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REAWAKENING THE PAST: THE ROLE OF GAMIFICATION IN PRESERVING CULTURAL LEGACY – A CASE STUDY FROM CZECHIA

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Those who cannot remember the past
are condemned to repeat it.
George Santayana

Abstract

In recent years, there has been a growing emphasis on protecting both natural and cultural heritage, which often faces the threat of being forgotten or lost. The digital era and new technologies have opened up new opportunities to make these heritage sites accessible to the public. This trend is particularly evident in Czechia in the Sudetenland, where the German population was displaced after World War II. These regions, characterised by high depopulation rates, have significant tourism potential due to their rich natural and cultural resources. This study explores new directions in gamification and identifies successful examples in cultural heritage care. Using geospatial data, the research tests various gamification techniques in the field on the background of concepts STEM and HASS. The findings suggest that gamification is crucial for regional development and community engagement, leading to revitalising abandoned villages and economic diversification. The study highlights the importance of gamification in preserving cultural heritage and its role in regional development, education, and tourism. Rurex represents an innovative gamification process with significant potential for future development and sustainability.

Keywords: heritage, gamification, STEM and HASS, rurex

Introduction

More and more attention has recently been paid to protecting natural and cultural heritage, which often faces the threat of oblivion or extinction. With the advent of the digital era and new technologies, new avenues are opening to reintroduce these "places of memory" to local communities and increase their tourism potential. These sites are usually located in areas of low population density. In most cases, these are displaced areas characterised by high depopulation rates and very low birth rates at all administrative levels or regions with negative natural increases and negative net migration[1]. In the Czechia, the Sudetenland area fits

[1] Romano Bisaschi et al., *Research for TRAN Committee – Transport infrastructure in low-density and depopulating areas, European Parliament, Policy Department for Structural and Cohesion Policies*, (Brussels 2021).

this description. These are the borderlands where the German population was displaced after World War II. However, these areas have excellent tourism potential. For areas with a low population density, cultural heritage can become an essential resource for regional development. Here, heritage tourism can strengthen the local economy, promote the preservation of traditional crafts, and raise awareness of regional identity. According to Dallen[2], developing cultural and heritage tourism trails can bring new community engagement and entrepreneurship opportunities to these areas, diversifying the economy and reducing dependence on traditional industries. Cambridge Dictionary[3] defines cultural heritage as "*features belonging to the culture of a particular society, such as traditions, languages, or buildings, that were created in the past and still have historical importance*". Dallen identifies **heritage tourism** as the primary form of tourism, estimating that 50 to 80 per cent of all domestic and international travel involves cultural aspects such as visits to museums and historical sites, appreciation of music and art, and experiencing a destination's history. Cultural heritage provides significant economic potential, leading many areas worldwide to develop and promote cultural tourism as a key component of their economies. Recently, several trends affecting the use of cultural heritage for socio-economic development emerged, which, according to Dallen, include:

- Heritage of the everyday past: this trend involves extending the concept of cultural heritage to include common aspects of the past, such as rural cemeteries, fishing landscapes, and industrial sites. Travellers are now looking for a more authentic and less idealised depiction of the past to learn how ordinary people survived daily.
- Authenticity and branding: Authenticity has become a key concept in cultural tourism. Travellers seek genuine experiences and places, which is reflected in marketing strategies emphasising cultural sites' authenticity and originality.
- Cultural and heritage trails: Cultural trails and routes connect individual sites into thematic corridors that offer a joint critical mass for similar cultural places. These routes help spread tourism's benefits across a broader range of communities, thus reducing the pressure on individual sites.

These trends indicate growing recognition and use of cultural heritage as a tool for socio-economic development and a transformation in how the managed destinations and sites are promoted and perceived by the public. Gamification is an important marketing tool for achieving these objectives related to economic and heritage development. A game is a fictional, structured, meaningful entertainment medium providing learning and social interaction opportunities. Gaming and gamification thus provide a platform to document and present cultural heritage and the possibility to create a medium to promote it[4]. Gamification in cultural

[2] Timothy J. Dallen, "Contemporary Cultural Heritage and Tourism: Development Issues and Emerging Trends, Public Archaeology ", 13:1-3, 30-47, https://doi.org/10.1179/146551871 4Z.00000000052.

[3] "Cambridge dictionary", accessed May 20, 2024, https://dictionary.cambridge.org/.

[4] Sevde Karahan and Leman Figen Gül, " Mapping Current Trends on Gamification of

heritage refers to integrating game design elements and principles into cultural heritage contexts to enhance engagement, learning, and appreciation of cultural artefacts and sites. This approach leverages the motivational aspects of games to create interactive experiences that can attract a wider audience, particularly younger generations, and foster a deeper understanding of cultural heritage. One of the primary definitions of gamification is the application of game elements such as rewards, missions, and challenges in non-game contexts, which has been shown to increase user engagement and participation significantly[5]. In cultural heritage, gamification can take various forms, including mobile applications that guide users through museums or archaeological sites, serious games that educate players about historical events, and augmented reality experiences that bring artefacts to life[6]. A typical phenomenon in the Sudetenland related to its cultural heritage is the high concentration of abandoned villages and settlements, which were mostly deliberately demolished. Fig. 1 shows that in these areas, no listed (i.e. legally protected) buildings (churches, castles, houses, etc.) are subject to official care by the National Heritage Institute.

