A SYSTEMATIC LITERATURE REVIEW OF GAMIFICATION IN CULTURAL HERITAGE: WHERE ARE WE? WHERE DO WE GO?

Célio Gonçalo Marques[1]
João Paulo Pedro[2]
Marta Dionísio[3]
Paula Almeida[4]
Cláudia Pires da Silva[5]

Abstract:
Gamification has become an important tool in many organizations and fields of study. Despite the growing body of work, there are still many open paths for new research. This paper aims look at the uses of Gamification in the field of Cultural Heritage, to take account of where the research is and to point the open paths for the future in a post-pandemic word. To do this, this paper presents a systematic literature review on Gamification in Cultural Heritage. While other endeavors have been conducted by other authors to map out the field, the scope of this study aimed to be much broader. The goal was to understand who the main actors with publications in the field are, as well as for what purposes and to what forms of Heritage is gamification being applied to. The findings indicate that European institutions are the main publishers of research on Gamification in Heritage, with the field still being dotted with incidental, one-time, studies. Whist intangible forms of Heritage are gaining ground in the use of Gamification, the field is largely dominated by GLAM institutions and groupings of mutually diverse Cultural Heritage assets, such as in tourist destinations. This paper also argues for more substantial networks and collaborative work between researchers.

Keywords: Gamification; Heritage; Tourism; Systematic Literature Review

---

[1] TECHN&ART - Centre of Technology, Restoration and Art Enhancement; Polytechnic Institute of Tomar, *celiomarques@ipt.pt*

[2] TECHN&ART - Centre of Technology, Restoration and Art Enhancement; Polytechnic Institute of Tomar, *j-pedro.techart@ipt.pt*

[3] TECHN&ART - Centre of Technology, Restoration and Art Enhancement; Polytechnic Institute of Tomar, *marta.dionisio@ipt.pt*

[4] TECHN&ART - Centre of Technology, Restoration and Art Enhancement; Polytechnic Institute of Tomar, *paula.almeida@ipt.pt*

[5] TECHN&ART - Centre of Technology, Restoration and Art Enhancement; Polytechnic Institute of Tomar, *claudia.silva@ipt.pt*

REVISÃO SISTEMÁTICA DE LITERATURA DE GAMIFICAÇÃO EM PATRIMÓNIO CULTURAL: ONDE ESTAMOS? PARA ONDE VAMOS?

Resumo:

A gamificação tornou-se uma ferramenta importante em muitas organizações e áreas de estudo. Apesar do crescente campo de trabalho, existem ainda muitos caminhos abertos para nova investigação. Este artigo pretende olhar para os usos da gamificação na área do património, dar conta de onde se encontra a investigação e apontar caminhos para o futuro num mundo pós-pandémico. Para isto, o artigo apresenta uma revisão sistemática da literatura sobre a gamificação no património cultural. Apesar de esforços anteriores para mapear o campo por outros autores, este estudo pretendeu ser mais abrangente. Procurou-se entender quais os principais atores com publicações nesta área, bem como para que propósitos e tipologias de património a gamificação está a ser aplicada. Os resultados indicam que as publicações têm origem principalmente em instituições europeias, com o campo ainda a ser principalmente constituído por estudos ocasionais. Apesar do património imaterial ter ganho terreno no uso da gamificação, o campo é dominado por instituições GLAM e por bens do Patrimônio Cultural mutuamente diversos, como em destinos turísticos. Este estudo revela também a necessidade de redes de investigação e trabalhos colaborativos mais substanciais.

Palavras-Chave: Gamificação; Património; Turismo; Revisão Sistemática da Literatura

1. Introduction

It can be asserted that the academic inquiry into gamification has been gaining maturity. While much of the current literature still approaches it as a novel strategy to be explored, finding increasingly new ways to apply it to specific needs of varying fields and practices, there have emerged more expanded discussions that built on the contributions of previous research (Brigham, 2015, p. 472). The new questions being posed, and new approaches being adopted, can be signs that gamification is finding its place as a tool with merit on its own, deserving of deeper exploration beyond its days as a novelty.

As such, this study comes as a response to this reality: to map out and take stock of this maturing but still expanding field, in its applications to Heritage practice. The goal was to understand where the field is with current developments in Gamification within Heritage and what paths lay open for future research in this apparently steady maturing stage. To do this, a systematic literature review was conducted from a pool of studies indexed in Scopus and Web of Science, given that these are some of the most relevant indexation platforms. The choices of data collection were purposefully made to obtain a very broad set of publications, so that the mapping of the field can be, itself, very broadly encompassing.

This broad scope allows the study to understand the broader directions that gamification within Heritage practice is taking, by asking who the main actors with

publications in the field are, what forms of Heritage is gamification being applied to, and for what purposes. In the following sections, the study begins by presenting a brief exploration of the concept of gamification, drawing from how it has been applied in other fields to inform its application to Heritage practice. This is followed by a detailed description of the methodological approaches in this broad systematic literature review, as well as detailing the steps taken to obtain the sample of publications. The paper then presents and discusses the findings, subdividing them by the main actors in the field and the uses of gamification, as well as an additional discussion on the uses of software in gamified Heritage practice. The study concludes with final remarks on future directions that this research points to, namely the need for more substantial networks and collaborative work between researchers

2. On Gamification and gamified Heritage practice

While there are many definitions and approaches to the phenomenon of gamification, with varying degrees of relation to its namesake act of playing games, one of the most widely accepted working definitions of gamification is that of Deterding et. al., who summarized it very generally as "the use of game design elements in non-game contexts" (2011, p. 9). The study of gamification and its applications, with its many iterations, has caught the attention of a variety of fields, from education and pedagogical debates (Osatuyi, Osatuyi & de la Rosa, 2018), to business and organizational management contexts (Prakash & Manchanda 2021), to finance (Heide & Želinský, 2021), to civic engagement initiatives (Ouariachi & Wim, 2020) and even as a response to the challenges brough about by the Covid-19 pandemic (Cavada, 2022).

Many of the academic discussions revolve around the "emotional and motivational mechanisms through which gamification achieves its impact" (Krath, Schürmann & Korflesch, 2021, p.1), as well as with the elements of game design present in gamified experiences. Gamification has often been heralded as a tool fitted to the cultural patterns of contemporary culture, for its potential to increase engagement, incentivize specific behaviors or participation in a variety of contexts, both individually and in groups/teams, and provide a more digestible way to transmit information. Its emergence is also correlated with the greater presence of digital technologies and mediums in everyday life, with gamified experiences and techniques often making use of new technological developments (Pasca, et. al., 2021).

The field of Heritage has not been left out of the discussions surrounding gamification and its value as a tool, working on the premise that it "encourages increased [public] involvement and engagement" (Brigham, 2015, p. 474). Within the field, gamification has been approached from various angles and perspectives and for varying purposes, from heritage and tourist destination marketing (Xu, et. al., 2016) to tourist product design (Kim, et. al., 2021), safeguard of intangible and digital Heritage goods (Alivizatou, 2019) and even in participatory approaches to dissonant or difficult Heritage (Seitsonen, 2017).

