




## Article

# Mapping Gamification for Sustainable Urban Development: Generating New Insights for Tourism Education

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**Abstract:** Although scientific literature already shows the connections between gamification, tourism and sustainability, there is still a gap in research into how gamification can transform cities into more playful, sustainable and intelligent tourism destinations. Gamification in tourism promotes engagement, education and innovation, enriching experiences and driving the development of smart destinations. This study advances this debate by employing a mixed methodology, combining a systematic review (supported by Rayyan, an artificial intelligence) and content analysis (supported by Iramuteq, a textual software, version 0.7 Alpha 2). Additionally, we used Dreamscape by Voyant Tools online for a geographical analysis of the textual corpus formed by  $n = 61$  abstracts. The intersection of main findings from the techniques applied provides eight new insights on urban tourism education through gamification, which are as follows: (1) exchange between the Global North and South; (2) local and global participation; (3) collaborations to achieve the 17 SDGs; (4) improve urban destination marketing by ethics principles; (5) deepening disruption technology and ethics studies; (6) the transformation of reality by sciences; (7) gamification on interdisciplinary perspectives; and (8) the role of gamification on the tourism and hospitality industry. The results suggest that gamification in tourism can offer a new ontological approach to addressing sustainable urban development, highlighting both theoretical and practical challenges. This research has both theoretical and practical implications, advancing the concept of ecogaming by integrating technology, entertainment and sustainability, and reinforces its potential to educate and engage in sustainable urban tourism practices.

**Keywords:** gamification; sustainable urban development; tourism education; smart cities; sustainable development goals (SDGs)



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## 1. Introduction

The role of game play in tourism education is highlighted by many authors, for instance Chan et al. (2019) focused on urban tourism education from an online scenario game perspective. In this way, games can be more than one's own game in tourism education scenarios. In his book called *Homo Ludens*, Huizinga (2007) explains that play is a cultural phenomenon that relates to aspects such as language and knowledge. There are countless types of games (board games, card games, big games, role play games, alternative reality games, and serious games, among others). Games can be digital and/or analogue, online/offline and/or hybrid (Araújo et al., 2019). However, regardless of the type of game and the way it is played, what is in perspective as an asset for Huizinga (2007) is playfulness. In the 21st century, we can see the rise of a new adjective for cities, which is

the label “playful city”. In general terms, the playful city aims to promote play and games in public spaces from the perspective of leisure and creativity (Thibault, 2020).

Thus, games can be educational tools to improve sustainable urban development. It should also be added and clarified that, in practical terms, certain types of games, such as alternative reality games (ARG)—which straddle a fine line between real and alternative realities (Dominik, 2008)—can be a powerful and relevant device for changing behaviour in favour of social and environmental causes (McGonigal, 2011a). Following on from this, it is worth noting that McGonigal (2011b) advocated the following: “Be a gamer, save the world” (p. 11). Even Abraham (2022), faced with the current climate crisis, debates, “How Can Games Save the World?” (p. 27). Therefore, gamification in the context of urban dynamics can help a city, as a tourism destination, to be more sustainable and intelligent. From this perspective, gamification should be aligned with the 17 Sustainable Development Goals of the 2030 Agenda (United Nation, 2015). Research linking gamification, tourism and sustainability is evident in the scientific literature, such as Souza et al. (2020) and Jolly and Budke (2023), among others. In this context, a new paradigm is opening up: gamification to make cities, as urban tourist destinations, more playful, sustainable and intelligent. In order to understand how this topic has been dealt with in academia, this study focused on systematic reviews published over the last few years on gamification and tourism, allowing five key articles to be identified: (1) Araújo et al. (2019); (2) Pradhan et al. (2023); (3) Quiroz-Fabra et al. (2022); (4) Pasca et al. (2021); and (5) Paixão and Cordeiro (2021).

