THE ROLE OF BUILT HERITAGE WITHIN EDUCATION FOR SUSTAINABLE DEVELOPMENT THROUGH MOBILE AUGMENTED REALITY GAMES

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ABSTRACT

Looking at heritage and considering it as a relevant piece for education is currently part of different narratives, whether of educational, cultural, political, or even legal nature. The aim of this paper is to explore the concept of heritage and its implications for education for sustainability, using technology as a facilitator. Through a narrative literature review, an analysis is made of the concept of heritage, with special focus on the concept of built heritage and its connection to education, as a learning space, and of its role in the development of competences related to education for sustainability, with technology assuming an aggregating role. It was found that although the important role that built heritage has for the development of the human being, there is still limited literature and research about this. We also saw the important role that technology plays in exploring these areas, particularly through a Mobile Augmented Reality Learning in an App. Since the Augmented Reality contents, the mobile educational game and the EduCITY App itself, are still under development, this document is an exercise of theoretical development. As final remarks it is possible to assume the effective connection of heritage and its role to the development of education for sustainability, taking advantage of the potentialities of technology as Mobile Augmented Reality Learning. Despite this recognition, research on the articulation of these concepts is still underdeveloped, and this paper seeks to contribute to the deepening these fields of human development and their connections.

KEYWORDS

Heritage, Education for Sustainable Development, Mobile learning, Augmented Reality, EduCITY

1. INTRODUCTION

Everyone recognizes the valuation of the cultural heritage, rather being tangible or intangible, as one of the pillars of the evolution of society, especially in a conception of society as post-materialist, whose values have moved from effective relations to material aspects, such as economic development, housing needs or food security, to values linked to immateriality, i.e., related to environmental concerns, social and cultural development, among others (Inglehart, 1977). Of course, this eminently political and sociological positioning emerges as a possible trigger for an awakening towards the valuation of heritage and the need for its preservation; however, it should be noted that the concern with heritage issues is much older, with records on Europe dating back to the year AD 44 on the need for heritage protection (Correia, 2014).

Alongside the progressive concern with heritage and as already mentioned above, there is also, in the mid-20th century, a growing concern with environmental issues. These issues, which emerged within the concept of Sustainable Development, have been deepened from 1987, the year of publication of the United Nations "Our Common Future" report, where concerns are introduced at the level of the relationship between human beings, their development and the environment (Brundtland, 1987). It was then defined that sustainable development ensures that the development of future generations is not harmed by the previous ones. However, despite this concern, at the end of the 20th century, several fragilities were highlighted, which at the present time, are experienced with greater impact, such as climate change or the growing scarcity of resources or even the extinction of animal species (UNDP, 2022), among many others.

We live in a time of uncertainty, constant reconfigurations and eminent complexity, making the 21st century, despite all the progress achieved by Man, a time of great uncertainty about the future. However, as Morin (2021) stated, human being, in the face of the unknown and the complexity, shows enormous versatility and capacity for action, reacting, adapting, creating and recreating new tools. Two of the most effective and powerful tools developed by Man, which allow us to respond to the unknown, are education and technology (UNESCO, 2021). In a world woven of multiple and growing complexities, education is a mean of transmitting and empowering knowledge through an effective resilience that everyone recognizes. This knowledge is more effective and efficient when produced and conveyed in a transdisciplinary way, grounded on the environment, starting from the known to the unknown, searching for bridges between the past and the future, in a clear commitment to a narrative and systemic thinking articulated with ecological awareness (Morin, 2002), which today is called as education for sustainability.

Needing to approach an active citizenship, education had to reformulate itself seeking for new allies, in order to approach the daily realities of its various agents. Currently, education coexists with the specificities and potentialities of technology, especially the one that allows us to see beyond the physical and immediate reality, towards other new contents, such as Augmented Reality or Virtual Reality. There are several potentialities of mixed realities, especially Augmented Reality that is recognized as a useful tool in education, considering its potentiality on mobile learning contexts (Crompton & Burke, 2018). School is no longer closed in the classroom, coming closer to experiences of students and their families, and teachers, taking place in new spaces, thus enabling new narratives and learning. This allows establishing bridges between different types of knowledge, searching for a global and transdisciplinary knowledge (UNESCO, 2021). These bridges are a concern in the PhD project of the first author, entitled "Built heritage in Mobile Game for development of key skills towards Education for Sustainability – from academia to society", where it is intended to develop a game to be explored while touring the city, with specific points of interest related to build heritage in order to promote people's environmental awareness, in a citizen science logic, promoting cities as safe, healthy and accessible for all, making aware of their built heritage, assuming it as a resource education for sustainable development.