The numerous practices within the Heritage field, from Heritage education to Heritage dissemination, have been heavily influenced by its applications to other disciplines and practices, particularly those originating in Education and Business Studies. However, because it deals with the transmission of information regarding the

past and the inherited goods of a community, Heritage practice presents gamification with specific challenges. As Tara Brigham put it "unlike designing linear lectures or a static online learning module, gamification might require the creation of storyboards, flowcharts, prototypes, or computer code, in addition to a cycle of experimentation, assessment, feedback, and modification" (2015, p. 475).

Brigham's (2015) observations are just some of the challenges presented to Heritage practitioners. The reflections and discussions within the field are ripe for debate around not just the effectiveness of gamification within the practice, but also around the many complexities that gamification brings to the treatment of the inherited past. As such, as the field matures and these expanded discussions emerge further, it becomes important to map out the ebbs and flows of these debates, in its broad and multiple dimensions.

Some studies have taken up this goal, with one of the closest being the, likewise, systematic literature review conducted by Imran Khan, Ana Melro, Ana Carla Amaro and Lídia Oliveira (2020), from the University of Aveiro, Portugal, entitled *Systematic Review on Gamification and Cultural Heritage Dissemination*. Whilst this is a very comprehensive study, opening significant doors for the conversation around gamification in Cultural Heritage, its focus is still on Heritage dissemination. Building on the work of these and other authors, this study aimed to go further, towards a broader understanding of the field.

3. Systematic Literature Review Methodology

To map out the field of Gamification in Heritage practice in a broader sense, a systematic literature review methodology was adopted. The selected data bases were Scopus and Web of Science and the search terms were "HERITAGE" and "GAMIFICATION". The databases and the search terms were purposefully selected to find the relevant papers in a broader pool of results within this intersection. This first query yielded 131 results in Scopus and 119 in Web of Science.

Secondly, the pool was limited to the following parameters: 1) only studies published over the last 5 years (2017-2021); 2) only publications in English; 3) only journal articles, conference papers and book chapters. This limited the results to 66 in Scopus and 50 in Web of Science, a total of 116 articles. Following this, the publications were checked for overlaps between both indexation platforms, which lowered the sample to 92 publications.

Finally, the content of the publications was examined to access their relevance to this research. Because the goal was to provide a very transversal understanding of the field, the main inclusion criteria for consideration was the focus of the publications being the application of gamification to the Heritage field. This excluded publications that only mentioned gamification or heritage, without tackling the intersection of both. With this, the final sample of publications in consideration was narrowed down to 77. All of the publications are referenced in Table 1, divided into the established categories of uses of gamification in the Heritage field.

While this is still a fairly large sample, it meets the established purpose of providing a broader mapping of the field. This also meant that the research question that guided the

inquiry should be done in accordance with the limitations of a sample such as this. As such the following research questions were formulated to guide the analysis:

1. Who are the main actors with publications in the field?
2. What forms of Heritage is gamification being applied to?
3. For what uses is gamification being applied?

4. Findings and discussion

Of the analyzed sample, the publications are mostly conference papers, referring to 64.94% of the total, 25.97% being journal articles and 9.09% book chapters (figure 1). Regarding the evolution of the number of publications in the field, within the past 5 years, from 2017 to 2021, there is an indication of a slight general increasing trend (figure 2). Whereas there were 13 publications in 2017, followed by a decrease to 9 in 2018, 2019 and 2020 saw an increase to 19, respectively, with only a small decrease in 2021, with 17 publications. Although the evolution of these numbers cannot on its own to claim a definitive upward trend, they can be indicative of an increasing interest in the gamified Heritage practice, which is what has been observed by previous authors (Pasca, et. al., 2021).

Figure 1. Type of publication
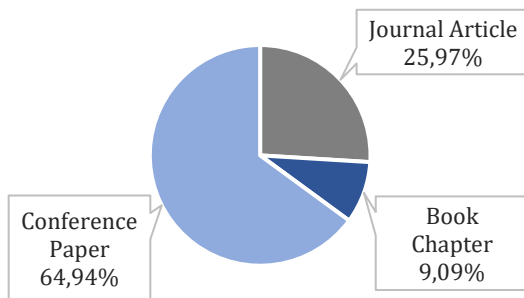
Source: Own authors

Figure 2. Number of publications per year
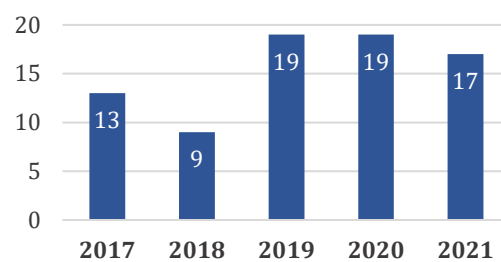
Source: Own authors

The publication with the most citations within the dataset, according to the metadata provided by the indexation platforms, is Deggim, et. al. (2017) *Segeberg 1600- reconstructing a historic town for virtual reality visualisation as an immersive experience.* The following are Vayanou, et. al. (2019) *Designing performative, gamified cultural experiences for groups*, Luimula and Trygg (2017) *Cultural heritage in a pocket: Case study 'Turku castle in your hand'* and Pantile, et. al. (2017) *New Technologies and Tools for Immersive and Engaging Visitor Experiences in Museums: The Evolution of the Visit-Actor in Next-Generation Storytelling, through Augmented and Virtual Reality, and Immersive 3D Projections.*

4.1 Main actors in the field

To map out the main actors and institutions working in the field of gamified Heritage, the study considered the institutional affiliations in the metadata provided by the indexation platforms. The publications of this sample originate from 40 countries and a total of 132 total mentions of institutional affiliations, corresponding to 113 total

institutions and organizations when accounting for institutions with more than one publication.

Regarding the origin of the publications (Figure 3 and 4), a vast majority originate in Europe, with a total of 70,45% of institutional affiliations. Within Europe, Italy leads with authors indicating affiliation to Italian organizations in 19 instances. Italy is followed by Greece, with 14 instances, the United Kingdom with 10, Portugal and Bulgaria at 7 each and Spain with 6. Asia is second in terms of institutional affiliations with 18.18%, with China leading with 8 instances of institutional affiliations, followed by Malaysia, with 5 and Turkey with 4 (which was grouped with Asia due to the location of the institutions being in its Asian territory). The remainder are distributed between the Americas (8), with Colombia (4) and the United States (2) being the most significant, Africa (4), with only Egypt (2), South Africa (1) and Morocco (1) being present, and Oceania only counting with Australia (2) and New Zealand (1).

