



Implementation of Virtual Reality in Teacher Training: A Case Study with VRChat and Oculus Quest 2

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Abstract. The growing adoption of immersive learning technologies, such as Virtual Reality (VR), demands a transformation in lesson planning and pedagogical practices. In this case study, 13 teachers enrolled as students in the Digital Resources in Education Master's program at the School of Education of the Santarém Polytechnic University, Portugal, participated in a practical VR experience as part of the Digital Resources II course. During the activity, participants explored learning scenarios in VRChat using Oculus Quest 2. The primary objectives were to provide teachers with hands-on experience in VR, enable them to design VR-integrated lesson plans based on instructional design principles, and facilitate critical reflection on the pedagogical implications of VR.

Keywords: Virtual Reality (VR), Pedagogical Practices, Teacher Education, Teacher Training.

1 Theoretical Framework

Virtual Reality has gained increasing attention due to reports on its potential to engage students, facilitate the understanding of complex concepts, and allow skill practice without physical risks, thus reducing costs and overcoming the limitations of traditional teaching [1]. Additionally, VR offers cultural and emotional experiences by exploring diverse perspectives and abstract or invisible concepts [2].

However, implementing VR in education faces significant challenges, such as integrating immersive experiences into the classroom and developing appropriate pedagogical approaches [3]. A significant obstacle is inadequate teacher education and training with VR [4].

Many teachers have no prior experience with this technology and may feel insecure or intimidated when integrating it into their pedagogical practices [4]. Educators may hesitate to adopt or use VR ineffectively without a solid understanding of its potential and limitations. Additionally, the technical and logistical support required to implement VR solutions is not always available in schools. Acquiring and maintaining the necessary hardware and software can represent a significant challenge, especially in contexts with limited resources [4]. Educators may feel overwhelmed and frustrated without proper support, leading to resistance and underutilization of VR. This is the role of instructional design.

Using instructional design (ID) in lesson planning for VR environments with headsets presents several challenges that must be addressed. ID systematically translates learning principles into educational materials and activity plans, which are essential for creating meaningful learning experiences [5, 6]. However, integrating technologies such as VR into teaching requires carefully adapting ID methodologies, as these technologies introduce new challenges and pedagogical demands [7, 8].

Integrating technologies such as VR requires careful adaptation of ID methodologies [9]. The main challenge is the need for ongoing teacher training to effectively incorporate new technologies into their pedagogical practices [10].

Furthermore, creating virtual learning environments that use VR requires detailed planning that considers students' needs and learning goals [11] based on instructional design models, which should combine general pedagogical concerns with VR-specific considerations, addressing students' needs and learning objectives. This

planning must cover aspects such as managing immersion time, initial adaptation to the virtual environment, and creating assessment elements suitable for the immersive context [12]. The use of models not explicitly designed for the context of Virtual Reality can make the planning process unclear, particularly when addressing the specific requirements for developing lessons in immersive Virtual Reality environments [12]. The lack of clear and adapted guidelines for using VR in ID can result in inadequate planning, leading to unsatisfactory learning experiences [13].

Finally, collaboration between educators, instructional designers, and technology experts is crucial to overcoming difficulties implementing ID in VR environments. A participatory approach to ID can facilitate the harmonization of perspectives and co-creating content that meets students' needs [14, 15]. Therefore, exploring and describing these implementations to enable replication and practical application [16] is necessary. Also, collaboration is essential to ensure that learning experiences are both technologically and pedagogically practical, promoting meaningful and engaging learning [5, 6, 10].

In summary, while ID offers a valuable framework for lesson planning in virtual reality environments, its practical application requires continuous training and careful planning.

2 Case Study

The study involved 13 students (primarily teachers or education professionals) from the Master in Digital Resources in Education, aged between 36 and 59, during the Digital Resources II course in the second semester of the 2023/2024 academic year. Of these, 46% had no prior experience with Immersive Virtual Reality. The methodology was structured into two complementary sessions, combining the practical exploration of virtual reality (VR) technologies with theoretical reflection on their implementation while considering instructional design principles.

First Session: Introduction and Immersion in Virtual Reality. The first session focused on familiarizing participants with VR learning environments and providing practical experience. The main steps in this session were:

Familiarization with VR Use. Participants were introduced to VR devices, specifically the Oculus Quest 2 and the VRChat platform, which enables the exploration of immersive and interactive learning environments.

Exploration of VR Learning Scenarios. During the session, participants engaged in a guided tour of various virtual scenarios available on VRChat, created as part of the REVEALING project, which falls under the Erasmus+ initiative (Erasmus+ Project REalisation of Virtual Reality Learning Environments (VRLEs) for Higher Education). The goal was to explore the pedagogical potential of this technology, particularly in creating active and immersive learning experiences.

Reflection on Challenges and Opportunities. After exploring VR scenarios, participants were encouraged to reflect on the possibilities, limitations, and challenges of using VR in education. The discussion emphasized the importance of specific training for educators to adopt and apply VR effectively. The literature indicates that the lack of adequate training is one of the significant obstacles to the successful implementation of VR, often leading to hesitancy or limited use of the technology [4].