This research focuses on the role that the built heritage assumes, as well as its valorisation in the development of key competences for Sustainability (Wiek et al., 2011), through technology, in particular the use of Augmented Reality in mobile learning games contexts.

This paper is organized into six sections. After an introduction, the second one is about the methods used in this paper, whose aim is to explore theoretically Heritage, Education for Sustainability and Technology and its connections. The third section concerns an analysis and theoretical development on heritage, aiming a deep understanding about the concept itself, and connecting it to the remaining fields of human action under analysis, education for sustainability and technology. On the fourth section an analysis is taken concerning the role that heritage plays in education for sustainability. The fifth section concerns about the role of technology on the development of education de-plotted and based on built heritage, with special attention to the use of contents in Augmented Reality through mobile learning. The last section stands as Final Remarks, constituting a brief presentation of the research developed, advancing also to future investigations.

2. METHODOLOGY

Despite the electronic search for academic literature through aggregators and databases such as Scopus and Web of Science, we did not carry out a systematic literature review, but rather a narrative review of the literature (Chaney, 2021) on the fields under analysis. Based on the aim of his paper, search string using Boolean operators was: KEY (education) AND KEY ("Augmented Reality"). Due the nature of this review, the above search string aimed only to the education field and the Augmented Reality, since previous searches were conducted. However, we would point out that the search should have been open to other search terms. We also point out that the Boolean AND was used in the sense of obtaining as much records as possible. This literature review was taken in order to develop theoretical understanding and aiming to search links between the concepts. Doing this type of research, a search was made to consolidate and summarize the concept of heritage and particularly built heritage, establishing connections of its role to the development of education for sustainability using technology as inductor. The use of other types of literature sources, as books, promoted a richer analysis of the first concept.

3. WHAT DO WE MEAN ABOUT BUILT HERITAGE?

Before we move on to an abbreviated analysis of the concept of heritage, it is essential to reinforce the idea that for our research, we are essentially concerned about built heritage.

The concept of heritage is complex, multidimensional and, for this very reason, it may be named and interpreted differently. The concept may also appear as Cultural Heritage or Historic Heritage, given its dynamic nature. It is a concept that has changed over time, being explored in different theoretical fields or fields of action of human being. Consequently, the legal concept of heritage differs from the aesthetic concept of heritage, among other contexts. Within these same different contexts that lies the important significance of this concept for society and particularly to its development (Marmion et al., 2010).

Despite the rarity of records prior to the 19th century regarding heritage protection processes, it is possible to realize that since Classical Antiquity there are some awareness about the vestiges of the past, however, it is important to emphasize that this concept cannot be understood as concerning the ancient or historical periods, but also as a contemporary concern (Choay, 2021). Moreover, if the temporal dimension tends to be a notion that no longer "ties" heritage to the past, other characteristics have also evolved considerably. It is possible to observe a clear transformation in its own understanding, moving from the tangibility of the monument to the intangibility of emotions (Choay, 2019), as far as heritage is not only considered as something material, but also something of expression, communication, transmission of knowledge and meaning (Smith, 2006). This new conception promoted an affirmation of oral traditions, and types of expression, such as music, customs and traditions, such as popular festivals. These types of heritage are called as "living heritage" (Martins, 2020, p. 23) or "practices of heritage" (Harrison, 2010, p. 9), which is nowadays translated as much more apparent representations of folklore, as it was called in the past. These types of heritage became understood as something complex, as it appears in the "Convention for the Safeguarding of the Intangible Cultural Heritage" (UNESCO, 2003).

Now, we will analyze another context of heritage, namely, the evolution of the concept building-object to object-involvement, which can easily be experienced in the case of built heritage. This evolution promoted an understanding of the building-object as part of its surrounding. This process became known as "historic ensemble", through the "Recommendation on the Safeguarding of Historic Ensembles and their Function in Contemporary Life" (UNESCO, 1976). There was then an integrated vision of the built heritage in relation to its surroundings, considering it no longer isolated, linking the built heritage to the community itself (Smith, 2006). To these previous contexts, others appear, as the one related to the transformation of the concept of heritage as a monument to something more subjective and connected with the values of a certain society, such as memory, identity and potentiator of dialogue between communities (Council of Europe, 2005). However, it is essential to understand that this subjectivity and relationships were developed through a process of "homogenization of the process values" (Choay, 2021, p. 106) that started taking place after the end of the Second World War.