**Figure 3.** Institutional Affiliations by continent
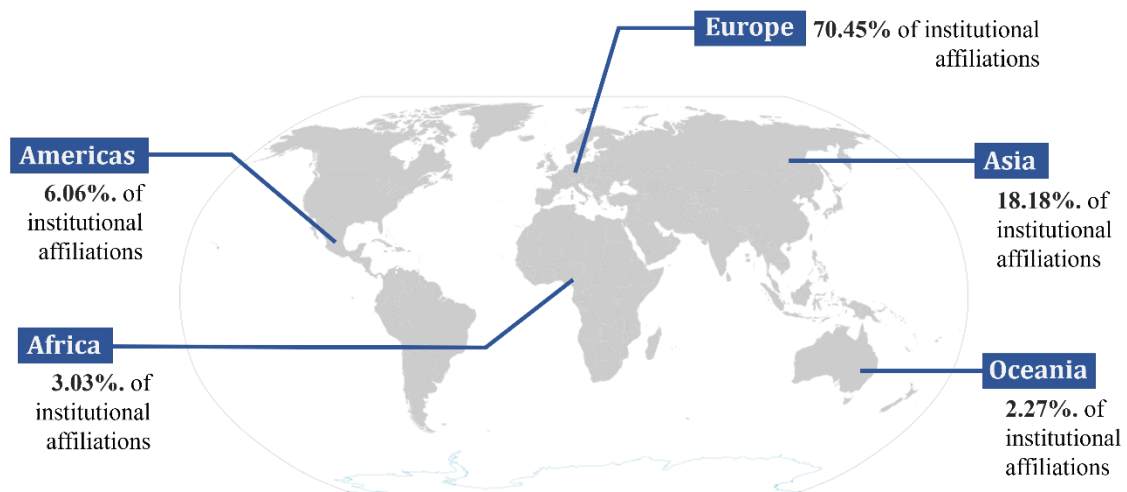
Source: Own authors

A relevant observation can be the relative absence of studies originating from North America, despite the significant literature on gamification from this region, as indicated by the 2016 Oxford Analytica and World Government Summit report (2016, p. 3). Many factors can contribute to this, but one hypothesis (relevant for future research) can be that, although many developments have been made in United States and Canadian institutions, these could mostly be within the context of education or others such as business applications, with recent publications regarding gamified Heritage practice being mostly from European institutions.

The most prominent organizations in this sample seem to be Lublin University of Technology in Poland, Coventry University in the United Kingdom, the Bulgarian Academy of Sciences in Bulgaria and the Centre for Research & Technology Hellas in Greece, each with 3 publications attributed to authors affiliated with them. This means that, although countries such as Italy do have a lot more institutions who have published within the field, only a few of those have more than 1 publication. This can also indicate that although there is a generalized interest in gamification applied to Heritage, there is still a need for more prolonged research, beyond incidental publications.

Figure 4. Institutional Affiliations across Europe
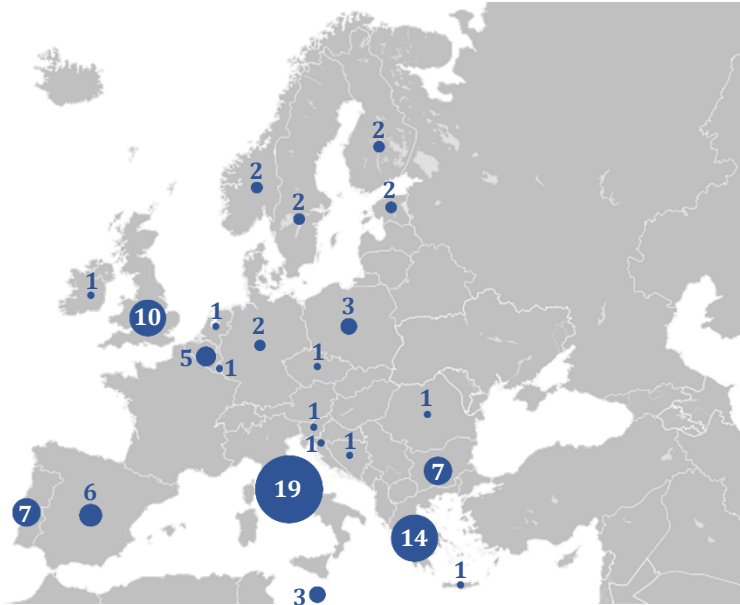
Source: Own authors

Additionally, the vast majority of organizations are higher education institutions, with 89,39% of the total sample. 9 private enterprises do appear as having author affiliations, 3 being from Italy and 2 from Greece, with 5 other instances of other institutions, such as non-profits foundations and independent research groups.

4.2 Heritage and the uses of Gamification

After understanding the "who" of this sample, it becomes important to understand the "what" and the "for what". That is, after analyzing what are the main institutions working within the field, thus mapping where the main debates are coming from, it becomes important to understand how gamification is being studied within academic discussions in this particular, if broad, sample. As such, firstly, this research sought to understand which forms of Heritage gamification is being applied to. After the general reading of the papers, 5 analytic categories were applied:

1. "Cultural Heritage (in general)", used in this context when the paper refers to heritage in general terms or to unspecified Heritage. For example, when a publication refers to the application of Gamification to the cultural heritage of a particular tourist destination, but not to a specific Heritage asset;
2. "Built heritage", referring to instances of heritage approached in its material, particularly architectural aspects;
3. "Archeological site", as the name indicates, referring to the archeological remains and gamification applied to the specific practice of Archeology;
4. "Intangible Heritage", referring to Heritage being approached in its immaterial aspects, namely traditional practices, oral traditions and other immaterial forms of Heritage work;

5. GLAM, the acronym referring to Galleries, Libraries, Archives, and Museums, referring to gamification applied to institutional heritage contexts.

These categories, as noted by González (2019), are not meant to be strict boundaries, as categorization within the heritage field is a very limited endeavor, and for some heritage research may be even detrimental. These are working categories that ought to be taken only to provide a very general understanding of what the authors are working on.

Likewise, it was important to establish analytical categories to understand how gamification was being used in the context of Cultural Heritage practice. This is important, especially because, as Laurajane Smith pointed out, Heritage ought not to be understood as much as what it *is*, but what it *does* (2006, p. 11). That is, the interest in understanding Heritage should not be in finding the best taxonomical descriptors, but in understanding how it is being worked by communities and academics and how it shapes and informs the larger social connectiveness.

As such, this study adopted the uses of gamification techniques as described by Marijana Ćosović and Belma Brkić (2020) in their paper *Game-Based Learning in Museums—Cultural Heritage Applications*. The authors point out 4 main purposes for gamification within the specific context of Heritage work, arguing that these are not watertight categories, but general purposes with great overlap and fluidity between them. These purposes are:
1. Motivation and Engagement; referring to uses of gamification more focused on the experience of the visitor and on techniques to increase their engagement with Heritage;
2. Possibility of Teamwork, referring to a focus on the capabilities for cooperation that gamification can bring about;
3. Progress Assessment, focusing on the use of gamification for the purposes of gathering information that can inform decision making;
4. Creativity Enhancement; referring to strategies focusing mainly on the enhancement of Heritage itself or on new ways to preserve or interpret it.

