

Gamification and Cultural Heritage: A Comparative Experience Between Virtual Environments Developed in Minecraft and Roblox

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Abstract— The Italian cultural heritage, due to its complexity and territorial diffusion, requires innovative strategies to be enhanced and transmitted to the new generations. In this perspective, the university environment represents a privileged context for experimenting with teaching approaches that integrate digital technologies and forms of active learning. Gamification, understood as the application of playful dynamics in non-playful contexts, has proven to be effective in encouraging engagement, participation, and understanding of complex cultural content. This paper describes a teaching experience conducted in the Computer Graphics course, in which students participated in the virtual reconstruction of the archaeological site of Villa Regina in Boscoreale. Two separate groups carried out the project using the digital environments of Minecraft and Roblox, respectively, following the same operational phases: historical analysis, 3D modeling, narrative design, and interactive tests. In addition to exploring the potential of each platform for enhancing cultural heritage, the objective of this work is to assess the educational impact of the activity through a questionnaire administered to students, focusing on aspects such as cognitive load, motivation, satisfaction, and perception of the effectiveness of the technologies used. The comparative analysis of the two experiences enables us to highlight strengths, critical points, and future scenarios for the application of gamified environments in university teaching, particularly in the context of cultural heritage.

Keywords— *Cultural Heritage, Gamification, 3D Virtual Reconstruction, Educational Technology, Immersive Learning*

I. INTRODUCTION

I Education in cultural heritage today represents one of the fundamental challenges for the education of the new generations, especially in a context such as the Italian one, characterized by a high density and variety of cultural heritage. Transmitting the historical, architectural and symbolic complexity of places of culture requires innovative approaches, capable of overcoming traditional modes of use and communication, and of promoting active, conscious and participatory interaction with the contents[1]. In this scenario, the integration of digital technologies into university training courses is acquiring an increasingly strategic role. Among these, gamification, understood as the application of game mechanics in non-playful contexts, has established itself as an effective tool to encourage motivation, involvement, and

active learning, even in complex areas such as cultural heritage[2]. In fact, the most recent literature highlights how the use of virtual environments, serious games, and immersive tools can enhance the understanding and appreciation of cultural content, favoring cognitive, emotional, and collaborative processes [3], [4]. Among the most widely used digital platforms in education, Minecraft stood out for its flexibility, blocky construction logic, and the possibility of real-time cooperation, proving to be particularly suitable for the virtual reconstruction of historical and archaeological contexts [5]. At the same time, environments such as Roblox, which were also born as playful tools, are emerging as creative spaces for 3D modeling, visual programming, and the creation of interactive narrative experiences, with a growing impact in educational and exhibition contexts as well. In particular, there is a lack of studies that comparatively analyze the educational value of different gamified environments applied to the same cultural context and with the same training target. This work is part of the framework, proposing a comparison between two parallel teaching experiences conducted within the Computer Graphics course of the degree program in Building Engineering-Architecture at the University of Salerno. In both cases, the students were involved in the virtual reconstruction of the archaeological site of Villa Regina in Boscoreale, using the Minecraft and Roblox platforms, to critically reflect on the educational and communicative potential of the technologies used.

II. PROPOSED METHODOLOGY

The project described in this study is part of the Computer Graphics training course, which focuses on learning digital architectural representation techniques and experimenting with innovative tools for project communication. The activity began with the selection of a real case study, Villa Regina in Boscoreale, a Roman archaeological site within the Archaeological Park of Pompeii, aiming to guide students through an integrated process of analysis, modeling, and virtual reconstruction of architecture. The entire site has been divided into thematic portions, assigned to working groups that have worked in parallel, adopting different development platforms: Minecraft and Roblox. Each group started its activity with a phase of study of documentary sources, including plans, reliefs, images, and historical descriptions, to digitally reconstruct the spaces in a way consistent with the archaeological reality. In both environments, the modeling