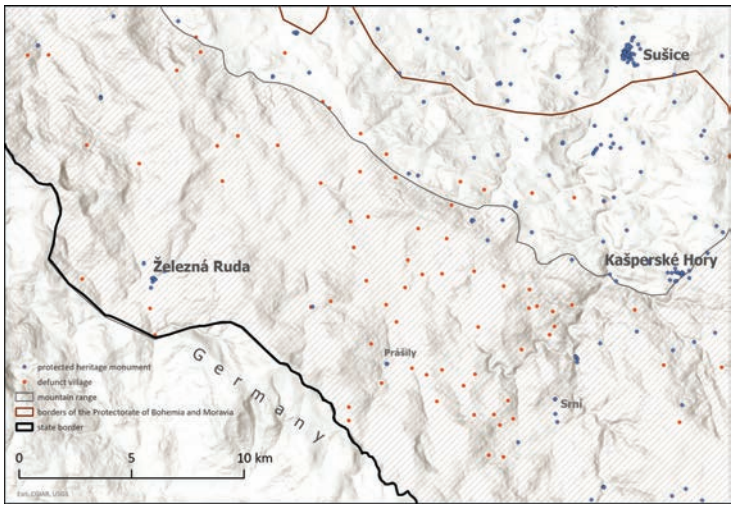

Fig. 1: Šumava. Typical situation in the mountainous border areas. Significant differences in heritage concentration in the German-speaking region of Sudetenland (former Protectorate) and the "Iron Curtain" area (the mountainous border area). (Authors 2024)

CulturalHeritage."in*Game+DesignEducation*,ed.Özge(SpringerInternationalPublishing2021): 281-293.

[5] Lee, Byeong Cheol. "The Effect of Gamification on Psychological and Behavioral Outcomes: Implications for Cruise Tourism Destinations." *Sustainability* 11, no. 11 (2019). https://doi.org/10.3390/su11113002.

[6] Heike Bahre, Giovanni Buono, and Valerie Isabel Elss. "Innovation Embraces Tradition – The Technology Impact on Interpretation of Cultural Heritage." In *Proceedings of the 4th International Conference on New Computational Social Science*, 319-326. 2020. https://doi.org/10.18662/lumproc/ncoe4.0.2020/28. Michela Mortara, Chiara Eva Catalano, Francesco Bellotti, Giusy Fiucci, Minica Houry-Panchetti, et al. "Learning Cultural Heritage by Serious Games." *Journal of Cultural Heritage* 15, no. 3 (2014): 318-325. https://doi.org/10.1016/j.culher.2013.04.004

The authors explore gamification elements that can increase tourism potential in Czechia's low-population-density areas. These areas are often characterised by undiscovered natural and cultural wealth and have great tourism potential. This research focuses on new trends in gamification and finding suitable examples of good practices in cultural heritage care. This study uses geospatial data from the National Heritage Institute of the Czechia before testing and evaluating specific gamification methods in the field.

Methodology

At the beginning of the field research, a geospatial analysis was conducted using the Retrospective Settlement Database and the Geographical Information System of Czechia (CZ Retro)[7]. The CZ Retro Database contains a comprehensive list of all settlements that have ever existed on the territory of Czechia. This data is publicly accessible through the National Heritage Institute's geoportal. For spatial analysis, subtype 10 was selected from this database, indicating a lost historical settlement with the parameter ZANIK = 5, which corresponds to its abandonment between 1945 and 1989, a period characterised by massive depopulation after the Second World War and during the Iron Curtain period in the border regions of the Czechia in question. This sub-type includes over 4,300 abandoned historical sites. The data were further filtered to remove sites associated with military camps (e.g. Ralsko, Boletice) and affected by the construction of water reservoirs (Lipno, Orlík) or mining activities, especially in the North Bohemian brown coal basin. Based on a study by Bisaschi et al., locations with low population density, mainly in the mountainous border areas of the Sudetenland annexed by Germany during World War II and subsequently forcibly vacated, were selected as areas of interest. Thus, the spatial analysis defined target areas for detailed research in the Czechia, namely Šumava, the Bohemian Forest, and the western part of the Ore Mountains. Fig. 2 shows that the Ore Mountains were less affected by depopulation and settlement liquidation than Šumava and the Bohemian Forest thanks to their geographic proximity to the German Democratic Republic (GDR, also known as "East Germany"), a state with which Czechoslovakia maintained friendly relations at the time, and their mineral wealth. In other areas of the Czechia border mountains (e.g. Jeseníky and Orlické Mountains), extinct villages have also been identified, but to a lesser extent. Demolition was, therefore, not carried out evenly across the entire border zone, which corresponds with the distribution of the Iron Curtain signal and wire fence zone. Based on the Guide to Identifying Best Practices for Gamification in Cultural Heritage, these areas were selected as representative model sites for further research.[8] .

[7] "CZ Retro", SOVAMM, accessed May 15, 2024, https://sovamm.wordpress.com/projekty/ktualni-projekty-sovamm/cz_retro/.

[8] Smokova, Marusya, Célio Gonçalo Marques, João Tomaz Simões, Lígia Mateus, Silviu Miloiu, Sergiu Musteață, a Evelina Parashkevova. *A Guide to Identifying Best Practices for Gamification in Cultural Heritage*. ISBN 978-954-23-2495-9.