Following this, the papers were analyzed according to these categories. Regarding the specific forms of Heritage that the papers focused on (figure 5), the results show that the vast majority of publications study gamification within the context of either Cultural

**Figure 5.** Heritage fields in the publications
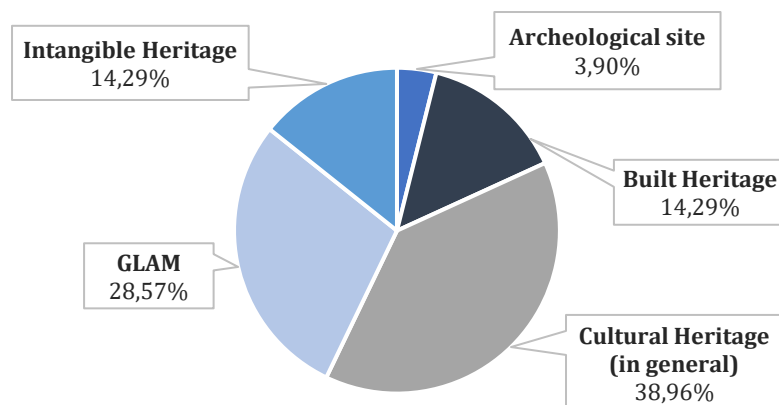
Source: Own authors

Heritage, with 38,96%, in general or GLAM, with 28,57%. This is followed by Intangible Heritage and Built Heritage at 14,29% each, with the remaining 3,90% referring to Archeological sites.

Regarding the second set of analytical categories (figure 6), the results show the large prevalence of gamification being used in Heritage practice with the purposes of either motivation and engagement of audiences (41.56%) or creativity enhancement of Heritage work itself (40,26%). Progress assessment is in penultimate place with 14.29% and the use for collaborative purposes is only represented in 3,9% of the sample. While the prevalence of the first two general uses is predictable given the specific needs of Heritage practice, it is notable that teamwork is not a relatively relevant use in this context, as collaboration is a large contributing factor for the use of gamification in other practices, such as education or teambuilding work (Meske, et. al., 2016). Table 1 corresponds to the sample distribution according to these purposes of gamification.

Figure 6. Gamification applications in Heritage practice
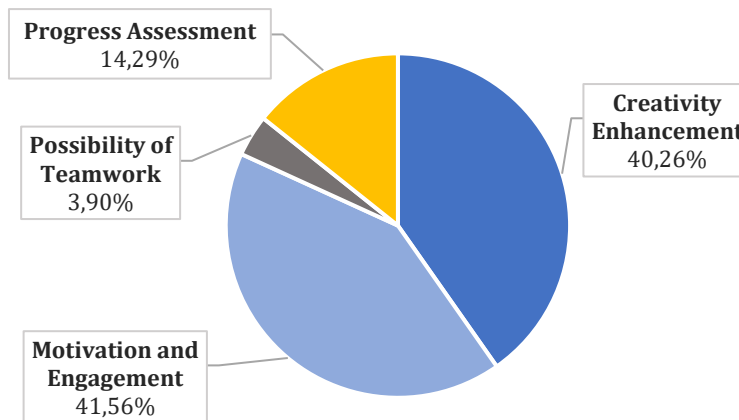
Source: Own authors

Figure 7. Forms of Heritage with Motivation and Engagement purposes
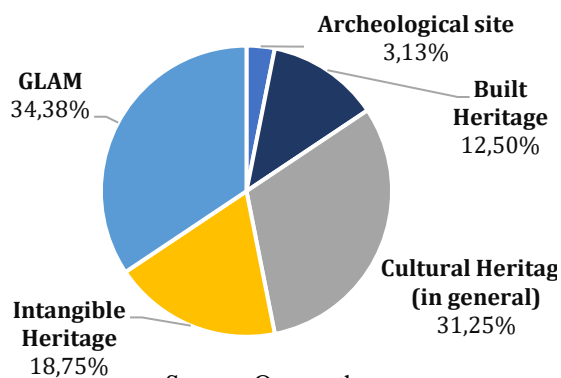
Source: Own authors

Figure 8. Forms of Heritage with Creativity Enhancement purposes
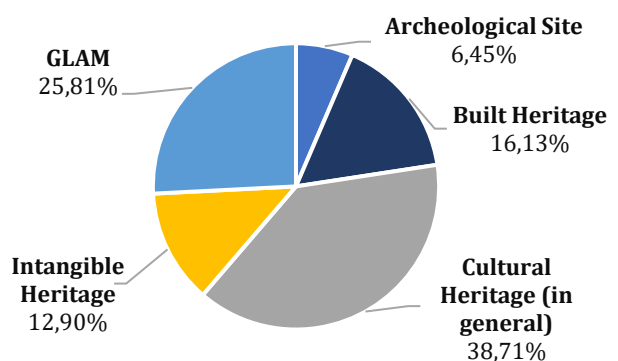
Source: Own authors

While there can be many contributing factors for this observation, one to consider can be the possibility that gamification for collaborative purposes can appear in heritage contexts, but it is mostly studied within the academic inquiries of other fields (for example, human resources focused studies into the effectiveness of teambuilding

techniques through tourism), thus not appearing represented within this sample. The instances in which it does appear seem to focus mostly on the possibility for the sharing of experiences with other visitors.

When it comes to how each gamification purpose is distributed by form of Heritage, the results show a distribution very similar to the general distribution of forms of Heritage (Figures 5 and 6). Beyond a slight prevalence of motivation and engagement purposes in GLAM, Intangible Heritage and Cultural Heritage in general, when compared to their distribution for creativity enhancement purposes, the differences are not particularly notable.

Table 1. Publications per purpose of Gamification in Heritage Source: Own authors

Gamification purposes in Heritage practice	Publications
Motivation and Engagement	Alatrash, Arnab, & Antlej, 2021; Alatrash, Arnab, & Antlej, 2021; Bălutoiu, et. al., 2019; Bazzurri, & Picardello, 2018; Benito-Santos, et. al., 2021; Bujari, Ciman, Gaggi, & Palazzi, 2017; Cauchi, & Scerri, 2019; Ceccacci, et. al., 2021; Chrast, & Beseda, 2018; Cunha, Mendonça, Morais, & Carvalho, 2018; Di Paola, Inzerillo, & Alogna, 2019; Georgiev, & Nikolova, 2021; Geronikolakis, et. al., 2020; Jia, et. al., 2019; Lah, et. al., 2020; Lee, 2019; Liritzis, & Volonakis, 2021; Lopez-Martinez, Carrera, & Iglesias, 2020; Lu, Yuan, Lin, & Yuan, 2020; Luigini, et. al., 2019; MacLeod, Reid, Donald, & Smith, 2021; Merchan, et. al., 2018; Micheletti, 2017; Pantile, et. al., 2017; Sprugnoli, et. al., 2021; Tan, & Lim, 2017; Varinlioglu, & Halici, 2019; Wang, Li, Shi, Shi, & Mi, 2019; Weng, Shen, Chen, & Xiao, 2019; Widarti, Suyoto, & Emanuel, 2020; Wilhelmsson & Backlund, 2020; Xiang, et. al., 2021.
Creativity Enhancement	Anastasovitis, et. al., 2018; Aydin, 2017; Bugeja, & Grech, 2020; Cordeiro, Sousa, & Carvalho, 2021; Cosovic,& Brkic, 2020; Deggim, et. al., 2017; Fakhour, et. al. 2020; Grammatikopoulou, et. al., 2019; Guarneri, et. al., 2020; Konstantinov, Kovatcheva, & Palikova, 2018; Liestøl, Ritter, & Ibrus, 2019; Liestøl, 2018; Luigini, & Basso, 2021; Luimula, & Trygg, 2017; Markopoulos, et. al., 2020; Matthys, et. al., 2021; Michala, Alexakos, & Tsolis, 2018; Montusiewicz, et. al., 2017; Moumoutzis, et. al., 2021; Montusiewicz, et. al., 2017; Noev, Goynov, Sapundjiev, & Valev, 2017; O'Connor, Colreavy-Donnelly, & Dunwell, 2020; Papathanasiou-Zuhrt, Weiss-Ibanez, & Di Russo, 2017; Quattrini, et. al., 2019; Roy, Singh, & Padun, 2021; Slavova-Petkova, 2017; Tsai, & Chiang, 2019; Vlizos, Sharamyeva, & Kotsopoulos, 2021; Uribe, et. al., 2020;
Possibility of Team Work	Basaraba, 2018; Nofal, 2020; Vayanou, et. al, 2019.
Progress Assessment	Corallo, et. al., 2019; Ivanjko, 2019; Kontiza, Liapis, & Jones, 2020; Lee, Yi, & Kim, 2020; Liberato, Nunes, & Liberato, 2021; Lopez-Martinez, Iglesias, & Carrera, 2020; Prandi, et. al., 2019; Synnes, et. al., 2019; Senatore, Gallozzi, Cigola, & Strollo, 2020; Slavec, Sajincic, & Starman, 2021; Stefanov, et. al., 2017;