was based on principles of proportion, modularity, and volumetric coherence, adapting the technical specificities of the platforms to the need to represent complex architectural elements, such as peristyles, thermal environments, vaulted rooms, and agricultural structures. The geometric and graphic limits imposed by the two development environments were addressed through conscious design choices, which guided the simplification or abstraction of some elements, while maintaining consistency with the distribution system and the spatial logic of the original site. Particular attention has been paid to the design of interactive paths within virtual environments, conceived not only as navigation spaces but as real narrative devices. In this direction, the students experimented with environmental storytelling dynamics, integrating textual, visual, and sound elements to enrich the exploratory experience and encourage an immersive reading of architecture. The comparison between the two platforms has made it possible to highlight different approaches to architectural restitution. If Minecraft has favored a modular and collaborative construction based on "voxel-based" logic, Roblox has offered more possibilities for graphic customization and scripting, paving the way for more articulated and interactive modeling. In both cases, architecture became a didactic medium, through which students were able to develop skills related to 3D modeling, digital representation and spatial communication in immersive environments

III. EXPERIMENTAL PHASE

The experimental part of the instructional activity, which took place at the end of the course, aimed to assess the competencies acquired in digital modeling and immersive design related to cultural heritage. The students were divided into two groups, each working on the same project assignment, utilizing the Minecraft and Roblox platforms, respectively. The tasks were categorized into a standardized sequence of phases: investigation of historical and architectural sources, the establishment of the narrative framework, three-dimensional modeling, creation of interactive components, and validation through testing and cross-verification. An anonymous questionnaire, organized into four categories and on a 5-point Likert scale, was conducted to evaluate students' perceptions of cognitive load, motivation, satisfaction, and platform usability. The obtained results indicate a predominantly favorable assessment of both experiences, with notable discrepancies in some key domains. Minecraft outperformed Roblox in accessibility and operational clarity, achieving an average of 4.25 in the Cognitive Load category, compared to Roblox's 3.95, and a score of 4.55 for Motivation and Engagement, which is slightly above the 4.45 average of the latter group. Moreover, Minecraft was seen as less technically challenging (average difficulty 2.1), promoting teamwork and self-directed activity management. Roblox demonstrated superior efficacy in customizing and creative possibilities, achieving an average score of 4.6 for customization skills, in contrast to Minecraft's score of 4.0. Despite an elevated initial cognitive load resulting from a steeper learning curve (average difficulty: 3.5), it achieved the highest score in the Platform Usability category (4.25, compared to Minecraft's 4.10), affirming its suitability for more intricate narrative experiences. The experience highlighted the educational efficacy of both

platforms, with distinct characteristics: Minecraft was more accessible and collaborative, whereas Roblox offered deeper expressive depth. Both methods substantially enhanced the development of digital, design, and critical abilities, resulting in a high level of overall satisfaction.

IV. CONCLUSIONS

The experience described in this contribution has highlighted how the integration of gamified environments in the context of university education can represent an effective strategy to promote active learning, awareness of cultural heritage, and the development of technical and narrative skills. Through the virtual reconstruction of Villa Regina in Boscotrespol, students in the Computer Graphics course of the degree program in Building Engineering-Architecture at the University of Salerno have experimented with two different platforms (Minecraft and Roblox), which, despite their differences, have both proven to be valid for educational and cultural purposes. The comparative analysis revealed that Minecraft lends itself particularly well to cooperative experiences, boasting a low learning curve and an intuitive interface. At the same time, Roblox offers more customization and scripting possibilities, making it more suitable for complex design contexts and students with strong digital skills. The data collected through questionnaires confirm the methodological soundness of the approach adopted, highlighting high levels of satisfaction, participation, and perception of educational usefulness. In addition, the adoption of a replicable model of activities, based on structured phases and accessible tools, makes the experience easily extendable to other training contexts, including in schools or museums. In the future, the project can be further developed by integrating advanced interactive elements, sensory simulations, and digital twin functionalities to create intelligent environments that connect the virtual world with the physical one. With this in mind, play platforms can evolve into multidisciplinary design and communication tools, promoting an increasingly immersive, participatory, and accessible use of cultural heritage.

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