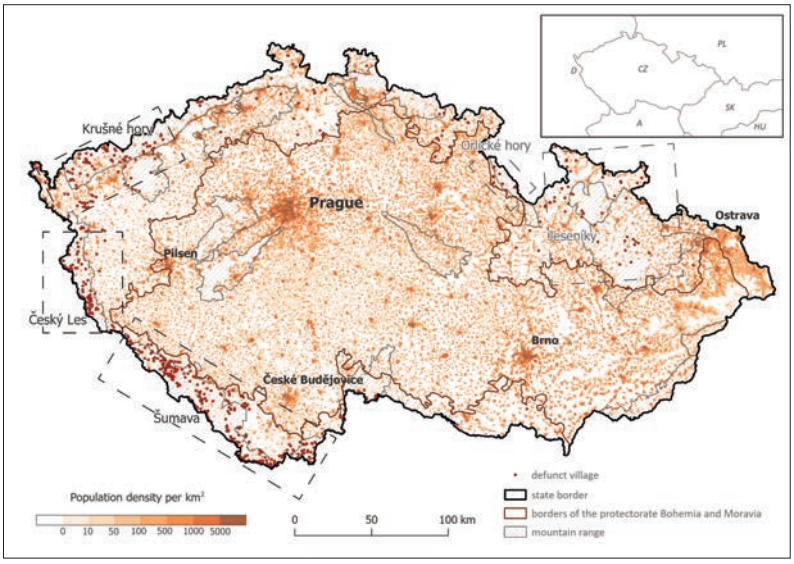

Fig. 2: Spatial analysis of the areas with low population density and high concentration of extinct villages in the Czech Republic (Authors 2024)

As these geographical locations are large and isolated for field research, it was necessary to implement secondary "desk research" after the spatial analysis. Initially, the MS Copilot tool was used with a prompt specific to each area of interest: "Identify elements of gamification using the extinct villages in the Bohemian Forest (Šumava, Ore Mountains)". The information was then verified through a targeted Google search. This allowed detailed site specifications in each area. Specifically, in situ, the area of the extinct Černé Údolí – Prášily villages in Šumava, the area of the former Lučina village (Grafenried in German) in the Bohemian Forest, and the area of Abertamy - Boží Dar in the Ore Mountains were investigated.

The Field Survey and its Results

During the field survey conducted by the Department of Geography, Faculty of Education, University of South Bohemia in České Budějovice from September 2023 to June 2024, the selected sites were studied to identify and describe specific protection and promotion methods for cultural heritage. This research, involving teachers and students in the second and third year of the geography teaching program, focused on the in-situ analysis of sites sharing characteristics similar to those of places in countries such as Spain and Italy. Although these sites are not officially protected under conservation, they receive support from the European Union, mainly through the Objective 3 Bavaria and Saxony-Czechia projects (Objective 3 BY-CZ and SA-CZ). An important common element in promoting these sites is their websites, either those of the projects or the individual sites and information boards placed on them. The quality of content and messages varies considerably depending on local community involvement and funding.

The research also identifies gamification methods, specifically storytelling, as a tool for promoting cultural heritage and understanding the site's genius loci. Storytelling, a fundamental part of human nature[9] and a significant way of understanding the world has proven effective in creating a connection between the storyteller and the listener; stories and narratives are both cognitive processes and products of cognition. Without a story, no identity, self, or one else exists[10]. As with websites and information boards, the amount of storytelling used varies by location, suggesting potential for further research on community engagement and funding in heritage conservation. Specific uses and usage levels for each site are described below.

1. Šumava

As part of the authors' multidisciplinary research in the Šumava National Park, two projects documenting and visualising the historical development of extinct villages in the park were analysed. The ***Historické album Šumavy*** *(Šumava Historical Album)* project and its complement ***Šumava dříve a dnes*** *(Šumava Then and Now)* focus on collecting and interpreting historical data that reflect the social and cultural dynamics of the region. These initiatives, funded by the cross-border Objective 3 BY-CZ program, not only provide valuable information about past life in local communities but also seek to reconstruct the architectural heritage of these areas digitally. The results of these projects contribute to a deeper understanding of the historical context and support the protection of cultural heritage in the Šumava National Park.

The *Šumava Historical Album* project was launched in 2014. During its implementation, the Šumava National Park and Protected Landscape Area Administration installed 30 durable information panels shaped as tables with open photo albums containing high-quality historical photographs (see Fig. 3), as noted by Kantor[11]. These panels are a means of storytelling, but their narrative is limited to describing the villages' historical development and subsequent demise. Visitors can view historical images on-site and read a brief history of the villages in Czechia and Germany. Another element that can be considered a form of gamification is the possibility of viewing the panel content in electronic form and saving the exact locations of all 30 extinct settlements on a mobile device via map applications from the Šumava NP website (npsumava.cz). However, the project does not use other gamification techniques, leading to specific challenges. The current information panel placement does not promote a sense of belonging to the site or engage local communities and visitors in an interactive game. Considering current pedagogical theories that emphasise play as a key element for interest and

[9] Caitlin Strachan and Jerry Mitchell. *Teacher's perceptions of Esri story maps as effective teaching tools Master's thesis*. (University of South Carolina: 2014). ISSN 2146-0353

[10] Patrick J. Lewis, "Storytelling as Research/Research as Storytelling". *Qualitative Inquiry* 17(6), (June 2011): 505-510, doi:10.1177/1077800411409883.

[11] Bohumil Kantor, "Historické album Šumavy", accessed May 20, 2024, https://www.sumava.eu/blog/2022/04/04/historicke-album-sumavy-panely-fotokniha/.

motivation for learning, these approaches may be considered insufficient. Digital storytelling is also valuable when communicating complex technical information for STEM (Science, Technology, Engineering, Mathematics) subjects[12] and HASS (Humanities and Social Sciences)[13.] This approach is based on integrating the arts into STEM activities and simulating how objects naturally interact in the real world. Today's youth is less interested in auditory learning and prefers to participate more while learning or exploring the traditional passive approach. Digital stories, according to Thesen and Kara-Soteriou[14], draw their power from connecting images, music, narrative, and voice, giving characters, situations, experiences, and insights deep dimensions and vivid colour.