This renewed vision on the role of heritage emerges after a moment of impact and transformation that occurred from the mid-twentieth century and, in particular from the 1970s/80s (Smith, 2006), especially in the affirmation about the need of protection of heritage, valuing it and integrating it into "contemporary life" (Choay, 2019, p. 233). At the same time, this approach to contemporary life, promoted one understating of heritage in an outward movement from the mystical aura of the museum concept, untouchable and not very accessible, giving it new functionalities, reinventing it, and using it in a sustainable way (Council of Europe, 2005).

Taking the example of the case of the "Grand Louvre" project (1981-1989), whose most visible structure are the metallic and glass pyramids designed by the architect I. M. Pei. If the physical transformation of the, now known as, "Cour Napoléon" has become evident, the identity and memory of the surrounding building did not disappear. However, we have come to witness what is called as a "heritage industry" (Choay, 2019, p. 239). This context appears associated with another one, massification of tourism or as "disneyfication of tourism" (Smith, 2006, p. 33). This happened to many historical sites and cities, as the case of the city of Venice, Italy.

Returning to the concept of heritage associated with memory and the construction of personal and collective identity (Harrison, 2010), we must understand the heritage-object as a "deliberated creation" (Choay, 2019, p. 19), as something that has been selected by someone as representative of a broader past than himself, being a representation that this someone had of a certain historical moment. As for memory, we can assume it in the relationship between heritage and the capital of knowledge itself, arising from the very development and human

experience (Hosagrahar et al., 2016; López-Fernández et al., 2021). In this case, heritage appears as an entity that supports memory, recognizing its importance in the very evolution of the human being, even if there is no certainty about the function or meaning of that piece of heritage, or the reason of its construction, as it is stated in the "Krakow Charter" (ICOMOS, 2000).

Another context of built heritage is linked to its function, ceasing to be an immutable object, capable of being adapted to gain new functions, moving from object of worship to object of learning, assuming that the experience in art is global (Dewey, 2005). This assumption promotes a movement of seeing and enjoying built heritage itself, as a "verification of pleasure" (Choay, 2019, p. 12) to a place of learning and questioning. This connects to Rancière words, about the role of spectator as an active agent of its own narrative, making his own translation of the "story" and being capable of building new narratives (Rancière, 2010). In this sense, and focused on the built heritage, the change of position regarding the role of the monument itself allows it to be seen as a learning space. This vision about built heritage as a learning space is a concept that has been evolving since the 1950s, being considered since the "European Architectural Heritage Charter" (Council of Europe, 1975) as essential to the balance and development of society, also revealing a decisive educational value and tool. These characteristics, are clearly displayed in the "Krakow Charter", appearing within the importance of the relationships between heritage, training and education itself, both on training technical experts in the field of heritage(s) and on the actions in an educational context (ICOMOS, 2000). More recently, built heritage has become labelled as a non-renewable asset, reinforcing the need for its protection and enhancement, and understanding it, as an essential educational resource for the development of the human being itself (UNESCO, 2014).

4. FROM EDUCATION THROUGH HERITAGE TOWARDS EDUCATION FOR SUSTAINABILITY: BUILDING A FUTURE

We have seen how the evolution of the concept of heritage, especially the built heritage, promoting it to new realities or functions, and as a space for training and education (Council of Europe, 1975; ICOMOS, 2000). This process occurred within the change of vision towards built heritage, affirming its value and need of preservation, as well as the assumption of its role to education, and as a tool for transforming the world and enhancing a sustainable future (UN, 2015).

Currently, and as already mentioned, the importance and urgency of a "viable future" (Mayor, 2002) is a base to the presentation of the Sustainable Development Goals through the "2030 Agenda" (UN, 2015). In these goals, heritage appears in Goal 11, and it's about "Make cities and communities more inclusive, safe, resilient and sustainable", relating it to the need to protect and safeguard heritage. This goal stems from the presentation, in the report "Future We Want" (2012), of the section "Sustainable cities and human settlements", point 134. In this section emerged the need for recognition, conservation and revitalization and rehabilitation of the natural and cultural heritage of urban centers, in a perspective of promotion and development of urban sustainability (UN, 2012). As we have seen, there are several relationships between heritage, education and sustainability. education is being assumed as the connecting link or tool of union (Heng, 2010), however, in addition of being a tool, education is responsible for promoting an overview of reality in order to respond to the unknown by strengthening the unity and plurality of the human being and its productions. This occurs through processes that focus on the particularity and the unity of all the parts, supported by a clear vision antagonistic to the crystallization of knowledge (Morin, 2002), which can be called as integration of knowledge. It is supported in this vision of global unity that heritage can be understood as a learning space and arising from its multidimensional nature enabling various fields of thematic exploration, such as History, Citizenship Education or more specifically, Education for Sustainability (Van Doorsselaere, 2021).