On a final analytical note, there is a considerable prevalence of the use of digital technologies and software in gamification, be it in Heritage practice or in other fields. As such, it is also important account for the uses of software within this sample of publications. Because of the large scope of the sample, the following very general

categories were applied: 1) Online; 2) Stand-alone; 3) Mobile apps; 4) Unspecified. The results (figure 9) show a very slight prevalence of stand-alone software, with 31.17% of instances, followed very closely by unspecified use of software (27,27%), mobile apps (22.08%) and online resources (19.48%).

Figure 9. Software applications for Gamified Heritage
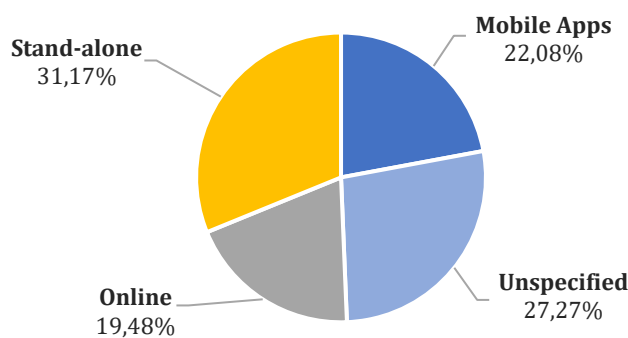
Source: Own authors

Although the further development on the specifics of software usage fall outside the scope of this study, a notable observation can be the prevalence of virtual reality and augmented reality within the context of Heritage work, as evident in this sample of publications. These seem to be often associated with Heritage interpretation and safeguard, with notable prevalence of 3D modeling. Digital games also seem to appear rather frequently, raging from games created independently for the purposes of Heritage work, to the adaptation of preexisting sandbox/open world games for Heritage work purposes, such as the use of Minecraft, as described by MacLeod, Reid and Smith (2021).

5. Conclusions and Future directions

As stated in the opening lines of this study, gamification is gaining the status of a respected part of the toolbox for various practices, no longer just a novelty to explore. The field has steadily been maturing enough to span numerous approaches and debates (Brigham, 2015, p. 472). This study was a response to this reality: to map out this maturing but still expanding field, in its applications to Heritage practice. As such, the purposefully broad scope of the study can indicate some important directions for future research.

In summary, the findings indicate the prevalence of European institutions in the field of gamified Heritage practice, with Italy, Greece, the UK, Portugal, Bulgaria and Spain having the most institutions with publications in the field and with higher education institutions being at the forefront of research. Despite this, the numbers indicate that many studies are still incidental, one-time publications. The study also found that gamification is also mostly being studied within the context of Cultural heritage in a broad sense, groupings of mutually diverse assets, and GLAM institutions, with some importance to intangible Heritage.

Additionally, gamification seems to be mostly used for the purposes of Creativity Enhancement and Motivation/Engagement of visitors, with open doors for studies regarding collaborative work, like it appears in the use of gamification in other fields.

Finally, regarding the use of digital technologies and software in gamification, there is a generally even distribution of its applications, with the main takeaway being its importance in gamified Heritage practice.

One of the most important aspects that this research points to is the observation that a vast majority of the field is dotted with incidental, one-time, studies. That is, while there is a lot of significant work, much of the research is not expanded with later papers by authors. This is not surprising, as tools and techniques seen as novel often begin with more exploratory or proof of concept papers. However, future research ought to go beyond incidental studies and expand on and debate with ideas that have previously been discussed, as well as studies that go deeper in their discussion of gamification in Heritage.

While much is yet to be done, these more substantial and deeper debates have already begun in other applications of gamification, particularly within the context of education and pedagogical practice and in the general field of business studies. There is an open door for discussions that do not take gamification as an isolated practice, but that study it within the broader context of the debates happening in the field. This is the case with debates on gamification within the field of education, namely its relationship with contemporary governmentality in the "knowledge economy" (Tulloch & Randell-Moon, 2018). As such, more critical approaches within Heritage studies and analysis closer to Cultural Studies ought can provide new and important insights into gamification within Heritage practice.

Finally, this evident maturing of the field requires more substantial networks and collaborative work between authors and institutions. Signs of this already exist within the considered sample, as it is not uncommon for papers to have authors affiliated with different institutions. However, deeper and more expanded reflections require greater consolidation of research and debate networks, both formal and informal in their constitution. This does not mean the need for authors to work in unison. In fact, enriched debates do require diverging positions and the discussions that these instigate. However, these can only happen if future work goes beyond isolated studies and tackles gamification as an established tool in its own merit, with an open door for newer approaches within Heritage studies and with newer questions to be asked.

REFERENCES

Alatrash, S., Arnab S., & Antlej, K. (2021). Interactive storytelling experience for museums in the era of COVID-19. *Proceedings of the European Conference on Games-based Learning*, 795-802.

Alatrash, S., Arnab, S., & Antlej, K. (2021). The Potential of Implementing Interactive Storytelling Experience for Museums. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 713-721.

Alivizatou, M. (2019). Digital Intangible Heritage: Inventories, Virtual Learning and Participation. *Heritage & Society*, 12(2-3), 116-135. DOI: 10.1080/2159032X.2021.1883950.

Anastasovitis, E., Ververidis, D., Nikolopoulos, S., & Kompatsiaris, I. (2018). Digiart: Building new 3D cultural heritage worlds. *3DTV-Conference 2017*, 1-4.

Aydin S. (2017). Decoding kashgar: Participatory digital heritage making via digital online interaction and gamification. *TVX 2017 - Adjunct Publication of the 2017 ACM International Conference on Interactive Experiences for TV and Online Video*, 93-97.

Bălutoiu, M. A., Grădinaru, A., Moldoveanu, A., Moldoveanu, F., Morar, A., Nazare, A. K., & Rădoi, M. (2019). Libquest - revitalize libraries and reading through gamification. *eLearning and Software for Education Conference*, 173-180.

Basaraba, N. (2018). Co-constructing cultural heritage through a web-based interactive digital narrative. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 642-645.

