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Mobile games for the Revival of Archeological Parks in Campania: A Pilot Experience Bridging Virtual Environments and Cultural Heritage

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Abstract **– Italy's archaeological heritage is extraordinarily rich and widespread, yet its valorization is often inconsistent. Many sites with high historical and cultural value remain on the margins of public engagement due to limited resources and poor visibility. A striking example is Longola archaeological park da Poggiomarino whose historical relevance remains largely underexplored.**

This work proposes the development of an educational mobile video game designed to enhance knowledge and appreciation of the site through an interactive experience primarily intended for children. The prototype is structured as an infinite runner and step-by-step construction game, where players explore the culture of this long-lost village by following a storyline built with educational storytelling techniques.

The system architecture integrates accurate historical content to foster active engagement, learning, and historical empathy. The game is designed to extend beyond the digital experience, encouraging children to continue the adventure through an on-site visit, where they can interact in real life with what they learned in the video game. The overall goal is to offer an effective tool for heritage education in both school and museum settings by promoting a model that motivates users to physically engage with lesser-known archaeological parks, leveraging the potential of digital technologies and game-based dynamics. A preliminary experimental phase will assess the usability and educational impact of the prototype.

I. INTRODUCTION

Italy holds one of the world's most extensive cultural heritages, shaped by millennia of historical, artistic, and civic stratification. However, the exceptional richness and geographic dispersion of archaeological and monumental assets are hindered by a chronic shortage of economic and infrastructural resources dedicated to their valorization [1], [2]. Consequently, many sites—despite their profound historical and cultural value—risk being excluded from touristic circuits and collective memory, metaphorically "frozen in amber."

A paradigmatic case is Longola that introduces a new dimension to the customs of that area. Furthermore, the site demonstrates that Pompeii and Herculaneum citizens are the descendants of a population whose roots stretch back millennia; that they still participate in that same ancient "water culture" that the inhabitants of Longola have so astutely harnessed to their advantage [3], and still its narrative and educational potential remains largely untapped.

In this context, new digital technologies—such as gamification, storytelling, and mobile applications—offer concrete opportunities to enhance and make accessible historical sites that are often neglected. These tools can facilitate new modes of interaction, learning, and public engagement, particularly among younger generations [4], [5].

In recent years, gamification has emerged as one of the most promising strategies to foster interaction, learning, and engagement in non-game contexts, including education, marketing, and cultural heritage promotion. Gamification refers to the application of game mechanics—such as scoring systems, rewards, levels, missions, and interactive narratives—within non-gaming environments to stimulate active and participatory behaviors [6], [7].

In the cultural heritage domain, gamification has demonstrated the ability to surpass traditional passive modes of engagement, transforming visitors into active and emotionally involved participants, particularly when combined with communicative techniques such as digital storytelling and mobile platforms. The use of accessible, co-created digital games not only raises cultural awareness but also promotes inclusion and sustainability through participatory design [8].

Recent studies have shown that gamification can enhance both hedonic (pleasure and enjoyment) and eudaimonic (reflection and personal growth) aspects of learning, although outcomes vary depending on the context and audien ce [9]. The balance between educational value and entertainment is especially evident in comparisons between gamified and non-gamified museum environments, where the former tends to facilitate more profound and more enduring interactions with cultural content. Kurniawana, Sademia and Maulana [10] came to the conclusion, after they conducted a study on gamification and augmented reality experiences applied on British museums, most users were more engaged throughout their tour and the immersive experience provided an easier way to learn [11]. This approach is particularly well-suited for archaeological parks, where narrative reconstruction helps bridge the gap between ancient ruins and the visitor's imagination, offering especially younger audiences a direct, emotional, and immersive connection to antiquity [12], [13].

Within this framework, it is possible to design and develop a prototype of an educational video game that brings ancient daily life to life, aiming to raise children's awareness of historical, social, and civic themes through an interactive and engaging experience. The game is envisioned as a infinite runner and step by step building, guided by a narrative that weaves together playful elements and historical content through storytelling techniques [4], [14], [15]. This approach not only maintains children's attention but also reveals the cultural value of often-overlooked sites, such as the Archaeological Park of Longola, which remains marginalized in contemporary cultural and touristic experiences. A portion of the game may also be completed on-site, allowing players to acquire additional elements that enrich the user's learning experience [16], [17].