In the sense of understanding how the topic has been dealt with in academia, the first stage of this research was to undertake an accurate analysis of systematic reviews published exclusively in scientific journals in the last five years on gamification and tourism, which resulted in the identification of five papers: (1) Araújo et al. (2019); (2) Pradhan et al. (2023); (3) Quiroz-Fabra et al. (2022); (4) Pasca et al. (2021); and (5) Paixão and Cordeiro (2021). From these five reviews, the first fact observed was that although sustainability is dealt with directly, the urban and smart city approach seems to be indirect. This was borne out by the following: (a) Although Araújo et al. (2019) emphasised the term “city” as part of their results, none of the five studies included a search for key terms connecting the relationship between “gamification”, “tourism”, “sustainability”, “urban” and/or the term “smart city”, in a direct way. (b) Pradhan et al. (2023) focused on aspects linked to “sustainability” and “smart”, evidenced by the use of the term “smart tourism”, from two perspectives: (1) “gamification mechanics and design” and (2) “gamification in tourism”. However, they did not address the “smart city” category. (c) Quiroz-Fabra et al. (2022) were more incisive in affirming the asymmetrical relationship between “smart tourism” and the technological development of regions. These authors stated that it is in the more developed “urban” areas that there is a greater tendency towards “smart tourism”. (d) Although they do not cite the term “urban”, Pasca et al. (2021) cited works that dealt with “smart tourism” (by Yoo et al., 2017) and “smart city” (by Fischoder et al., 2018), which are related terms. (e) Paixão and Cordeiro (2021) addressed the term “smart destination” in the context of gamification in tourism, and allied this to “sustainability”. The second fact observed was that the systematic reviews undertaken connecting tourism and gamification were mostly carried out on the Scopus scientific database (Araújo et al., 2019; Pradhan et al., 2023; Quiroz-Fabra et al., 2022; Pasca et al., 2021), and this is relevant to searches on other databases. The third fact observed was that, although the various studies used different bibliometric methods from the systematic reviews, adopting specific protocols (Pasca et al., 2021), or with specific theoretical models (Paixão & Cordeiro, 2021), it was noted that none of them used a mixed approach, including the support of software such as Iramuteq (2020) and Voyant Tools (2024).

This justifies the motivation to explore gamification in sustainable urban development and urban tourism education, because to the best of the authors' knowledge, no research has been carried out on this specific topic to date. What is more, there is a need to more effectively involve both residents and tourists in sustainability efforts. Therefore, by integrating gamification, this paper aims to create innovative educational approaches that raise awareness of and participation in sustainable practices. Thus, considering the above and anchored in the three facts together, a research problem is presented, to be pursued both by researchers who aspire to generate robust contributions to the ontological and epistemological advancement on this emerging theme of gamification in tourism and sustainability education, explicitly and directly including the urban and/or smart city in the debate, but also pursued by practitioners, teacher and students, researchers, planners and managers of urban tourist destinations who yearn for innovative solutions, and this problem is as follows: How can gamification strategies in sustainable urban development inform innovative approaches to tourism education by mapping spatial trends, analysing convergences and divergences in key concepts and exploring communities of thought in the literature to identify patterns, gaps and opportunities for future research? In order to better answer the research question on the promotion of urban educational tourism, this study maps trends and spatial patterns in gamification strategies for sustainable urban development, analyses convergences and divergences between key concepts in the literature and explores similarities in how these insights can inform innovative strategies for tourism education. In order to fulfil the research objectives, this study adopted a mixed methodology consisting of a systematic review and content analysis, as in other studies of the same kind (Klant & Santos, 2021). The Web of Science (WoS) database was used because it is selective and focuses on older publications with a greater impact (Campos et al., 2022). The main results highlight the top eight new insights for improving educational tourism from gamification perspectives in order to encourage sustainable urban development.

## 2. Literature Review

Teaching and learning from a gamification perspective is a process full of complexities (Fraga et al., 2012). On the other hand, urban tourist destinations and attractions that can be targeted by gamification for sustainable tourism are also complex. For example, these destinations can be immersed in different geomorphological dynamics (islands and archipelagos and mountains, among others) (Lohmann & Duval, 2014). Therefore, when addressing complex issues such as participatory planning and the inclusion of children in the debate on smart cities, using gamification in Jakarta, Indonesia, as done by Akbar et al. (2024), it should be emphasised that being an island, the urban territorial dynamics are particular. In view of these and other complexities, it is essential to delve into the literature reviews already carried out on gamification and tourism, in order to shed light on the still nebulous points of connection. Table 1 summarises a set of systematic reviews that have been produced in recent years and published in various databases (WoS and Google Scholar, among others).

A detailed analysis of the papers published between 2008 and 2022 allows us to highlight the following: (1) Gamification in interface with tourism has already been the subject of a number of studies with diverse objects (T&S, practices, etc.), with sustainability emerging as a key aspect of the main results (Pasca et al., 2021; Pradhan et al., 2023). (2) Although Araújo et al. (2019) found "city" as a prominent term in the main results, none of these reviews focussed on the urban area or the city as a central focus. This could possibly be related to the scarcity of results when terms such as "urban" and "city" are included alongside gamification and tourism in scientific databases. (3) There is a predilection for using the Scopus scientific database, which suggests that inserting other databases, such as WoS, could cover the topic more comprehensively.