Bazzurri, F., & Picardello, M.A. (2018). Optimization Techniques for Photogrammetry Applied to Cultural Heritage and the Action of Transformation Groups. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 332-348.

Benito-Santos, A., Dorn, A., & Gomez, A. G. L., Palfinger, T., Sanchez, R. T., Wandl-Vogt, E. (2021). Outdoor Education, the Enhancement and Sustainability of Cultural Heritage: Medieval Madrid, *Sustainability*, 13(3). DOI: 10.3390/su13031106

Brigham, T. (2015). An Introduction to Gamification: Adding Game Elements for Engagement. *Medical Reference Services Quarterly*, 34(4), 471-480. DOI: 10.1080/02763869.2015.1082385.

Bugeja, M., & Grech, E. M. (2020). Using Technology and Gamification as a Means of Enhancing Users' Experience at Cultural Heritage Sites. *Studies in Computational Intelligence*, 859, 69-89.

Bujari, A., Ciman, M., Gaggi, O., & Palazzi, C. E. (2017). Using gamification to discover cultural heritage locations from geo-tagged photos. *Personal And Ubiquitous Computing,* 21(2), 235-252.

Bujari, A., Ciman, M., Gaggi, O., & Palazzi, C. E. (2017). Using gamification to discover cultural heritage locations from geo-tagged photos. *Personal And Ubiquitous Computing,* 21(2), 235-252.

Cavada, M., (2022). Evaluate Space after Covid-19: Smart City Strategies for Gamification. *International Journal of Human–Computer Interaction*. DOI: 10.1080/10447318.2021.2012383.

Ceccacci, S., Generosi, A., Leopardi, A., Mengoni, M., & Mandorli, A. F. (2021). The Role of Haptic Feedback and Gamification in Virtual Museum Systems. *ACM Journal on Computing and Cultural Heritage*, 14(3). DOI: 10.1145/3453074.

Chrast, O., & Beseda, J. (2018). New Technologies and New ICT and Gamification-Based Approaches for the Cultural Heritage Education and Comparison of their use in some Czech Republic's Cultural Heritage Sites, Cultural Monuments and

Virtual Museums. *Overcoming the Challenges and Barriers in Open Education.* 401-411.

Corallo, A., Fortunato, L., Renna, C., Sarcinella, M. L., Spennato, A., & De Blasi, C. (2019). Mobile app for promoting cultural heritage: Geostatistic and textual analysis. *IMEKO International Conference on Metrology for Archaeology and Cultural Heritage, MetroArchaeo*, 194-201.

Cordeiro, P. A. N., Sousa J.P., & Carvalho, A. (2021). Digitization and Gamification in Cultural Heritage: The portuguese context in the framework of national and international policies and some practical examples. *Iberian Conference on Information Systems and Technologies – CISTI.* DOI: 10.23919/CISTI52073.2021.9476328.

Ćosović, M. & Brkić, B. (2020). Game-Based Learning in Museums—Cultural Heritage Applications. *Information*, 11(22), 58-63.

Ćosović, M., & Brkic, B.R. (2020). Game-Based Learning in Museums-Cultural Heritage Applications. *Information*, 11(1). DOI: 10.3390/info11010022.

Cunha, C.R., Mendonça, V., Morais, E.P., & Carvalho, A. (2018). The role of gamification in material and immaterial cultural heritage. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018: Innovation Management and Education Excellence through Vision 2020*, 6121-6129.

Deggim, S., Kersten, T.P., Tschirschwitz, F., & Hinrichsen, N. (2017). Segeberg 1600-reconstructing a historic town for virtual reality visualisation as an immersive experience. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*, 42 (2W8), 87-94.

Deterding, S., Dixon, D., Khaled, R. & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification". *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9-15. DOI: 10.1145/2181037.2181040.

Di Paola, F., Inzerillo, L., Alogna, Y. A. (2019). Gaming Approach for Cultural Heritage Knowledge and Dissemination. *27TH CIPA International Symposium: Documenting the Past for a Better Future*, 42(2-W15), 421-428.

Cauchi, M., & Scerri, D. (2019). Enriching tourist UX via a location based AR treasure hunt game. *IEEE International Conference on Consumer Electronics*, 199-204.

Georgiev, V., & Nikolova ,A. (2021). Virtual reality simulations for presenting cultural-historic content in e-learning for kids. *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 11, 267-272.

Geronikolakis, E., Zikas, P., Kateros, S., Lydatakis, N., Georgiou, S., Kentros, M., & Papagiannakis, G. (2020). A true ar authoring tool for interactive virtual museums. *Springer Series on Cultural Computing*, 225-242.

González, P. A. (2019). *O Antipatrimónio: Fetichismo do Passado e Dominação do Presente*. Imprensa de Ciências Sociais.

Grammatikopoulou, A., Laraba, S., Sahbenderoglu, O., Dimitropoulos, K., Douka, S., & Grammalidis, N. (2019). An adaptive framework for the creation of exergames for intangible cultural heritage (ICH) education. *Journal of Computers in Education*, 6(3), 417-450.

Guarneri, M., De Collibus, M. F., Francucci, M., & Ciaffi, M. (2020). The Importance of Artworks 3D Digitalization at the Time of COVID Epidemy: Case Studies by the Use of a Multi-wavelengths Technique. *2020 IEEE 5th International Conference on Image, Vision and Computing*, 113-117.

Fakhour, M., Azough, A., Kaghat, F.-Z., & Meknassi, M. (2020). A Cultural Scavenger Hunt Serious Game Based on Audio Augmented Reality. *Advances in Intelligent Systems and Computing*, 1102, 1-8.

Heide, A. & Želinský, D. (2021). 'Level up your money game': an analysis of gamification discourse in financial services. J*ournal of Cultural Economy*, 14:6, 711-731. DOI: 10.1080/17530350.2021.1882537

Ivanjko, T. (2019). Crowdsourcing image descriptions using gamification: A comparison between game-generated labels and professional descriptors. *42nd International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2019 – Proceedings*, 537-541.

Jia, X., Tan, Y., Xiong, Q., Li, Y., & Hai, W. (2019). Designing edutainment games for intangible cultural heritage: The bnreg project. *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 9, 281-286.

Khan, I., Melro, A., Amaro, A. C., & Oliveira, L. (2020). Systematic Review on Gamification and Cultural Heritage Dissemination. *Journal of Digital Media & Interaction*, 3(8), 19-41. DOI: 10.34624/jdmi.v3i8.21934.

Kim, Y. N., Lee, Y., Suh, Y. K. & Kim, D. Y. (2021). The effects of gamification on tourist psychological outcomes: an application of letterboxing and external rewards to maze park. *Journal of Travel & Tourism Marketing*, 38(4), 341-355.

Konstantinov, O., Kovatcheva, E., & Palikova, N. (2018). Gamification in Cultural and Historical Heritage Education. *12th International Technology, Education and Development Conference (INTED)*, 8443-8451.

Kontiza, K., Liapis, A., & Jones C. E. (2020). Reliving the Experience of Visiting a Gallery: Methods for Evaluating Informal Learning in Games for Cultural Heritage. *Pervasive Health: Pervasive Computing Technologies for Healthcare*. DOI: 10.1145/3402942.3403009

Krath, J., Schürmann, L. & Korflesch, H. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior*, 125. DOI: 10.1016/j.chb.2021.106963.