The article is structured as follows: the next section reviews related works to contextualize the project within the academic discourse on gamification in cultural heritage. This is followed by a description of the system architecture, focusing on narrative, technological, and onsite experiential aspects. Subsequently, the video game prototype is presented, including a preliminary experimental phase aimed at assessing feasibility and educational potential. The contribution concludes with reflections on the results and future developments, emphasizing the model's replicability and integration into educational and museum contexts.

II. RELATED WORKS

The growing interest in the use of gamification and immersive technologies for promoting cultural heritage has led to a wide range of studies exploring their potential in educational and tourist contexts.

It was discovered that gamification in digital marketing can enhance the online image of cultural heritage sites. Through two experiments, they demonstrated that gamified content generates greater interest and appeal than traditional approaches, improving destination perception. However, the effectiveness also depends on the cultural symbolism of the storyteller. The paper proposes the AIEDA model (attention, interest, evaluation) as a framework for evaluating gamified cultural marketing strategies [18].

In the field of cultural heritage, initiatives such as the didactic experience at the University of Trieste have explored the potential of ESRI Story Maps to integrate *digital storytelling* and gamification techniques. Through interactive narratives, text, images, videos, and web maps were combined producing territorial stories that not only foster geographical understanding but also encourage active and playful engagement with heritage [19].

Another relevant approach is the development of open-source 3D web platforms designed to document and narrate cultural heritage sites. In the case of the Farnese Castle in Piacenza, such a platform combined geomatic surveys with interactive navigation, offering users an accessible and engaging way to explore the site's history. By lowering technical barriers and promoting playful interaction, this methodology highlights how digital storytelling and gamified exploration can broaden access to heritage for both experts and general audiences [20].

Finally, there're also interdisciplinary development that focuses on the digitization of historical soundscapes in Évora between 1540 and 1910 via an interactive platform accessible on mobile devices. Although not centered on gamification, it demonstrates how sensory-based historical narratives can be integrated into digital environments [21].

In contrast to the studies mentioned above, the system proposed in this work distinguishes itself in several ways. First, it focuses on a lesser-known and underutilized archaeological site—Longola—which, despite its rich historical and cultural significance, remains peripheral to both academic and touristic circuits. This choice presents a challenge but also an opportunity to test the potential of gamification in marginal or overlooked contexts.

Moreover, the approach favors experiential, historical storytelling explicitly tailored to a young audience. The game is designed as an educational endless runner and a step-by-step village-building mechanic, combining playful mechanics with authentic historical content to emphasize narrative and sensory dimensions within an inclusive and accessible framework.

Unlike general-purpose platforms or models primarily aimed at online consumption, the proposed prototype promotes an interactive use that encourages physical visits to archaeological sites. This enables a mixed physics experience science that strengthens the connection between place, history, and participant, fostering emotionally meaningful and contextually grounded learning.

III. THE PROPOSED APPROACH

This contribution proposes the development of an educational mobile video game designed to promote the Longola Archaeological Park through an interactive, narrative-based experience for children. The system aims to combine gamification, storytelling, and mobile technologies to make the history of an underappreciated heritage site accessible and engaging.

The system architecture is structured across three main interconnected layers: the narrative layer, the technological layer, and the on-site experiential layer, designed to integrate with the visitor (user) experience at the archaeological park seamlessly (see Fig.1). The videogame acts as the mediator between heritage content and the user, establishing a bilateral interaction: while the game provides stimuli through narrative and mechanics, the user responds with actions that influence the unfolding experience, creating a continuous feedback loop that drives engagement and learning.

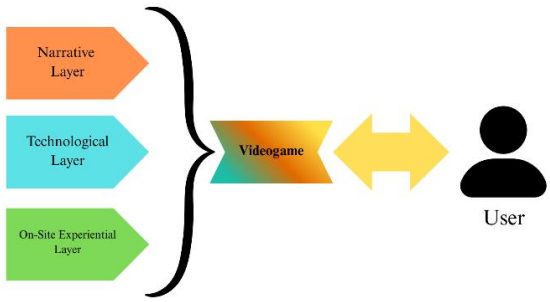

Fig.1. Work flow of the videogame and its user.