**Table 1.** Literature reviews of gamification in tourism.

Author (Year)/ Journal	Base n—Type (Years)	Search String	Methodology Approaches
Araújo et al. (2019)/International Journal of Marketing Communication and New Media	Scopus 40—practices (2013–2019)	Words filtered in the title, keywords or summary of articles using the words “gamification+tourism”	Bibliometric and content analysis
Pasca et al. (2021)/Journal of Service Theory and Practice	Scopus 36—papers (2011–2019)	Title-Abs-Key (gamif* AND touris* OR travel* OR accommodation OR hospitality OR “sharing economy” OR “peer-to-peer platform”	Protocol of SRL from Pickering and Byrne (2014) and Pickering et al. (2015) (apud Pasca et al., 2021)
Paixão and Cordeiro (2021)/Revista Brasileira de Pesquisa em Turismo	Portal de Periódicos, Science Direct, Publicações em Turismo (USP), Website Gamificação em Turismo 40—practices (Not located)	“Gamificação and Turismo”; “Game and Turismo”; “Gamification and Tourism”; “Game and Tourism”; “Gamification and Tourisme”; “Ludification and Tourisme”; “Gamificación and Turismo”; “Ludificación and Turismo”	The results of SRL were analysed by the Model of Werbach e Hunter (2012) apud Paixão & Cordeiro, (2021).
Quiroz-Fabra et al. (2022)/Human Behavior and Emerging Technologies	Scopus 54—studies (2008–2022)	Title (“e-learning” or “gamification” or “apprehension” or “learning process”) and title (“Natural Park” or “environmental park” or “National park” or “tourism” or “outdoors” or “outside”).	Systematic review of literature (SRL)
Pradhan et al. (2023)/Sustainability	Scopus 64—articles (2015–2022)	Title-Abs-Key (“Gamification”) AND TITLE-ABS-KEY Title- Abs- Key (“Tourism” OR “Tourist,” OR “Travel”),	Hybrid systematic review—combined (1) bibliographic and (2) content analysis

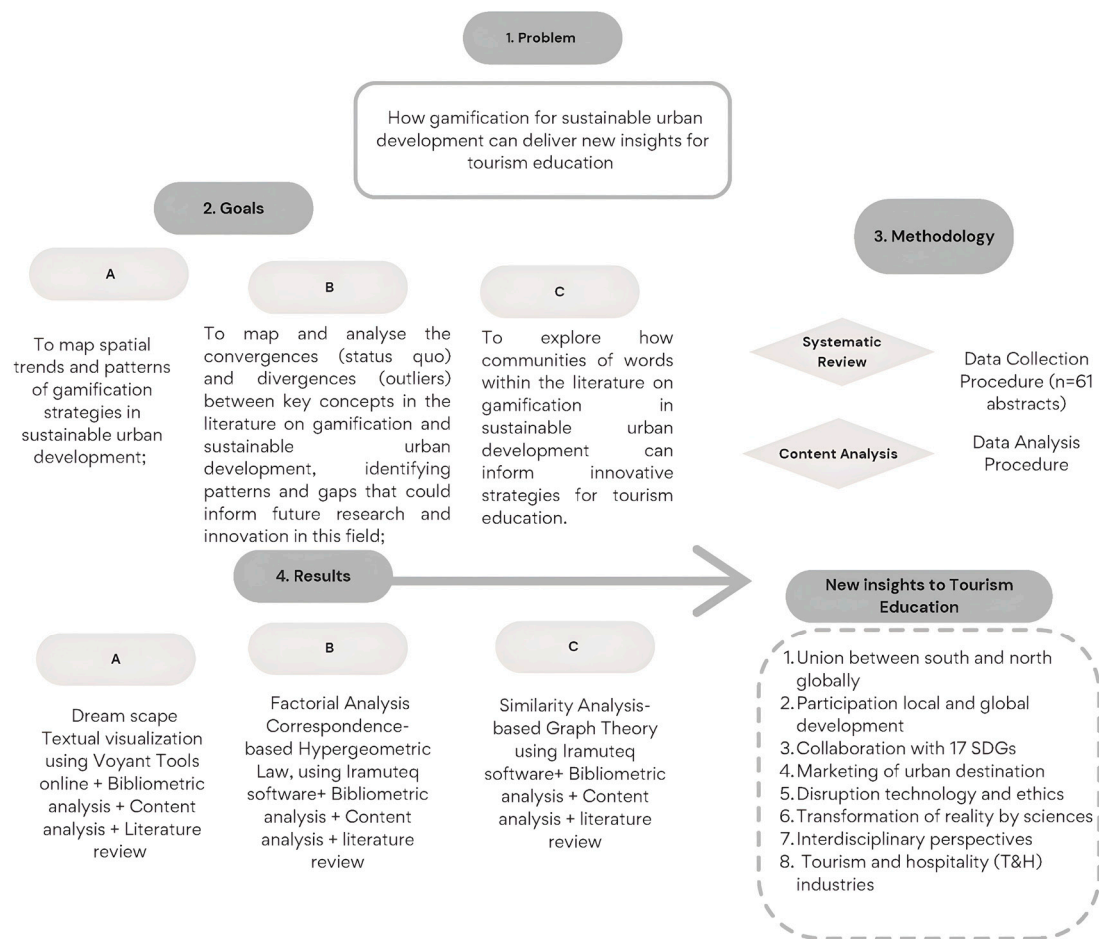
It should also be emphasised that the construct “smart cities” and how it relates to “smart tourism” or “smart destination” is part of a broad debate about the fact that adjectives that were once human prerogatives have been incorporated into objects and places. In other words, if intelligence was once exclusively part of the human domain, now with technological advances in computing and the popularisation of artificial intelligence (AI), human adjectives have been transposed to objects and places as a result of technological disruption (Cardoso & Fraga, 2024). In this sense, it is worth considering what was argued by Pradhan et al. (2023), who emphasised that including these neuroscientific methods could be a differentiator for future research into gamification in tourism, corroborating the relevance of the interface between computing and neuroscience.