Unfortunately, physical information boards are also often vandalised, including torn or destroyed photographs, scratched or wholly removed texts, and, last but not least, garbage littered in the surroundings, which reduces the overall attractiveness of the information panels and limits their educational potential. The Šumava Historical Album project aims not to restore or revitalise the extinct places but to produce information panels that reconstruct the villages and landscapes' original appearance using historical photographs and former village plans.

Fig. 3: An example of an information panel from the *Historical Album of Šumava* project informing about the extinct village Krásná hora (Lucie Říhová, mapy.cz)

[12] Sandra Hill and Claudia Grinell, „Using digital storytelling with infographics in STEM professional writing pedagogy", *2014 IEEE International Professional Communication Conference (IPCC)*, (Pittsburgh, PA, USA: 2014): 1-7, https://doi.org/10.1109/IPCC.2014.7020367. Jorge López Benito and Enara Gonzalez, "A Storytelling Platform for Deeper Learning in STEM Combined with Art-Related Activities", *International Journal of Education and Learning Systems*, 3: (IARAS:2018) 84 – 92.

[13] Smyrnaiou, Zacharoula, Eleni Georgakopoulou, and Sofoklis Sotiriou. "Promoting a Mixed-Design Model of Scientific Creativity through Digital Storytelling—The CCQ Model for Creativity." *International Journal of STEM Education* 7, no. 1 (2020). https://doi.org/10.1186/s40594-020-00223-6.

[14] Ashley Thesen and Julia Kara-Storeou, "Using digital storytelling to unlock student potential", *New England Reading Association Journal*, 46(2), (NERA Journal: 2011): 93-100.

The more recent project, "*Šumava Then and Now*"[15], implemented from 2017-2021 and funded by the Objective 3 BY-CZ programme, involves an innovative approach to presenting the history of the Czechia-Bavarian region. It uses multimedia elements such as augmented reality, conveying the region's historical development to visitors through video mapping on a large plastic 3D model of Šumava (see Fig. 4).

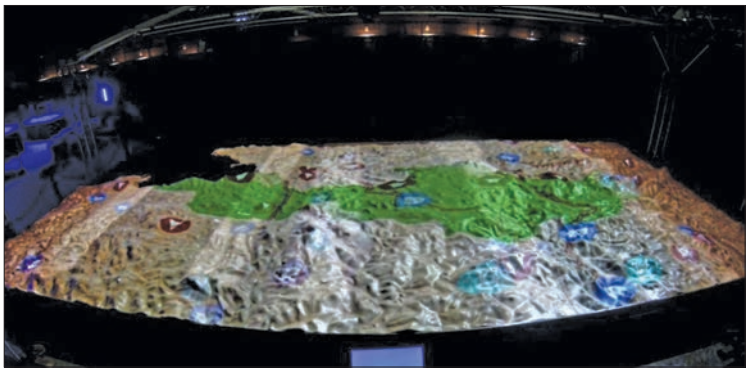

Fig. 4**:** Example of a video mapping on a 1:10 000 plastic model (Ekofilm Šumava 2021)

The project is accompanied by the film cycle "*Šumava zaniklá, znovuzrozená*" (Šumava Extinct, Reborn), which tells authentic stories of old-time residents from both sides of the border. These stories are accompanied by video programs focusing on music, crafts, and gastronomy. This advanced form of storytelling is available online on the project website (Ekofilm Šumava 2021). Video mapping is part of the displays in the visitor centres, which are rotated every two years between Modrava (CZ), Plzeň (CZ), and Zwiesel (DE). The project also aims to partially recreate the villages through 1:100 scale models of original Šumava architecture, which give visitors an idea of the village's historical appearance (see Fig. 5).

Fig. 5: A 1:100 model of the extinct Hůrka village in NP Šumava (Ekofilm Šumava 2021)

[15] Ekofilm Šumava, "Šumava dříve a dnes", accessed May 15, https://www.dokrajin.cz/.

Although these projects in the Šumava NP bring significant added value to the protection of cultural heritage, they do not include any major gamification elements. Gamification is defined as applying gaming elements and dynamics to contexts, not primarily gaming, to increase user engagement and motivation[16]. For the Šumava projects, these criteria are not met, as they do not implement game mechanisms that would stimulate interactivity and user engagement according to gamification principles. This does not diminish the projects' quality or importance. On the contrary, these projects are crucial for highlighting significant moments in Czech-German history and promoting recognition of the importance of national memory.