A. Narrative Layer

At the core of the system lies a dynamic narrative framework grounded in principles of educational storytelling. The game's storyline is structured around missions inspired by Longola's ancient water culture, guiding children through an endless runner and a step-by-step village-building mechanic. These mechanics invite players to reconstruct aspects of daily life, such as collecting typical objects and learning about traditional building practices. The narrative is intentionally aligned with historical and archaeological findings, transforming abstract knowledge into an embodied and interactive journey. By encouraging players to identify with the inhabitants of Longola, the system fosters historical empathy and helps children contextualize the cultural value of the site.

B. Technological Layer

The application can be developed for mobile devices using a 2D/3D game engine and supported by a variety of location-based technologies (e.g., GPS, QR codes, or beacon systems) that trigger content in proximity to real points of interest. The in-game experience may, in the future, integrate mini-games, augmented reality (AR) components, and interactive narrative objects, creating multiple layers of engagement.

Gamification elements—such as missions, achievements, and reward systems—can be embedded to motivate participation and sustain user interest. The overall system is conceived as modular and adaptable, allowing future updates as well as replication in other cultural or educational contexts.

C. On-Site Experiential Layer

The final layer focuses on extending the digital experience into real-world interaction during site visits. Children, guided by educators or parents, are encouraged to explore the archaeological park while recognizing and connecting with places they first encountered in the game. This mirroring of virtual and physical environments strengthens memory retention and enhances cultural learning. The system also promotes collaborative play, as children can share discoveries, solve challenges together, and discuss the cultural significance of what they encounter. At the conclusion of the visit, each child receives a narrative summary—accessible via a dedicated website—which not only consolidates what they learned but also provides further information about the park. This continuity between gameplay, site exploration, and post-visit reflection highlights the potential of the system to foster long-term engagement with cultural heritage.

Overall, this architecture seeks to merge game and history, bridging digital and physical spaces with a strong emphasis on accessibility, historical empathy, and replicability. Its layered design demonstrates how interactive storytelling, and gamification can be applied to underrepresented heritage contexts, offering a sustainable and adaptable model for heritage education.

IV. GAME IMPLEMENTATION

A. Narrative Layer

The development of the system is grounded in a collaborative and interdisciplinary effort. The narrative component is designed in close cooperation with archaeologists and art historians, ensuring historical accuracy and cultural sensitivity. Drawing on the discoveries of Cicirelli and Livadie [3], the storyline is informed by original excavation findings, which provide the basis for reconstructing the cultural practices and daily life of ancient Longola society.

B. Technological Layer

The technological dimension provides the infrastructure for delivering this narrative. The application is developed for online display using the 2D game engine Construct 3 (see Fig.2), ensuring accessibility and cross-platform compatibility. QR codes are strategically placed at points of interest across the archaeological park, serving as triggers that activate gameplay. This integration enables

visitors to move fluidly between digital interaction and physical exploration. The system is modular by design, allowing scalability, future updates, and adaptation for other archaeological sites with minimal exposure.

Fig.2. Guide example for a 2D video game on the Construct 3 platform.

This combination of historical research, technological development, and pedagogical design demonstrates how interdisciplinary collaboration can transform cultural heritage into an accessible, playful, and educational experience.

C. On-Site Experiential Layer

The videogame is structured around three main focal points, each corresponding to a distinct level. The first introduces the user to the narrative context: through an introductory animation, the characters Sarnon and Giormar explain that their village is under threat and that the user's help is essential. The second focal point centers on an endless runner mechanic, chosen both for its familiarity and its ability to capture attention through playful interaction. In this stage, players collect objects typical of Longola culture, based on findings from archaeological excavations. Although designed as an "endless" mechanic, the level is intentionally finite, prioritizing educational goals over prolonged playtime. At its conclusion, players receive feedback on their performance and a short explanation of the collected items. The third and most significant focal point introduces a step-by-step building mechanic, which illustrates the construction of islets and highlights their intrinsic connection to Longola's water culture. Future plans involve testing the game on-site at the Longola Archaeological Park, where players would unlock special content directly tied to the physical environment.