### 3. Materials and Methods

To conduct this research, as in other studies, a mixed methodology combining systematic review and content analysis was adopted (Cardoso et al., 2020; Santos et al., 2020). Content analysis is a method applied to the social sciences that allows the content of text to be analysed (Stepchenkova et al., 2009). Content analysis can be applied to bibliometrics (systematic reviews) when it involves qualitative analysis, which in this study involved the use of Iramuteq software (version 0.7 Alpha 2). The content analysis carried out with Iramuteq can be classified as lexical content analysis or categorical content analysis with quantitative support, as it combines qualitative and quantitative approaches (Ramos et al., 2018; Klant & Santos, 2021; Neuendorf & Kumar, 2015; Zavyalova, 2022). In addition, the online tool Voyant Tools was used to contribute to a geographical analysis of the textual corpus. In order to answer the research question and the main objective, this study has adopted the following objectives: (1) to map spatial trends and patterns of gamification strategies in sustainable urban development; (2) to structure and analyse the convergences (status quo) and divergences (outliers) between key concepts in the literature on gamification and sustainable urban development, identifying patterns and gaps that could inform future research and innovation in this field; and (3) to explore how communities of words within the literature on gamification in sustainable urban development can inform innovative strategies for tourism education.

Thus, in order to fulfil the objectives of the research, some methodological procedures were adopted that combine qualitative and quantitative methods of analysis in different phases of the research, as well as some methodological decisions similar to what has already

been done by other bibliometric research of the same type (Cardoso et al., 2020, 2021, 2022; Campos et al., 2022; Cardoso & Fraga, 2024). Figure 1 shows us the scheme of the research.



**Figure 1.** Scheme of research.

It should also be emphasised that Figure 1 aligns the research objectives with the methods and techniques used and provides some information on the insights that the main results bring to tourism education.

### 3.1. Data Collection Procedure

The data collection procedure was conducted in WoS on 24th October of 2024 (Web of Science, 2024); the strategy adopted in this review involved four important decisions based on evidence from previous reviews: (1) A database still little used in review studies on the subject was chosen, the WoS, in order to cover other articles that may not have been available in the main database (Scopus) consulted in previous reviews. In this way, Vieira and Gomes (2009) highlighted Scopus and the WoS as complementary. (2) More search terms were linked using a more robust string than those found in previous reviews, namely the following: gamification\* (topic) AND sustainability\* OR sustainable\* OR smart\* (topic) AND touris\* OR hospitalit\* OR travel\* OR vacation\* (topic). (3) The term urban\* OR city\* OR cities\* was not included, as the search gave a reduced output of papers (n = 21). (4) A mixed approach was adopted, with textual analysis (supported by Iramuteq version 0.7 Alpha 2) and geographical analysis (supported by Voyant Tools, 2024), the latter being essential for analysing the urban area and the city. Based on these decisions, the results found for tracking how gamification, tourism and sustainability relate to the urban and smart city were (n = 115) papers, which made it possible to start the systematic review,

whose main objective was to identify gamification strategies for urban sustainability, which can be aligned with smart city and smart tourism destination concepts.

To support the general objective, the specific objective was subdivided into two: (a) to check whether urban and smart tourism are research gaps in gamification in tourism and sustainability and (b) to include issues relating to smart (city, destination, etc.) in the urban debate.