2. The Bohemian Forest

Like Šumava, the border areas of the Bohemian Forest represent key locations to understand the historical events that shaped the relations between the Czech and German peoples. These events are essential in the study of the cultural and social coexistence of the two nations. In the context of this research, two significant projects applying the principles of gamification were identified in the geographical area. The first one is a set of projects related to the history of the extinct village of Lučina, also known under the German name Grafenried. The second project is the ***tourist game "Český les s mobile v lapse"*** *(Bohemian Forest with a phone in your pocket)*, which uses mobile technology to explore the region interactively. The authors then focused on analysing these projects and their contribution to regional development and education:

The first set of projects concerns the history of the extinct Lučina village. During the 1950s, the village of Grafenried (later renamed Lučina in Czech) was incorporated into the forbidden border zone, which led to large-scale demolitions. After the border guards departed in 1964, the church and remaining buildings were demolished. Until 1990, Lučina remained inaccessible to the public and was abandoned. The entire village became overgrown with wild vegetation, which was challenging to identify in the field. The first initiatives to restore the village started in 1991, beginning with the reconstruction of the cemetery (see Fig. 6). In 2000, an association was founded which initiated the restoration of the church's foundations, and in 2001-2002 a pilot project *"Znovuzrození kostela sv. Jiří v Lučině – Grafenriedu" (Rebirth of St. George's Church in Lučina – Grafenried)* was implemented. The commemorative restoration of the church remains was carried out in 2010 with financial support from the Euroregions Disposition Fund "Objective 3: Czech Republic - Free State of Bavaria" from 2007-2013[17].

[16] Sebastian Deterding et al., "Gamification: Toward a definition", *Conference: CHI 2011 Gamification Workshop Proceedings*, (January 2011).

[17] Zdeněk Procházka and Helmut Roith, "Grafenried – Lučina: Stavebně historické zhodnocení objektů odkrytých v zaniklé obci(2014–2017)", *Cíl EÚS 2014–2020*, accessed May 5, 2024, https://www.svazekdomazlicko.cz/e_download.php?file=data/multipage/editor/editor-4-45-cs_1.pdf&original=Grafenried_CZ.pdf.

Fig. 6: Gradual restoration of the cemetery in Lučina (The archive of Z. Procházka 1991; Authors 2024)

Between 2017-2020, the Czechia-German project "Naučná stezka Lučina – skanzen odhalené minulosti" *(Educational Trail Lučina* - Open-*air Museum of the Past Revealed)* was implemented, which allowed the complete reconstruction of the extinct village and the revealed buildings to be secured. This project involved exhuming the buildings and cultivating the overgrown area (see Fig 7).

Fig. 7: An example of the exhumation of the once completely overgrown brewery in Lučina - now the main visitor centre and the beginning of the quest (1: L. Gasseldorfer 2011, 2: Allexkoch 2015; 3: bergpoetin.eu 2015; 4: Authors 2024)

The remains of Lučina today should be seen not only as relics of the buildings but also in the context of the cultural landscape influenced by anthropogenic factors (see Fig. 8). As Karel (2018)[18] Points out that the connection with the surrounding nature is significant in the long term and forms the central image of the whole area.

[18] Tomáš Karel, „Odborné vyhodnocení možností konzervace a prezentace reliktů zaniklé vesnice Lučina – Grafenried", accessed May 5, 2024, https://www.svazekdomazlicko.cz/e_download.php?file=data/multipage/editor/editor-4-45-cs_4.pdf&original=Lu%C4%8Dina%20-%20Graferied.pdf.

Fig. 8: Comparison of the state of Lučina in 2023 (picture on the left) and the development before the displacement of 1946 (picture on the right). Nature has completely taken over the village. Gradually, individual buildings are being exhumed. (Authors 2024)

Questing, a gamification strategy, was implemented in the Lučina area. Questing, defined according to Clark and Galzer[19] as an interactive game based on completing tasks and searching for specific objects or locations based on provided instructions, serves as a tool to engage visitors. In Lučina, the quest is available online to download and in a printed version on-site, allowing visitors to explore the artefacts and monuments interactively. This process is enriched with the local's narratives, strengthening the connection to local history and culture. Questing is an excellent tool for place-based learning while being mindful of the local environment, addressing natural, historical, and cultural issues, and putting them in context with the region while emphasising the relationship to nature. Learning develops students/visitors/players' motivation to care for nature and the community or site. The main element of the quest in Lučina is the narrative technique of storytelling, which reconstructs the historical stories of its inhabitants and houses. A "secret cellar" is revealed to players as a final reward where they can write into the valuable in-game village chronicle. These gamification initiatives are supported by other community projects, including regular Czech-German church services held in the restored local church and student projects such as the 2021 land-art festival for Czech and German landscape architecture students.

In Lučina, gamification techniques are used efficiently, even though they do not rely on digital technologies such as augmented and virtual reality (AR and VR) and digital storytelling. By making non-gaming activities at Lučina "behave" like games, visitors are more engaged, and their experience is more fun. However, the absence of digital techniques may deprive some visitors of an additional interactive dimension and a more profound experience that digital elements could

19 Delia Clark and Steven Glazer, *Questing: A Guide to Creating Community Treasure Hunts*, (University Press of New England: Hanover and London, 2004): 276.

bring. It is, therefore, important to consider what approach is most appropriate for a particular target group to ensure that visitors have the wealthiest and most engaging experience possible.

The second surveyed project is the hiking game *"Through the Bohemian Forest with a phone in your pocket"*, an innovative way to combine technology and nature, offering players a unique experience of discovering the beauty of the Bohemian Forest. The game uses smartphones with GPS and data leading to prominent attractions (e.g., small sacred objects, see Fig. 8) where players scan points using QR codes on information panels. It was launched in June 2024 and is active from June to October. If the player is active and records a visit to at least 10 places via the mobile app, they receive a unique tourist sticker as a reward. According to Tondello et al., gamification strategies involve obtaining a unique reward limited in time and space. Again, playing the game online from the comfort of home and "visiting" the game locations virtually through a mapping application is possible.