Lah, H. A., Ghani, R. A., Mahmood, A. S., Rahman, M. N. A., Sulaiman, I., Omar, A., & Mustafa, W. A. (2020). Preserving the Nation's Legacy Through Emerging Technology. *Journal of Physics: Conference Series,* 4. DOI: 10.1088/1742-6596/1529/4/042059.

Lee, B. C. (2019). The Effect of Gamification on Psychological and Behavioral Outcomes: Implications for Cruise Tourism Destinations. *Sustainability*, 11(11). DOI: 10.3390/su11113002.

Lee, J., Yi, J.H., & Kim, S. (2020). Cultural Heritage Design Element Labeling System With Gamification. *IEEE ACCESS*, 8, 127700-127708.

Liberato, D., Nunes M., & Liberato, P. (2021). Wine and Food Tourism Gamification. Exploratory Study in Peso da Régua. *Smart Innovation, Systems and Technologies*, 497-508.

Liestøl, G., Ritter, C.S., & Ibrus, I. (2019). Audiovisual industries and tourism: Forms of convergence. *Emergence of Cross-Innovation Systems: Audiovisual Industries Co-Innovating with Education, Health Care and Tourism*, 165-172.

Liestøl, G. (2018). The Photo Positioning Puzzle Creating Engaging Applications for Historical Photographs by Combining Mobile Augmented Reality and Gamification. *2018 3RD Digital Heritage International Congress (Digitalheritage) held Jointly with 2018 24th International Conference on Virtual Systems & Multimedia (VSMM 2018)*, 245-252.

Liritzis, I., & Volonakis, P. (2021). Cyber-Archaeometry: Novel Research and Learning Subject Overview. *Education Sciences*, 11(2).

Lopez-Martinez, A., Carrera, A., Iglesias, C.A. (2020). Empowering Museum Experiences Applying Gamification Techniques Based on Linked Data and Smart Objects. *Applied Sciences-Basel*, 10(16). DOI: 10.3390/app10165419.

Lopez-Martinez, A., Iglesias C. A., & Carrera, A. (2020). Gamified Smart Objects for Museums Based on Automatically Generated Quizzes Exploting Linked Data. *Proceedings of the 16th International Conference on Intelligent Environments*, 132-139.

Lu, Y. S., Yuan, F., Lin, J. W., & Yuan, K.Y. (2020). TouristGo: a location-based mobile game to improve tourist experience by visiting path optimization, *Personal and Ubiquitous Computing*, 24(3), 405-418.

Luigini, A., & Basso, A. (2021). Heritage Education for Primary Age Through an Immersive Serious Game. *Springer Tracts in Civil Engineering*, 157-174.

Luigini, A., Parricchi, M., Basso, A., Basso, D. (2019). Immersive and participatory serious games for heritage education, applied to the cultural heritage of South Tyrol. *Interaction Design and Architectures*, 43, 42-67.

Luimula, M., & Trygg, M. A. N. B. (2017). Cultural heritage in a pocket: Case study 'Turku castle in your hand'. *7th IEEE International Conference on Cognitive Infocommunications, CogInfoCom 2016 – Proceedings*, 55-58.

MacLeod K., Reid A. J., Donald I. & Smith K. (2021). Cumbrae craft: A virtual environment for teaching cultural heritage to primary school children. *Proceedings of the European Conference on Games-based Learning*, 499-508.

Markopoulos, E., Markopoulos, P., Liumila, M., Almufti, Y., Romano, C. (2020). Digital Cultural Strategies Within the Context of Digital Humanities Economics. *Advances in Intelligent Systems and Computing*, 973, 283-295.

Matthys, M., De Cock, L., Vermaut, J., Van de Weghe, N., & De Maeyer, P. (2021) An Animated Spatial Time Machine in Co-Creation: Reconstructing History Using Gamification Integrated into 3D City Modelling, 4D Web and Transmedia Storytelling. *ISPRS International Journal of Geo-Information*, 10(7). DOI: 10.3390/ijgi10070460.

Meske, C., Brockmann, T., Wilms, K., & Stieglitz, S. (2016). Social Collaboration and Gamification. In S., Stieglitz, C., Lattemann, S., Robra-Bissantz, R., Zarnekow, & T. Brockmann (eds.) *Gamification - Using Game Elements in Serious Contexts* (pp. 93-109). Springer.

Merchan, M. J., Perez, E., Merchan, P., Salamanca, S., & Moreno, M. D. (2018). Making History a New Challenge. 3d Gamification on the Study of Arts Subjects. *11th International Conference of Education, Research And Innovation (ICERI2018)*, 4081-4088.

Michala, M., Alexakos, C., & Tsolis, D. (2018). Digitization and Gamification Technologies in the Design, Development and Evaluation of a Digital Secondary Education Program for Greek Art and Culture. *EDULEARN18: 10TH International Conference on Education and New Learning Technologies*, 7746-7755.

Micheletti, A. (2017). Motivating and Involving Users Through Gamification: A Proposal. *Digital Libraries and Multimedia Archives*, 701, 20-30.

Moumoutzis, N., Pappas, N., Xanthaki, C., Perrakis, S., Maragkoudakis, Y., Christodoulakis, S., & Paneva-Marinova, D. (2021). Gamification and cultural institutions in cultural heritage promotion: a successful example from Italy, *Cultural Trends*.

Montusiewicz, J., Barszcz, M., Dziedzic, K., Kesik, J., Milosz, M., Tokovarov, M. (2017). The Concept of a 3d Board Game to Recognise Architectural Monuments. *INTED2017: 11th International Technology, Education and Development Conference*, 8665-8674.

Montusiewicz, J., Milosz, M., Kesik, J., Barszcz, M., Dziedzic, K., Tokovarov, M., & Kopniak, P. (2017). Developing an Educational Board Game Using Information Technology. *9th International Conference on Education And New Learning Technologies (EDULEARN17),* 7396-7405.

Noev, N., Goynov, M., Sapundjiev, V., & Valev, I. (2017). A serious educational game of Bulgarian military and historical heritage. *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 7, 249-254.

Nofal, E., Panagiotidou, G., Reffat, R.M., Hameeuw, H., Boschloos, V., & Vande Moere, A. (2020). Situated Tangible Gamification of Heritage for Supporting Collaborative Learning of Young Museum Visitors. *ACM Journal on Computing and Cultural Heritage*, 13(1). DOI: 10.1145/3350427.

O'Connor, S., Colreavy-Donnelly, S., & Dunwell, I. (2020). Fostering engagement with cultural heritage through immersive vr and gamification. *Springer Series on Cultural Computing*, 301-321.

Osatuyi, B., Osatuyi, T., & De La Rosa, R. (2018). Systematic review of gamification research in is education: A multi-method approach. *Communications of the Association for Information Systems*, 42(1), 95–124. DOI: 10.17705/1CAIS.04205

Ouariachi, T & Wim, E. J. L. (2020). Escape rooms as tools for climate change education: an exploration of initiatives. *Environmental Education Research*, 1193-1206. DOI: 10.1080/13504622.2020.1753659

Ovallos-Gazabon, D., Meléndez-Pertuz, F., Collazos-Morales, C., Zamora-Musa, R., Cardenas, C. A., & González, R. E. R. (2020). Innovation, Technology and User Experience in Museums: Insights from Scientific Literature. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 819-832.