The adaptation of the PRISMA flowchart (2009) (Moher et al., 2009) combined with the support of Rayyan artificial intelligence (2024), was used to streamline the process and systematically determine the data collection and organisation part, which resulted in  $n = 61$  papers. In this context, Johnson and Phillips (2018) provided an overview of Rayyan for systematic reviews. Table 2 details this adaptation, determining the exact moment when AI was used in the review process.

**Table 2.** Adapted PRISMA flowchart (2009).

Steps	Description	Papers
(1) Identification	gamification * (topic) AND sustainability * OR sustainable * OR smart * (topic) AND touris * OR hospitalit * OR travel * OR vacation * (topic).	$n = 115$
(2) Screening	Filters: (1) articles ( $n = 65$ ) (2) English ( $n = 114$ )	$n = 65$
(3) Eligibility *	Abstract available	$n = 65$
(4) Included *	Direct or indirect link between gamification and sustainable development in urban perspective	$n = 61$

\* Used AI Rayyan (2024).

The four articles excluded ( $n = 4$ ) were based on the fact that they included topics other than those analysed here, such as the work by Christie et al. (2019), which addressed the specificities of emotional health for young people through gamification using smartphones.

### 3.2. Data Analysis Procedure

With regard to the papers ( $n = 61$ ) that resulted from the screening process, the abstracts were organised for insertion into the Voyant Tools (2024) tool, an open source textual analysis and data visualisation tool, which makes it possible to analyse and map geographical references in texts, revealing how specific locations are linked to gamification strategies in tourism, and to extract the DreamScape, which highlights these locations geographically. It should be noted that on the Voyant Tools (2024) website there is a reminder that this tool is still in the experimental phase and that it is difficult to define the exact locations using only words from the abstracts, as this can lead to errors, such as the following: if the text mentions Paris Hilton, the location may be Paris in France. In this sense, a careful reading of the abstracts makes it possible to check and adjust before processing in the software (Voyant Tools, 2024).

Subsequently, with the support of a second textual analysis tool, the textual corpus was organised and coded in accordance with the Iramuteq 0.7 Alpha 2 (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires) software manual (2020). Iramuteq is also free, open-source software for statistical analyses of texts and qualitative data, including content analysis, and is widely used to explore themes and patterns in large volumes of text in the social sciences, psychology and linguistics (Sousa, 2021). The instructions in the software manual suggest using the following code: \*\*\*\* \*variable\_name\_n, whereby in this study the variable name was replaced by abstract, and the  $n$  by the respective job number, ranging from 1–61. Table 3 shows the textual analysis techniques used.

It should also be noted that, for the coding, the text corpus was adjusted with the standardisation of the text for UK English, and submitted to the software with an adjustment of the “adverb” category to supplement it.

**Table 3.** Textual analysis techniques.

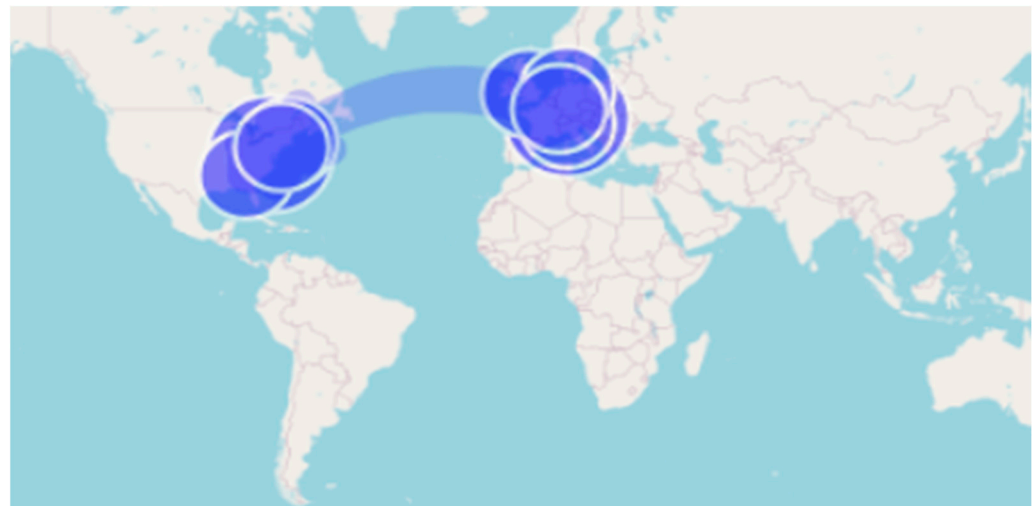
Techniques	Description
Factorial Correspondence Analysis (FCA)	In this analysis, only the active terms per modality were determined, including all the variables (abstract 1–61). In addition, the default of the Iramuteq software (2020) version 0.7 Alpha 2 was maintained, i.e., a frequency equal to or greater than 10 terms.
Similarity Analysis (SA)	At this stage, the Iramuteq software was calibrated as follows: (a) Score: co-occurrence; (b) presentation: Fruchterman Reingold; (c) Graph type: statistics; (d) Communities and halos: edge betweenness community; (e) Frequency of terms equal to or greater than 20 terms.