Fig. 9: Excerpt from the tourist game *"Through the Bohemian Forest with a phone in your pocket"* (Authors 2024)

This tourist game, based on the principles of geocaching, brings a new dimension to traditional tourism and offers players a fun and educational way to explore and appreciate the natural beauty of the Bohemian Forest while emphasising interactive engagement and technological integration into the tourist experience. This interactive learning method encourages physical activity and social interaction (players can search for points in groups, with their families, etc.). Although the game uses modern technologies that can improve the user experience, one must be aware of the potential limitations and challenges associated with their use. Dependence on technology can cause the players to become too absorbed by their mobile devices, which can diminish their perception of the surroundings and distract them from the game's primary goals, such as interacting

with nature. In the Bohemian Forest, a limited mobile signal can significantly limit the game's accessibility in areas with unstable or non-existent data network connections, and data consumption appears to be a significant barrier. However, the game's educational value is evident as it provides an interactive way for users to learn more about the natural and cultural heritage of the region.

In the Bohemian Forest, local communities are pioneering the recognition of the importance of cultural heritage as a key factor for economic and tourism development. An example is the exhumation of the Lučina village, which became the basis for creating the first complete game celebrating local history and culture. This project, sponsored by the Voluntary Association of Municipalities Domažlicko, shows how cultural heritage can inspire cooperation and develop cross-border relations. Municipality and community representatives meet regularly to discuss further initiatives that could strengthen the region economically while promoting community cohesion. This cooperation shows how cultural heritage can contribute to the prosperity of a region.

3. Ore Mountains

Unlike the Bohemian Forest and Šumava, the Ore Mountains region has a long mining tradition, which has resulted in a historically higher settlement rate and overall development in the area. Particularly during the normalisation period, the Ore Mountains became a key location for extracting mineral and energy resources, especially brown coal and uranium. Despite this, several villages and settlements disappeared due to the Iron Curtain. However, this demolition was not carried out with the same intensity as in the previously mentioned Czech regions, which can be attributed to the GDR's proximity. In this region, the research focused mainly on the south-western part of the Ore Mountains, where two projects, the ***Znovuoživené Krušnohoří*** *(Revived Ore Mountains)* and the ***Königmuhle***, were identified to achieve consistency with the regional development trends researched before.

Regarding regional development, the *Revived Ore Mountains* app (zivehory.cz) is a key project that offers a comprehensive view of the historical events in the Czech and Saxon parts of the Ore Mountains through mobile technology. The Objective 3 SA-CZ program supported the project. The app is free to users and is available for download on Google Play for Android and the App Store for iPhone and iPad. It includes seven educational trails that deepen visitors' knowledge of the local landscape and culture. The need to download approximately 2GB of data for each route, which may affect user-friendliness, could limit the project (see Fig. 9). If visitors only discover the application exists. At the same time, in the field, they may encounter problems related to data download due to weak signals. However, tourists can borrow tablets from the information centres involved in the project, which is an effective solution to this issue.

Fig. 10: 1: Example of the *Living Mountains* app; 2: Information panel for the game in the field; 3: Example of a localised 360° video (Authors 2024)

The *"Revived Ore Mountains"* project contributed to digitising cultural heritage by creating 39 visualisations reconstructing authentic historical places via augmented reality. These visualisations are accessible in augmented reality and as traditional and spherical 360° videos, which brings a comprehensive visual experience. Information boards in relevant places are equipped with QR codes (see Fig. 10); scanning them opens the relevant section of the application to users and invites them to perform interactive tasks. Although the app works in any environment, the optimal user experience of augmented reality is achieved only when physically present at historical places. This is a similar scenario to the one presented by Gheorghiu and Livia[20].

As part of the research, the Loučná pod Klínovcem route was analysed, including the extinct settlement of Königsmuhle (see Fig. 11). This location shows significant similarities with the concept in Lučina. Today, this place is referred to as an "extinct settlement, " reflecting a series of intravillan and extravillan processes following the German population's expulsion in 1945 and 1946. After the expulsion of the Königsmuhle inhabitants in the autumn of 1946, their dwellings were used by the remaining inhabitants of the nearby Háje settlement as a source of building material. Removing the roofs, balconies, windows, and doors led to the gradual demise of the settlement. On the site of the former settlement, the last remains of the house walls were subsequently exhumed and preserved by a group of enthusiasts, creating several narratives dedicated to specific houses

[20] Gheorghiu, Dragos, and Livia Stefan. "Immersing into the Past: An Augmented Reality Method to Link Tangible and Intangible Heritage." *PLURAL. History, Culture, Society* 8, no. 2 (2020): 91-102. Accessed October 13, 2024. https://doi.org/10.37710/plural.v8i2_9

and families involving the participants in the living history of the place – in the life of the village. Unlike in Lučina in the Bohemian Forest, digital storytelling is used here as spatial storytelling linked to a specific place. Hamid and Perkis[21] refer to this type of storytelling as interactive digital storytelling and note its potential as an expressive framework to engage with the most pressing issues of 21st-century culture and as cognitive support to increase individual and collective understanding of complex systems. However, interactive digital storytelling can significantly impact STEM fields by providing innovative ways to present complex concepts and promote education and public engagement. On-site users can, for example, visualise the original appearance of specific houses (see Fig. 9) and get a glimpse into the lives of residents through augmented reality. Stories and historical contexts are presented using live actors and hand-painted backgrounds, adding to the authenticity of the experience. A key element is the re-engagement of local communities.