It is understandable that a building can serve several functions, as it changes over time, however, in the great majority of the cases, when a building is constructed with a well-defined purpose, the initial function is maintained. That is the case of religious buildings, civil buildings, like libraries or palaces, and also buildings or constructions of military nature. However, we also see buildings that, by their identity and memory, are changed, most often for purposes related to education and culture. A good example of this, is the case of the Museum of Aveiro, which was built as a religious monastery, and after 1911, became a museum of this city, enriched by other religious institutions (DGPC, n. d.), or the "Museu Arte Nova", also in the same city,

which was built as a private residence and today it is the interpretative centre of this artistic style, and considered one of the most emblematic buildings of this style in Portugal (MCA, n.d.).

It is through the process of safeguarding and valuing the built heritage that key competences for education for sustainability are sought to be developed. These competences were defined by Wiek et al. (2011) as: "Systems-thinking competence" - the ability to analyse or understand different systems; "Anticipatory competence" - the ability to analyse and understand "the big picture" and relate it to the resolution of future problems; "Normative competence" - the ability to map, connect or reconnect, negotiate and apply the values, principles and actions related to sustainability; "Strategic competence" - the ability to boost actions towards the implementation of solutions; and, "Interpersonal competence" - the personal ability to promote, facilitate and carry out actions (Wiek et al, 2011, pp. 207-211). According to these assumptions, the first author's research seeks to develop these competences, through the development of a mobile educational game "Art Nouveau Path" based on challenges that integrate educational resources in Augmented Reality, simulations, 3D animations and informative spots, which are triggered, in the app, in several strategic points of the city, where there is Art Nouveau built heritage, spread around the city of Aveiro. This mobile educational game is to be integrated in the mobile app EduCITY, developed under the Research & Development project "EduCITY - Smart and sustainable cities with Augmented Reality mobile educational games created by and for citizens", which intends to create better learning experiences, supported by the users' experience in situ and their performance while playing or creating pervasive and challenging games in order to enhance public understanding of built and natural heritage.

5. THE ROLE OF TECHNOLOGY IN DEVELOPING EDUCATION FOR SUSTAINABILITY THROUGH BUILT HERITAGE

Assuming, as already mentioned, the value of the heritage as a training and educational space, with special significance for the development of key competences for education for sustainability, it becomes essential to conceive educational actions that take place in the real context in which the heritage exists. This assumption arises from the vision of the transforming role that education has in society. However, this same role induces it, as we have seen previously, to new challenges. Those new challenges comprise the need of approach to students' daily experiences, in order to manage learning as an effective process (UNESCO, 2021) and assures that learning must be concrete, starting from the real to the abstract, towards the creation of new values and new learnings, promoting more solid and effective interdependencies of knowledge (OECD, 2018).

We have seen how the development of key competencies in sustainability can be supported by technological developments, since technology allows, when properly exploited, to enable new experiences, extending reality, using Virtual Reality, Mixed Reality or Augmented Reality (Alnagrat et al., 2022). These new realities complement the material world, enhancing and mobilizing new learning experiences (Chen & Duh, 2018). It also allows the exploration of learning in new contexts, whether formal, non-formal or informal, at school or in outdoors, in close contact to reality, near nature and in a perspective of lifelong learning (Pombo et al., 2019).

The potential of integrating the tangibility of real world with the intangibility of new realities, such as Augmented Reality, has proven to be significantly positive for students, both in terms of increasing their interest and performance, but also in terms of the effectiveness of their own learnings (Alnagrat et al., 2022). However, the use of Augmented Reality and its effective potential mobilization as an educational resource is enhanced through mobile learning (Marcel, 2019). That occurs attending the fact that built heritage exists in outdoor context, and mobile learning acts as a connector of the realities, and as a tool to the promotion of Augmented Reality and its use as education resource.