## 4. Results and Discussion

The results will be presented and discussed in accordance with the proposed objectives which are related to (1) trends and spatial patterns of gamification strategies in sustainable urban development; (2) key concepts in the literature on gamification and sustainable urban development, which make it possible to identify patterns and gaps in order to promote innovation and guide future research; and (3) innovative strategies for tourism education based on the literature on gamification in sustainable urban development. In the last subsection, the overall discussion takes on the global objective of identifying gamification strategies for urban sustainability, aligned with the concepts of smart city and smart tourist destination.

### 4.1. Spatial Trends and Patterns of Gamification Strategies in Sustainable Urban Development

Mapping gamification in the context of sustainable urban development involved first analysing the papers geographically ( $n = 61$ ). In other words, this involved a spatial interpretation of the themes included in the abstracts. Figure 2 shows that the target cities for gamification in tourism are part of the Global North, including mostly European and North American countries, which are connected to each other, demonstrating their hegemony on the subject.



**Figure 2.** DreamScape. Source: [Voyant Tools \(2024\)](#).

The geographical approach to the subject is so relevant that [Yoo et al. \(2017\)](#) adopted the Google Maps platform in their research into the factors involved in gamified smart tourism. On the other hand, [Maltese et al. \(2021\)](#) explained that gamification is lacking for advances in active transport (including walking, cycling, etc.) in Italian cities. So, with regard to the cities identified in the database, which are urban tourism destinations, they could identify with and benefit from the insertion of a topic on gamification in education on how to promote sustainable urban tourism strategies. Urbanism as part of the gamification of the cultural

experience (Prandi et al., 2019) makes it possible to enhance teaching and learning about key elements of sustainable development, such as heritage. Another aspect is the neologism eco-gamification and this is a key theme for urban environments as it unites technology, entertainment and the environment (Souza et al., 2020; Souza & Marques, 2022, 2024).

Some studies emphasise that transport and mobility issues are key in gamification studies in favour of urban development, for example the GoEco tested in Switzerland by Cellina et al. (2019), a study that teaches lessons about sustainable mobility in two Swiss tourist destinations, Cantoese Ticino and Zurich. As there is no sustainable tourism without sustainable mobility, Høyer (2000) emphasises that it is essential for urban tourism education to consider this binomial. Relevantly, a type of game called Mobile Geo-games has emerged and been used for experimental purposes. For example, Pajarito and Gould (2018) used one of these games to identify the frictions that inhibit cycling, with three locations attracting visitors: Munster in Germany, Castello in Spain and Valletta in Malta. Another key issue was recycling, for example, in Europe there is Urban Waste, an app about changing recycling behaviour (Aguiar-Castillo et al., 2019; Aguiar-Castillo et al., 2018). In fact, from this perspective, Aguiar-Castillo et al. (2018) questioned the ethical limits of gamification in terms of encouraging undesirable behaviour and used a neologism, “gamipulation”, which is an item that requires a critical debate that is essential in the context of tourism education.

