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Implementation of an XR Center in a Higher Education Institution in Brazil: A Case Study

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Abstract. This practitioner paper describes an institutional initiative on extended reality (XR) education, which took place at a higher education institution in southern Brazil. The XR Center project involved the creation of specialized learning environments, the formation of a development team, and the selection and development of XR educational proposals from faculty members. The ongoing project's results and features are presented, and several challenges are discussed.

Keywords: Educational Technology, Extended Reality, Higher Education.

1 Introduction

Pedagogical initiatives involving extended reality (XR) are widely recognized as beneficial, particularly in terms of their potential to enhance immersion and engagement in simulated real-life learning experiences [1] and to increase motivation for learning [2]. However, despite awareness of the growing significance of XR technologies in education, instructors often require institutional support to effectively implement them [1]. This is due to perceived complexity and the need for adequate training [3].

A research study conducted on the integration of XR technologies into the educational practices of a Norwegian university recommended the establishment of a joint resource center. The center would be responsible for developing new XR resources, providing technical and pedagogical support, and delivering training to teachers in order to broaden the adoption of these technologies in classrooms [4]. The objective of this work is to describe an ongoing case of the implementation of an XR Center in a higher education institution in Brazil and to discuss some of the challenges encountered during the process.

2 The XR Center Project

2.1 Project Motivation and Structuring

The XR Center project was initiated in 2019 when faculty members from a research group on medical images proposed the technological revitalization of an outdated full dome theater located in the main campus to the institution's leadership. The research group had a successful track record of developing ultra-high definition and interactive simulators for human dissection in anatomical learning [5], as well as 360 and stereoscopic images, which provided credibility for the proposal.

With financial and structural support from the institution, the project evolved into an XR Center managed by the Educational Development Vice-Rectory. The center is composed of a development team responsible for creating immersive educational experiences suggested by faculty members. In the near future, the Center will also be responsible for providing faculty development on XR technology and offering technical support to classrooms.

The development team comprises teachers, students, and technical staff from various disciplines, including education, game design, music, and software development.

2.2 Environments and Technology

The XR Center's infrastructure comprises two large environments: 1) a full-dome theater and 2) an entire floor of dedicated spaces for the development of XR learning experiences in one of the buildings on PUCPR's campus. The latter is set to be inaugurated in July 2023. Table 1 provides a brief description of the most significant spaces within the XR Center. The primary objective is to provide infrastructure and technical support for a diverse range of XR learning experiences across all programs offered by PUCPR.

Table 1. Main infrastructure of the XR Center.

Space	Description
Full dome	An auditorium equipped with a 14m diameter hemispherical projection screen
CAVE	Collective experiences with 360 projections in a 11.5m diameter cylinder
Virtual production studio	LED panels, motion capture technology and cameras for virtual production
VR/MR Labs	Rooms with flexible or no furniture for experiences with VR or MR head-mounted devices. The rooms are equipped with screens to share the users' activities during VR/MR experiences.
Arena	A circular auditorium surrounded by two large screens, allowing 360 projections
Collaborative rooms	Five classrooms dedicated to activities pre- and post-XR experiences
Development rooms	The workplace of the XR development team

2.3 Selection and Development of XR Experiences

A call for proposals was sent to the faculty, and those who intended to develop an XR experience were asked to answer a set of questions. These questions aimed to determine the nature of the proposed XR experience, its context of learning, its potential contribution to student learning, what students would do during the experience, and any similar XR experiences that may have inspired the proposal.

Table 2. XR learning experiences selected among proposals.

XR Experience title	Description	Knowledge areas
Medical Interview Simulator	Live role-play in which a student (in the role of a physician) interacts with a patient represented by an avatar screen projected in human scale and animated by the teacher or an actor. This XR experience aims to provide a realistic medical scenario where students can practice their clinical skills and communication with patients.	Medicine
Health Pro	Virtual Reality experience based on video exercise	Physical education

	situations in a gym environment. Students are expected to select the best guiding orientations to different physical exercises performance, applying kinesiology and biomechanics concepts. The experience is a preparation to field action, as it encourages students to make their own decisions and fail in a safe environment.	
Entomology	Real 3D models of insects seen in mixed reality, in large scale, allowing the teacher to be sure that the students are observing the anatomy details they were supposed to, what is quite difficult with the small real insects in the lab.	Agronomy and Biology
Understanding crime: the cave explorers' case	Students should feel immersed in a crime scene. The main purposes are to generate empathy to better understand the circumstances under a criminous situation: This XR experience aims to provide a realistic crime scene where students can immerse themselves in the situation and understand the circumstances of the crime.	Law

Over a period of two years, the XR Center received 30 proposals from a group of around 1,300 faculty members. The development team then evaluated these proposals based on time and technical constraints. Some proposals were not classified as XR experiences because the professors did not have a clear understanding of what XR is. To address this, the XR Center held meetings to introduce the project and provide examples of XR learning experiences in virtual and augmented reality, and 360 projections both in full dome and CAVE. After these meetings, the quality of the proposals improved, and most of them could be scheduled in a production calendar. Table 2 presents some of the XR learning experiences selected by the development group. To build these experiences, an agile development method, the Scrum Method, was adopted, supported by the Microsoft Azure platform. In six months, five XR educational experiences were built, including requirements refinement and adjustments due to technical, time, and cost constraints.

Throughout the development process of the XR experiences, proponents are asked to dedicate one to two hours of their weekly workload to provide feedback on prototypes and deliverables to the development team. Some professors who are passionate about educational technologies were the first to submit proposals. Engaging in the XR project not only provides self-motivation, but also benefits faculty members when writing their teaching portfolio, which recognizes their pedagogical innovation. The evaluation of the teaching portfolio is the most significant criterion for the Annual Excellence Teaching Award at the institution.

3 Challenges and Final Remarks

One of the challenges of this project has been the learning curve, both for developers and faculty. Although the development team is composed of former game design and image processing students, the technology is rapidly evolving. One of the main challenges we faced during this project was the steep learning curve, both for the

development team and faculty. Although our team consists of former game design and image processing students, the rapidly evolving technology posed a significant challenge. We had to learn while building the experiences, relying heavily on tutorial videos and mentoring from experienced faculty and game developers. On the faculty side, we noticed that many of them were unclear about the possibilities with XR and the differences between virtual and augmented reality. To address this, we conducted a workshop that demonstrated the different types of XR technology and their potential uses. Furthermore, faculty members require support and guidance to effectively adopt XR educational experiences that contribute to better learning outcomes. Therefore, it is crucial to offer both pedagogical and technical support, as well as conduct research on the educational effectiveness of XR experiences [1].

Financing and knowledge partnerships are essential for the success of the project. However, finding the necessary financing was particularly challenging for us, especially since hardware and software are quite expensive, particularly in countries like Brazil with unfavorable exchange rates. As a result, equipment acquisition needs to be carefully planned and paced. Additionally, faculty members should be encouraged to search for commercially available XR experiences that are suitable for their learning context to accelerate the adoption of XR technology and enhance the learning experience.

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