This situation can be facilitated through the massification of the use of mobile devices and its relevance to education, having proven to be prolific not only at individual learning, but also through cooperative strategies and dynamics learning activities (Chen & Duh, 2018). The use of Augmented Reality is still considered as recent, and there are few authors who study its potential to promote learning. This potential regards the fact that Augmented Reality enables contact with reality, through the process of overlaying new content (Barrado-Timón & Hidalgo-Giralt, 2019). By requiring the existence of real contexts, Augmented Reality induces learning in spaces outside classrooms or schools, bringing them closer to the real world (Pombo, 2022). This causes engagement and motivation in its users (Chen & Duh, 2018). However, as Scavarelli et al. (2021)

refer, it is necessary to continue developing work to make Augmented Reality more efficient, with especial regard to educational contents. This implies the development of Augmented Reality contents considering educational specificities, as proper exploration in terms of the context of the resources and its relations with school curricula, ensuring their educational or formative role.

5.1 The Mobile Educational Game with Augmented Reality "Percurso Arte Nova" on the Educity App

The mobile educational game using Augmented Reality content "Art Noveau Path" is being developed, based on the potential of Augmented Reality among with Mobile learning, the importance of situated learning (Barrado-Timón & Hidalgo-Giralt, 2019; Pombo, 2021) and assuming that built heritage is an educational and learning space (Council of Europe, 1975; ICOMOS, 2000). Summing to the set out above, built heritage can take an essential role on the development of key competences of education for sustainability (Van Doorsselaere, 2021). This educational mobile game is part of the EduCITY mobile app that emerges under the Research & Development project "EduCITY", which allows the creation of a smart learning environment in the city of Aveiro, constituting itself in the future, as a reference for other cities. The educational mobile game "Art Noveau Path" will be, like others, available for free on the EduCITY app for Android and iOS operating systems. The development of the game follows the dynamics of Design-based Research, considering several cycles of improvement. Regarding the research aims, the game will be applied, through a quasi-experimental research plan, using classes of sixth and ninth grades, with pre and post-test groups. With this study, it is intended to contribute to the development of key skills for Education for Sustainability, enhancing the local built heritage, through the creation of challenges that integrate educational resources in Augmented Reality, simulations, 3D animations and informative spots, which are triggered, in the app, in several strategic points of the city, namely near the built heritage in Art Nouveau style, taking place in the city of Aveiro.

This research ensures the active involvement of various stakeholders, including students, teachers, academic and general community, assuming the construction of science as a complex process and as an exercise of citizenship.

6. FINAL REMARKS

We can proceed to a definition concerning the concept of heritage, stating that it is a process of culture and education (Chaoy, 2019). As any process, it is dynamic, allowing change and transformation, and being linked to the development of human being. Nowadays it is considered as an integral part of the memory and identity of any society (Council of Europe, 2005), allowing the establishment of connections between Past, Present and Future. Although the research was not exhaustive, it is possible to mention that this concept presents different natures, such as material, as architecture, or immaterial, as music, connected to its origin as human production. Although the importance of human productions, we must also value and protect natural heritage, as a space of balance and essential to the effective development of human being. Is considered as a multidimensional concept, perceived in different ways, according to one's personal experiences (Smith, 2006). It is a deeply sociological concept, whether established in personal or collective values. International agencies and organizations, such as the United Nations and UNESCO, recognize the role of heritage as an educational enabler, revealing, through its multidimensionality, its potential as an agent for the development of key competences for education for sustainability (Van Doorsselaere, 2021).

Despite the ease with which relationships between the areas investigated can be perceived, the literature search process, although not exhaustive, allowed us to realize the small amount of research on the importance of heritage in the development of key competences for education for sustainability. This paper aimed to build bridges between these research areas, constituting a hinge point for further research. In this sense, a narrative literature research was carried out on the concept of heritage, with special emphasis on the built heritage. From this, it was possible to establish links with the area of education, particularly with education for sustainability. For this relationship, technology is involved, in the sense that it enables, through resources in Mobile Augmented Reality Learning, the exploration of the built heritage as a learning space, with implications to the development of education for sustainability (OECD, 2018; UN, 2015; UNESCO, 2014, 2021). These relationships, which appear explicitly in this paper, will enable the development of future research.

The future research will include the development of an educational mobile game using Augmented Reality content. From the implementation of this game to the school community, data will be collected through the development of a quasi-experimental, sequential explanatory research plan, evolving six classes (three test groups and three control groups) and their respective teachers. To validate the previous results, we will also use a survey and focus group. It is expected, therefore, to contribute to the development of key competences related to education for sustainability, through the valorisation of the Art Noveau built heritage of the city of Aveiro.

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