The second initiative, the Do Krajin Association, is also related to this project. It aims to expand and intensify its activities in memory institutions in the Czech-German border area, especially in the Ore Mountains and is supported by the Czech-German Fund for the Future. The association has a ten-year history of revitalising an extinct settlement and has organised a land-art festival analogous to the Lučina one in the Bohemian Forest since 2012. The best-preserved part of the former mill has been transformed into a hostel for tourists, offering the possibility of overnight accommodation, heating, and food preparation. The location regularly hosts meetings for Czech-German compatriots (see Fig. 11) and is popular for wedding ceremonies and other social events.

Fig. 11: Königsmuhle 1: an overall view of the building remains; 2: The best-preserved part of the mill; 3: a Czech-German meeting, 4: land-art festival (Authors 2024)

[21] Asim Hameed and Andrew Perkis, „Spatial Storytelling: Finding Interdisciplinary Immersion", In ed. Rebecca Rouse et al. *Interactive Storytelling. Lecture Notes in Computer Science*, (2018): 323-332, https://doi.org/10.1007/978-3-030-04028-4_35.

The *Revived Ore Mountains - Living Mountains* app benefits the region from an economic as well as cultural-educational point of view. Its ability to connect history with modern technologies, gamification, and storytelling creates an attractive and educational experience for visitors. However, it is important to consider possible limitations and work to remove them to make the app accessible to a broader range of users. The app's demand for data, which can be limiting for users and only being available for users with compatible devices, could become an issue. Of all the projects, this one is among the most advanced initiatives in connection, gamification, storytelling, and learning about cultural and natural heritage. This project stands out especially for its innovative use of higher-order gamification techniques, which brings the following benefits:

- **Increased engagement and motivation:** Advanced gamification techniques such as game elements, challenges, and rewards increase visitors' motivation to explore and learn.
- **Educational value:** Combining gameplay and learning allows users to remember information and facts about the region better.
- **Promoting sustainable tourism:** The app encourages the discovery of lesser-known locations, helping to spread tourism and protect congested areas.
- **Interdisciplinary approach:** The project combines technology, history, art, and natural sciences, promoting a comprehensive understanding of the region and reflecting the aforementioned fundamental principles of the STEM and HASS concepts.

This approach benefits visitors, who get a richer and more interactive experience, and the region, which can become a more attractive destination for domestic and foreign tourists. The ***Revived Ore Mountains – Living Mountains*** project represents a model example of a STEM and HASS field application and shows how these principles can benefit regional development, education, and tourism. The connection between gamification in cultural heritage, STEM, and HASS concepts is increasingly evident as both fields converge to enhance educational experiences and promote engagement with cultural artefacts. Gamification utilises game design elements to motivate and engage users. At the same time, STEM and HASS education emphasises critical thinking, problem-solving, and the application of technology—all of which can be effectively integrated into cultural heritage contexts. One significant aspect of this connection lies in using technology within gamified experiences. For instance, gamification often involves the application of augmented reality (AR) and virtual reality (VR) technologies to create immersive experiences that allow users to interact with cultural heritage innovatively. Connecting gamification and learning about cultural and natural heritage brings a new dimension to how people learn and interact with the world around them, which is essential for developing an innovative and sustainable approach to education and heritage conservation.

Conclusion

The results show that gamification in preserving cultural heritage is essential in making the sites accessible, especially in their further development, both from the visitor-tourist and local communities' point of view. Several similar initiatives in Europe focus on preserving the memory of extinct municipalities and using gamification to engage the public. In Spain, for example, the *"Pueblos Abandonados"* offers virtual tours and games based on real stories of vanished villages through an app. In Italy, *"Borghi Fantasma"* uses interactive maps and treasure hunts to explore the history and culture of abandoned sites. Not only do these projects preserve history and culture, they also attract tourists and help the local economy. A common feature of these sites is the effort to revive and remind people of, at the least, the foundations of these buildings. We have identified a relatively unique approach to this revival in the Bohemian Forest and the Ore Mountains. This process is somewhat similar to Urbex, which involves exploring derelict and defunct places in cities (factories and similar objects). However, the fundamental difference is that within Urbex, there is an effort to hide these places so that many visitors do not discover them[22]. In these low-density areas, however, the goal is the exact opposite - to revive reminders of forcibly destroyed homesteads during the communist rule in the rural area in the 1945-1989 period. These sites are often literally exhumed since they are often entirely overgrown with vegetation and covered by nature, and it is necessary to dig them out or rediscover them. Based on these characteristics, the authors identified this process as **Rurex = Rural exhumation**. It refers to the common term Urbex, which seeks to promote these rural locations, make them accessible, and conserve them. The defunct village, in its specific, natural, and charming landscape, is the bearer of a whole range of aesthetic values that have the potential to be perceived by a broad audience. Here, every visitor can find what interests them. Genius loci play an important role here since the remoteness of the place strengthens its unique qualities. In the future, finding the optimal level of intervention to ensure tourist comfort will be essential. These sites should not be primarily seen as tourist sights; they should retain an element of searching to discover their hidden charms. Since this process is the basis of game development in these areas, this approach can be characterised as an innovative gamification process that cannot stand alone; its sustainability lies primarily in developing game forms and involving the local communities. In both Lučina and Königsmuhle, regular land-art exhibitions relying on the newly discovered genius loci of these places have been held independently of each other, which is an example of a successful Rurex approach. Other interstate community events, such as joint Czech-German masses or music festivals, weddings, etc., are also important.

