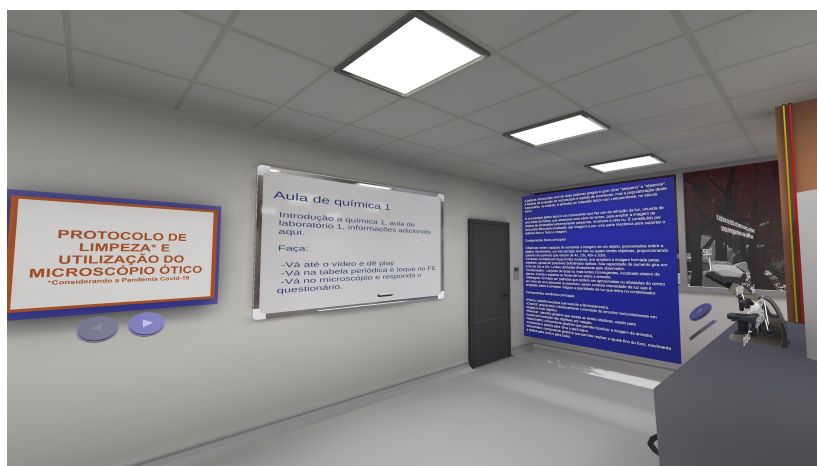


Figure 2. Integrated Virtual Reality Game.

3.2. Case Study

A virtual laboratory was designed for the case study developed in this work. The modeling of this environment aimed to make it as realistic as possible, considering the dominant colors and characteristics of the construction, resulting in a three-dimensional environment that seeks to portray the same experience obtained within a real-world laboratory. The lesson is about microscope concepts and parts and the necessary procedures for cleaning. In the scenario, the learner can refer to various multimedia content configured by the educator in the LMS. We also inserted a questionnaire to validate the student's learning and allow him to move on to the next lesson.

3.3. Expected Contributions

The project aims to include children, young people, adults, and teachers in a more immersive model in academic practices to overcome the lack of immersive tools with friendly interfaces to personalize classes by educators and personalize teaching. We hope this tool permits establishing the student at the center of learning, giving the actors autonomy for decision-making through information on the record of experiences. We hope this tool will soon become a potential ally for research in the HCI-Education context to carry out user studies with different objectives and become a powerful tool for personalizing teaching. From the HCI perspective, this work opens new possibilities for user studies. For instance, researchers can evaluate new multimodal interface proposals based on our solution. Also, this work presents a potential for the integration of brain-computer interfaces in order to identify user cognitive aspects during the learning process.

4. Conclusion

This paper makes an essay on using a serious and immersive game in learning practice. The proposed system comprises a game module, an LMS module, and a student behavior database. The goal is to allow the student to perform procedures in a game environment and provide the educator with an interface for personalized learning.

5. Acknowledgments

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001, the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPQ) financial code 306101/2021-1, the Instituto Tecnológico Vale (ITV) and the Universidade Federal de Ouro Preto (UFOP).

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