Initial Planning of Pedagogical Activities. The session concluded with a guided oral discussion, during which participants began outlining ideas for integrating VR into pedagogical activities relevant to their respective teaching areas to prepare them for the second session.



Fig. 1. Participants explored virtual reality and the escape room activity during the first session.

2.1 Session: Pedagogical Planning and Application of the Instructional Design Model

The second session focused on ID concepts' theoretical and practical application in planning pedagogical activities. The flipped classroom model guided the transition between the first and second sessions [17–19]. This model shifts the subject study, typically part of direct instruction, to outside the classroom, ahead of scheduled classes, allowing in-class time for collaborative and interactive activities dealing with the subject matter application, realization, debate, and in-depth exploration. Recent studies highlight the effectiveness of this approach in promoting active learning [17–19], developing critical thinking skills, and fostering lifelong learning adaptability. In this way, all the material necessary to understand the content of the second session was previously made available to participants on the course's Moodle platform, namely the instructional design model proposed during the REVEALING project's development, general information about the project, as well as the PowerPoint presentation of the session containing the concepts addressed. The main steps in this session were:

Review of Instructional Design Concepts. Participants began with a theoretical review of the fundamental elements of ID, emphasizing their application in lesson planning that incorporates digital technologies. The instructional design model used was developed during participation in the REVEALING project.

Lesson Planning Based on Instructional Design. Participants were then challenged to design a lesson or teaching session, applying the ID model discussed. This task required a critical analysis of the essential components of the teaching-learning process, including objectives, methods, and assessment.

Data Collection. Data were collected during both sessions using structured questionnaires.

2.2 Questionnaire from the First Session

After the practical VR experience, participants completed a structured questionnaire [20] with questions distributed across the following categories: (1) Use/control of the virtual environment; (2) Immersion/presence; (3) Quality of feedback and content; (4) Level of interaction; (4) Motivation to learn and use the virtual environment; (5) Simulator-induced nausea/discomfort; (6) Feelings and sensations when using the simulator. Responses were recorded on a 5-point Likert scale: 1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree.

2.3 Questionnaire from the Second Session

In the second session, participants answered questions about the relevance of the instructional design model presented. Opinions were collected on its positive aspects and areas for improvement, considering both the planning process and the usability of the design elements.

2.4 Data Analysis

The data collected during the first session were analyzed quantitatively. The percentage of responses associated with each point on the Likert scale was calculated for each question in the questionnaire. Only a summary of the results is presented in this study.

The data from the second session were analyzed qualitatively, focusing on the technical elements highlighted by participants and their suggestions for improving instructional design.

3 Results and Reflections

3.1 Session 1

Participants found the VRChat interface intuitive, though some reported difficulties in task completion and physical discomfort. The high levels of immersion and presence suggest VR's potential for engaging learning experiences.

The quality of feedback and content was unanimously praised, helping to maintain teacher engagement. However, perceived differences between virtual and physical interactions were highlighted as areas for improvement. Participants expressed strong interest in continuing to explore VR, showing the motivation generated by the experience.

The session also highlighted physical discomfort and fatigue challenges, suggesting optimizing technological design, adjusting activity duration, and providing more precise guidance. These adjustments are essential to maximize teacher engagement and participation.

3.2 Session 2

Although the primary focus was on analyzing the model, participants also proposed technological improvements, particularly regarding their experience with learning scenarios.

Regarding the technology, they highlighted the need to simplify its use through more intuitive interfaces. They also emphasized the importance of implementing immediate feedback in virtual environments, suggesting the use of artificial intelligence for this purpose and expanding interaction options in these environments. Accessibility was another key point, focusing on reducing implementation costs to make the technology more accessible to different institutions. Additionally, they stressed the importance of learning scenarios within virtual environments with greater interactivity and expanded the discussion on integrating additional opportunities for social interaction within the virtual environment.

As for the instructional design model, participants emphasized the importance of providing more detailed definitions of learning objectives. They highlighted the need to adapt the experience to performance and individual learning styles and goals. Suggestions included implementing feedback systems tailored to each student's progress and enhancing scenario design components, including the organization of specific environments, actors, and monitoring processes. Finally, they pointed out the need to develop more effective methods for evaluating students' progress and comprehension in immersive virtual environments.

4 Implications for Education

This initiative underscores the importance of combining practical exploration with pedagogical reflection to promote educators' confidence in adopting VR.

The two-session structure facilitated initial VR familiarization and allowed participants to understand better and implement instructional design principles.

However, in the second session, despite the prior distribution of materials and previous contact with instructional design concepts, many participants were not as active, receiving only four responses to the final questionnaire. This may indicate difficulties in understanding the instructional design model or implementation challenges due to the limited time. Therefore, the second session could have been even more effective if it had been subdivided into two distinct moments, allowing additional time for practice and reflection on the applications of instructional design in virtual reality.

The reduced engagement in the second session and the small sample size (n=13) highlight the need for further research to validate these findings.

Future studies should focus on a longitudinal study to track the application of VR-integrated lesson plans within real classroom environments and to investigate the long-term impact of this training on teacher performance and student learning.

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