Pantile, D., Frasca, R., Mazzeo, A., Ventrella, M., & Verreschi, G. (2017). New Technologies and Tools for Immersive and Engaging Visitor Experiences in Museums: The Evolution of the Visit-Actor in Next-Generation Storytelling, through Augmented and Virtual Reality, and Immersive 3D Projections. *Proceedings - 12th International Conference on Signal Image Technology and Internet-Based Systems, SITIS 2016*, 463-467.

Papathanasiou-Zuhrt, D., Weiss-Ibanez, D.-F., & Di Russo, A. (2017). The gamification of heritage in the unesco enlisted medieval town of Rhodes. *CEUR Workshop Proceedings*, 60-70.

Prakash D. & Manchanda, P. (2021). Designing a comprehensive gamification model and pertinence in organizational context to achieve sustainability. *Cogent Business & Management*, 8(1). DOI: 10.1080/23311975.2021.1962231

Prandi, C., Melis, A., Prandini, M., Delnevo, G., Monti, L., Mirri, S., & Salomoni, P. (2019). Gamifying cultural experiences across the urban environment. *Multimedia Tools and Applications*, 78(3), 3341-3364.

Pasca, M. G., Renzi, M. F., Di Pietro, L. & Mugion, R. G. (2021). Gamification in tourism and hospitality research in the era of digital platforms: a systematic literature review. *Journal of Service Theory and Practice*, 31(5), 691-737. DOI: 10.1108/JSTP-05-2020-0094

Quattrini, R., Pierdicca, R., Lucidi, A., Di Stefano, F., & Malinverni, E. S. (2019) The European Research Night: new ways for communicating Science with ICT and Videomapping. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 42 (2/W9), 647-654.

Roy, S., Singh, P. P., & Padun, A. (2021). Game-Based Learning for the Awareness of Culture & Tradition: An Exploratory Case Study on the Indigenous Naga Tribe. *Smart Innovation, Systems and Technologies*, 293-304.

Seitsonen, O. (2017). Crowdsourcing cultural heritage: public participation and conflict legacy in Finland. *Journal of Community Archaeology & Heritage*, 4(2): Special Series: African Perspectives on Community Engagements, 115-130. DOI: 10.1080/20518196.2016.1252129.

Senatore, L., Gallozzi, A., Cigola, M., & Strollo, R.M. (2020). Citizen Science and Gamification for Cultural Heritage. *EGA-Revista de Expresion Grafica Arquitectonica*, 25(39), 232-239.

Slavec, A., Sajincic, N., & Starman, V. (2021). Use of Smartphone Cameras and Other Applications While Traveling to Sustain Outdoor Cultural Heritage. *Sustainability*, 13(13). DOI: 10.3390/su13137312.

Slavova-Petkova, S. (2017). Project "models and applications of serious games in education of cultural heritage and national identity". *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 7, 243-248.

Sprugnoli, R., Guerini, M., Moretti, G., Tonelli, S. (2021). Architectural Jewels of Lublin: A Modern Computerized Board Game in Cultural Heritage Education. *ACM Journal on Computing and Cultural Heritage*, 14(3). DOI: 10.1145/3446978.

Stefanov, K., Bontchev, B., Boytchev, P., Georgiev, A., & Grigorov, A. (2017). Reusing components from cultural heritage games – the RAGE project approach, *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 6, 49-61.

Smith, L. (2006). *Uses of Heritage*. Routledge.

Synnes, K., Artopoulos, G., Smaniotto, Costa, C., Menezes, M., & Redaelli, G. (2019). CyberParks Songs and Stories - Enriching Public Spaces with Localized Culture Heritage Material such as Digitized Songs and Stories. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes*, 224-237.

Tan, K. L., & Lim, C. K. (2017). Digital heritage gamification: An augmented-virtual walkthrough to learn and explore historical places. *AIP Conference Proceedings*.

Tsai, T. H., & Chiang, Y. W. (2019). Research study on applying SLAM-Based Augmented Reality technology for gamification history guided tour. *2019 IEEE International Conference on Architecture, Construction, Environment and Hydraulics*, 116-119.

Tulloch, H. & Randell-Moon, H. E. K. (2018). The politics of gamification: Education, neoliberalism and the knowledge economy. *The review of Education, Pedagogy, and Cultural Studies*, 40(3), 204–226.

Uribe, S. A. N., Rincon, A. A. A., Castillo, C. A. R., Valencia, M., Lozano, H. D., & Guzman, C. (2020). Project for the Innovation in the Gastronomic Market of Bogota Through the Design of a Gamification Experience for Mobile Devices. *Proceedings Of The International Conference Of Applied Business And Management (ICABM2020)*, 246-275.

Varinlioglu, G., & Halici, S. M. (2019). Gamification of Heritage through Augmented Reality. *Ecaade Sigradi 2019: Architecture in the Age of The 4th Industrial Revolution*, 1, 513-518.

Vlizos, S., Sharamyeva, J. A., & Kotsopoulos, K.(2021). Interdisciplinary Design of an Educational Applications Development Platform in a 3D Environment Focused on Cultural Heritage Tourism. *Communications in Computer and Information Science*, 79-96.

Vayanou, M., Loumos, G., Kargas, A., Ioannidis, Y., & Sidiropoulou, O. (2019). Designing performative, gamified cultural experiences for groups. *Conference on Human Factors in Computing Systems – Proceedings*.

Wang, N., Li, J., Shi, Q., Shi, D., & Mi, H. (2019). Encourage Self-exploration Through an Interactive Chinese Scroll Painting Design. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 442-452.

Weng, Y., Shen, T., Chen, S., & Xiao, B. (2019). Gamification in Local Intangible Cultural Heritage Museums for Children: A Case Design. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 233-245.

Widarti, E., Suyoto, S., & Emanuel, A.W. R. (2020). Mobile Application Design for Heritage Tourism Uses Gamification Approach in Indonesia. *International Journal of Engineering Pedagogy*, 10(5), 89- 102.

Wilhelmsson, U., & Backlund, P. (2020). Everyone is not a gamer! developing cultural heritage experiences for diverse audiences. *Springer Series on Cultural Computing*, 263-281.

World Government Summit. (2016). *Gamification and the Future of Education* [report]. Oxford Analytica. https://www.worldgovernmentsummit.org/api/publications/document?id=2b0d6 ac4-e97c-6578-b2f8-ff0000a7ddb6.

Xiang, Y., Wang, J., Fa, J., Gu, N., Lo, & C. H. (2021). Disseminating Intangible Cultural Heritage Through Gamified Learning Experiences and Service Design. *Lecture Notes in Computer Science - subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics*, 116-128.

Xu, F., Tian, F., Buhalis, D., Weber, J. & Zhang, H. (2016). Tourists as Mobile Gamers: Gamification for Tourism Marketing. *Journal of Travel & Tourism Marketing*, 33(8), 1124-1142.