Another method apart from Rurex that plays a significant role in gamification is storytelling. It can take different forms - analogue as questing, which can reward the player simply by discovering a special hidden place, or digital, which lets participants

[22] Robin Lesné, "Urbex and Urban Space: A Systematic Literature Review and Bibliometric Analysis", *International Journal of the Sociology of Leisure*, no. 5 (2022): 425-443, https://doi.org/10.1007/s41978-022-00120-y.

travel in time and revive the site using augmented reality. This alone is a very satisfying element of the game and can be considered a reward for playing the game so that the gamification process is complete. These activities are also essential for education and integral to learning about culture and history. Storytelling brings an interactive element to STEM and HASS fields, allowing students to engage better and learn by creating stories. Digital storytelling in education encourages students to manage their learning process, leading to deeper understanding and better retention of information. This approach supports multidisciplinary and interdisciplinary analysis and prepares students to solve complex real-world problems. Last but not least, gamification strategies and related activities (e.g. installation of information panels) often lead to the spontaneous creation of other games and interactive experiences. Geocaching is an example of this process, a popular game where people search for hidden "caches" developed in all monitored areas as a natural extension of the original projects. These caches are directly connected to the implemented activities and projects, as evidenced by the cases from Šumava - Krásná hora in 2019, the Bohemian Forest – Lučina in 2007, and the Ore Mountains – Königsmuhle in 2008. This phenomenon shows the synergistic effect of gamification and educational initiatives, which support public involvement and the development of community games.

Gamification techniques and storytelling methods are key in protecting cultural and natural heritage. These innovative approaches help raise awareness of these sites' value and importance and support tourism's development and sustainability in low-population-density areas. Gamification and storytelling revive these areas, strengthen local communities, and attract new visitors, positively impacting the local economy and heritage preservation for future generations. These methods must be further used and developed to contribute to the prosperity and protection of our shared heritage. The impact of gamification on cultural heritage is multifaceted, encompassing enhanced engagement, educational benefits, and increased awareness of cultural significance. By integrating game design elements into cultural heritage contexts, gamification transforms traditional experiences into interactive and immersive learning opportunities, attracting a broader audience and fostering a deeper appreciation for cultural artefacts and sites. In summary, the impact of gamification on cultural heritage is profound, as it enhances visitor engagement, promotes educational outcomes, and raises awareness about the significance of cultural preservation. By transforming how individuals interact with cultural heritage, gamification enriches the educational experience and contributes to the sustainability and appreciation of cultural heritage for future generations.

Lust of illustrations:

Fig. 1. Šumava. Typical situation in the mountainous border areas. Significant differences in heritage concentration in the German-speaking region of Sudetenland (former Protectorate) and the "Iron Curtain" area (the mountainous border area). (Authors 2024)

Fig. 2. Spatial analysis of the areas with low population density and high concentration of extinct villages in the Czech Republic (Authors 2024)

Fig. 3. An example of an information panel from the Historical Album of Šumava project informing about the extinct village Krásná hora (Lucie Říhová 2023)

Fig. 4. Example of a video mapping on a 1:10 000 plastic model (Ekofilm Šumava 2021)

Fig. 5. A 1:100 model of the extinct Hůrka village in NP Šumava (Ekofilm Šumava 2021)

Fig. 6. Gradual restoration of the cemetery in Lučina (The archive of Z. Procházka 1991; Authors 2024)

Fig. 7. An example of the exhumation of the once completely overgrown brewery in Lučina - now the main visitor centre and the beginning of the quest (1: L. Gasseldorfer 2011, 2: Allexkoch 2015; 3: bergpoetin.eu 2015; 4: Authors 2024)

Fig. 8. Comparison of the state of Lučina in 2023 (picture on the left) and the development before the displacement of 1946 (picture on the right). Nature has completely taken over the village. Gradually, individual buildings are being exhumed. (Authors 2024)

Fig. 9. Excerpt from the tourist game "Through the Bohemian Forest with a phone in your pocket" (Authors 2024)

Fig. 10. 1: Example of the Living Mountains app; 2: Information panel for the game in the field; 3: Example of a localised 360° video (Authors 2024)

Fig. 11. Königsmuhle 1: an overall view of the building remains; 2: The best-preserved part of the mill; 3: a Czech-German meeting, 4: land-art festival (Authors 2024)

Rezumat

În ultimii ani, a existat un accent tot mai mare pe protejarea patrimoniului natural și cultural, care adesea se confruntă cu amenințarea de a fi uitat sau pierdut. Era digitală și noile tehnologii au deschis noi oportunități pentru a face aceste situri de patrimoniu accesibile publicului. În Cehia, această tendință este deosebit de evidentă în Sudetenland, unde populația germană a fost strămutată după al Doilea Război Mondial. Aceste regiuni, caracterizate prin rate ridicate de depopulare, au un potențial turistic semnificativ datorită resurselor lor naturale și culturale bogate. Acest studiu explorează noi direcții în gamificare și identifică exemple de succes în îngrijirea patrimoniului cultural. Folosind date geospațiale, cercetarea testează diverse tehnici de gamificare în domeniu pe fundalul conceptelor STEM și HASS. Constatările sugerează că gamificarea este crucială pentru dezvoltarea regională și implicarea comunității, conducând la revitalizarea satelor abandonate și diversificarea economică. Studiul subliniază importanța gamificării în conservarea patrimoniului cultural și rolul său în dezvoltarea regională, educație și turism. Rurex reprezintă un proces inovator de gamificare cu un potențial semnificativ pentru dezvoltarea și sustenabilitatea viitoare.

Cuvinte cheie: patrimoniu, gamificare, STEM and HASS, rurex

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