V. EXPERIMENTAL CAMPAIGN

In this section, the experimental results that took place through two parts will be discussed:

A. Pretest-posttest design:

The first phase involves the administration of an anonymous questionnaire after the gaming experience inspired in [22] design. The questionnaire is designed to assess the players' knowledge of the Longola Archaeological Park and its cultural background, as well as their perception of the game's mechanics and learning potential. A Likert scale from 1 to 5 was used, where 1 represents a negative evaluation and 5 a positive one (see Table 1).

Table 1. Questionnaire categories.

Knowledge of the Archaeological Park (A): clarity and accuracy in the information presented about the site.
Knowledge of Longola Culture (B): understanding of the traditions, artifacts, and construction techniques shown in the game.
Characters and Narrative (C): recognizability of the main characters and their role in transmitting historical information.
Game Mechanics (D): ease of interaction with the runner and building mechanics, including clarity of instructions.

The results (see Table 2 and Fig. 3) indicate that the game's characters and narrative are very well received by users, followed closely by the game mechanics. While knowledge about Longola and the Archaeological Park was also appreciated, it did not perform as strongly as the other two categories.

Table 2. Questionnaire answers.

Question	5	4	3	2	1
A1	10	15	1	2	2
A2	10	15	1	0	4
B1	9	14	1	4	0
B2	14	11	4	2	1
C1	14	9	1	2	2
C2	18	10	1	0	3
D1	13	16	4	2	3
D2	10	6	2	0	4

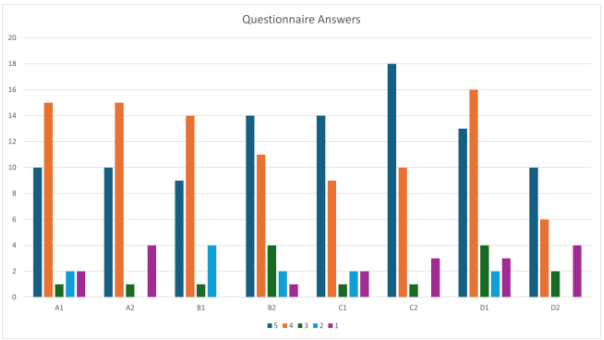

Fig.3. Questionnaire answers graphic.

B. Effectiveness of game design

To evaluate the effectiveness of the game design, two main variables were considered in relation to player performance. The first variable measured completion rates, showing that 73.3% of participants successfully finished the game, while 26.7% were unable to complete it (see Fig. 4).

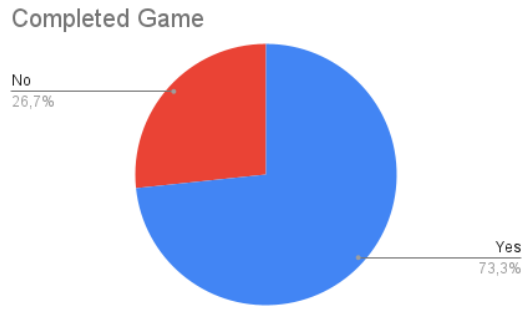

Fig.4. Percentage of users who completed the game.

The second variable analyzed the time required to finish the game. On average, players took 4.84 minutes to complete the experience, with a minimum recorded time of 4.22 minutes and a maximum of 5.46 minutes. These results provide valuable insight into both the accessibility of the game mechanics and the overall balance between challenge and engagement.

V. CONCLUSION

This research project explored the potential of short immersive mobile games to enhance cultural heritage appreciation. The approach aimed to investigate how playful experiences can foster a deeper understanding of daily life in ancient times, while also inviting players to become active on-site visitors for a richer experience.

The methodology adopted combined three pillar layers: narrative, technological, and on-site experiential. The project demonstrated a way to integrate gamification into cultural heritage promotion, with the potential to inspire curiosity and empathy in contemporary audiences.

In the future, we intend to further develop this approach, using AR and geolocation applications to bridge the gap between visitors' imagination and the historical visuals of the parks. We also aim to enhance the categories that showed lower performance and implement strategies to increase the proportion of users who complete the game, focusing particularly on less well-known parks to attract the attention of potential visitors and students.

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