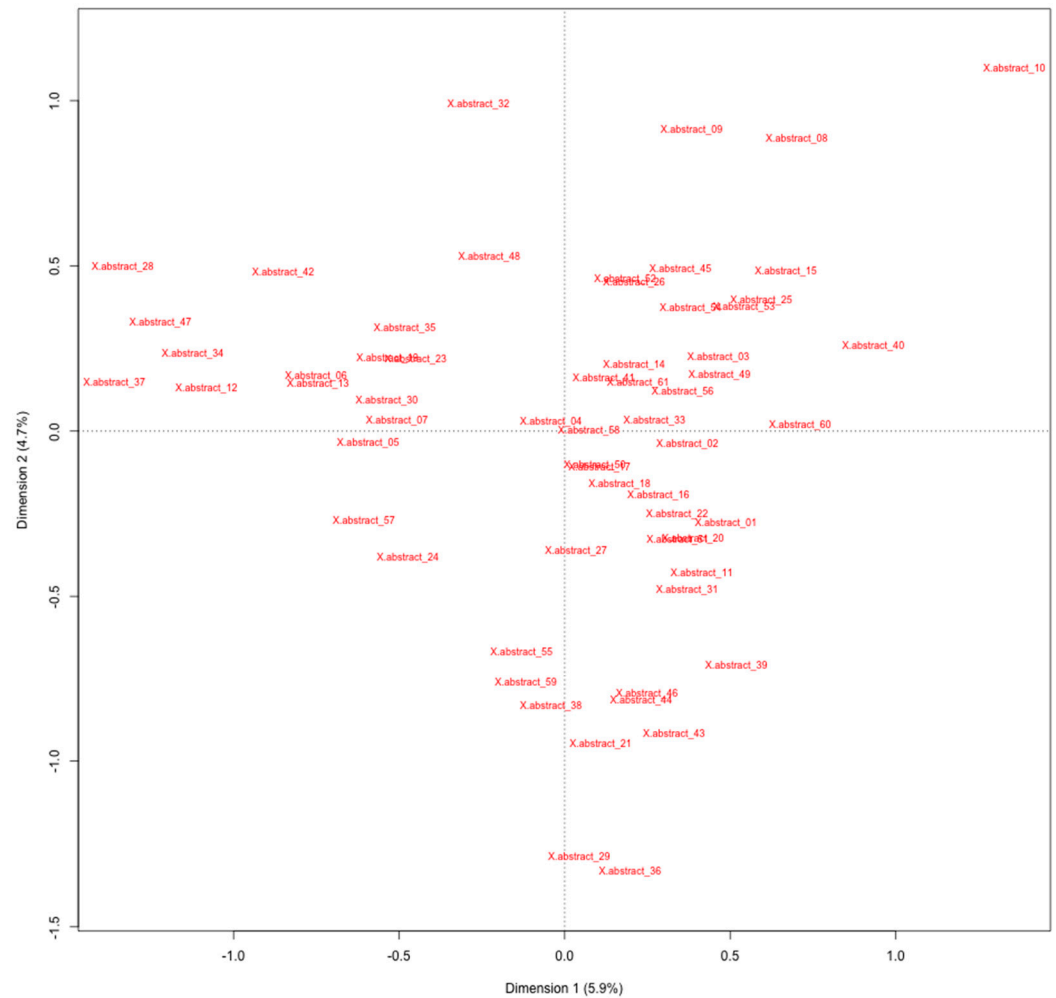
In general terms, the work by Chan et al. (2019) is one of the most significant in terms of gamification for urban tourism, considering the role of education. However, the study highlights a geographical problem, namely virtuality. As this is e-learning (distance education) using an online scenario, it should be emphasised that the geographical approach to teaching and learning gamification must be considered in the light of technological disruptions, including virtual reality, extended reality, augmented reality, etc. The study by Lacka (2020) highlights this problem when dealing with location-based augmented reality games in tourist destinations. From this perspective, there is a fine line in bringing together the relationship between the real, the virtual and the imagination (Lévy, 2011, when the aim is to teach and learn about gamification in favour of sustainable urban tourism development, with the geographical space itself being perceived from multiple digital and virtual layers. Still, in terms of teaching and learning, Lalicic and Weber-Sabil (2022) emphasise the role that serious games can play in engaging with sustainable tourism planning and highlight the role of urban space and other complexities. The authors even link education to research, emphasising that this type of game can be a differentiator.

Furthermore, although the asymmetry of gamification in the context of sustainable urban development in the Global North is not evident in Figure 2, it can be seen that it is more present in some countries than in others, as some studies, such as that by Maltese et al. (2021), point precisely to the lack of gamification strategies for sustainable urban development. At this neuralgic geographical point, it becomes relevant to delve deeper into the lessons shared between the studies, whether through convergence or divergence.

#### *4.2. Structuring and Analysing Convergences and Divergences Between Key Concepts in the Literature*

Analysing Figure 3 required an approach to the positioning of abstracts, i.e., in two directions: (a) convergent, which leads to a status quo, and (b) divergent, i.e., outliers. Following this approach, Table 4 presents the relevant examples in terms of the most visually evident relationships and organises them into quadrants.

In the first quadrant, four papers are identified as converging while maintaining the status quo, starting with abstract\_14 (by Aguiar-Castillo et al., 2018), abstract\_41 (by Souza & Marques, 2022), abstract\_56 (by Rosmadi et al., 2024) and abstract\_61 (by Souza & Marques, 2024), and it can be seen that the term “ecogamification” is the concept that brings abstracts 41 and 61 together, which even appear to be by the same authors.



**Figure 3.** Factorial correspondence analysis (FCA). Source: Iramuteq version 0.7 Alpha 2.

**Table 4.** Convergence with status quo maintenance and outliers.

Quadrant	Convergence (Status Quo)	Divergence (Outliers)
1	14, 41, 56, 61	10
2	6, 7, 13, 30	32
3	-	29
4	2, 17, 50	36

As mentioned, ecogamification is understood as combining technology, entertainment and environment (Souza & Marques, 2022, 2024). In the same quadrant, one paper is a clear outlier, this is abstract 10 (by Garcia et al., 2019) which offers a valuable insight into the mobile gamified experience validated by real tourists, this being an innovation by three destination marketing organisations (DMOs) involved in the search for innovation based on gamification and technology. As for the urban space of this validation, it took place in the Basque Country, and did not delve into the debate on urban or smart city. However, they did deal with “smart tourism” in the context of gamification. It is also clear that, in this case, the gamification in tourism is related to the marketing of places, as they are DMOs. Thus, the urban tourism education in sustainable urban development should have included smart as a relevant construct. In the second quadrant, there are also four converging papers: abstract\_06 (by Cellina et al., 2019); abstract\_07 (by Rey et al., 2016), which dealt with problems related to off-peak transport, taking into account gamification in travel behaviour, and demonstrating sustainability-oriented changes by users; abstract\_13 (by Weber et al., 2018), focused

on apps for smartphones in relation to cycling, including gamification; and abstract\_30 (by [Sottile et al., 2021](#)), which dealt with gamification as a strategy for changing behaviour, focusing on university mobility and also using smartphones. On the other hand, the outlier abstract\_32 (by [Tan & Lu, 2021](#)) highlights the role of emotions in the gamification process. The outlier in the third quadrant highlighted the role of Chan et al.'s (2019) study of urban tourism education. As mentioned, it is based in an urban context but developed from an e-learning perspective. However, the relationship among real, virtual and imaginary is relevant to teaching and learning about the topic. In the fourth quadrant, the convergence of abstract\_02 (by [Negruşa et al., 2015](#)), abstract\_17 (by [Souza et al., 2020](#)) and abstract\_50 (by [Zhai et al., 2023](#)) focused on making sustainability more than a concept, including gamification as relevant tools in the SDG context ([Souza et al., 2020](#); [Negruşa et al., 2015](#)). Furthermore, the outlier abstract\_36 (by [Chung-Shing et al., 2020](#)) is a scenario game, but with a focus on ecotourism; notably the game simulates an indigenous community in the Amazon rainforest (Peru). It differs from the study by [Chan et al. \(2019\)](#) in that it does not necessarily emphasise aspects of sustainable urban development.

#### *4.3. Similarities in Research Themes and Trends Can Inform Innovative Strategies for Tourism Education*

With regard to the mapping of gamification as a strategy for sustainable urban development and generating new insights for tourism education, the similarity analysis (SA) reveals the prominent terms of the textual corpus formed by the abstracts (n = 61), such as the following: study (f = 100), gamification (f = 84), tourism (f = 93), game (f = 79), tourist (f = 72), behaviour (f = 61), experience (f = 55), user (f = 51), research (f = 50), design (f = 47), sustainable (f = 46), result (f = 41), gamified (f = 40), and mobility (f = 40). This set of terms makes it clear how urban tourism education can improve themes (see [Figure 4](#) and [Table 5](#)):

In the first halo, the term environmental, in the context of gamification, refers to the setting or context in which gamified interactions take place, often mixing digital and physical experiences. The studies focus on the tourist and destination. In particular, the gamified experience. The mobile phone information is not just a technological tool, but a portal that connects tourists to the gamified environment, enriching the experience at the destination and making it more engaging and enjoyable. In this context, it is worth recalling the contributions of [Fernández-Ruano et al. \(2022\)](#) who argue that gamified interpretation of the environment has a great effect on the perception of the destination's brand value, even more so when the destination is seen as psychologically distant. The terms technology and information mobile could be key points for connecting the theme with smart city and smart destination. However, as these terms do not appear, this is still a gap in the scientific literature on the subject.

The behaviour halo is interconnected with the gamification halo; however, three topics stand out in this halo: app, travel and influence. Together, these three elements reinforce behaviour change: the app structures and rewards the user experience, displacement introduces specific contexts for behavioural goals and user influence amplifies engagement through social interaction. This connection is in line with [Ala AlMarshedi et al. \(2017\)](#), who argue that gamification influences behaviour, but on the other hand cultural factors also influence gamification. In the tourism halo, the link between the terms reveals that gamification in tourism can transform the tourist experience by creating meaningful connections with learning, development and positive impact for both tourists and host communities. This linking of topics is in line with what [Negruşa et al. \(2015\)](#) advocate, that gamification can boost sustainable tourism by improving relations between tourists, organisations and communities. Several authors argue that gamification in tourism can stimulate growth and innovation in tourist destinations, enhance the visitor experience with more interactive activities, facilitate learning about culture and the environment in an engaging way and generate a positive impact by encouraging sustainable practices and local cultural appreciation.

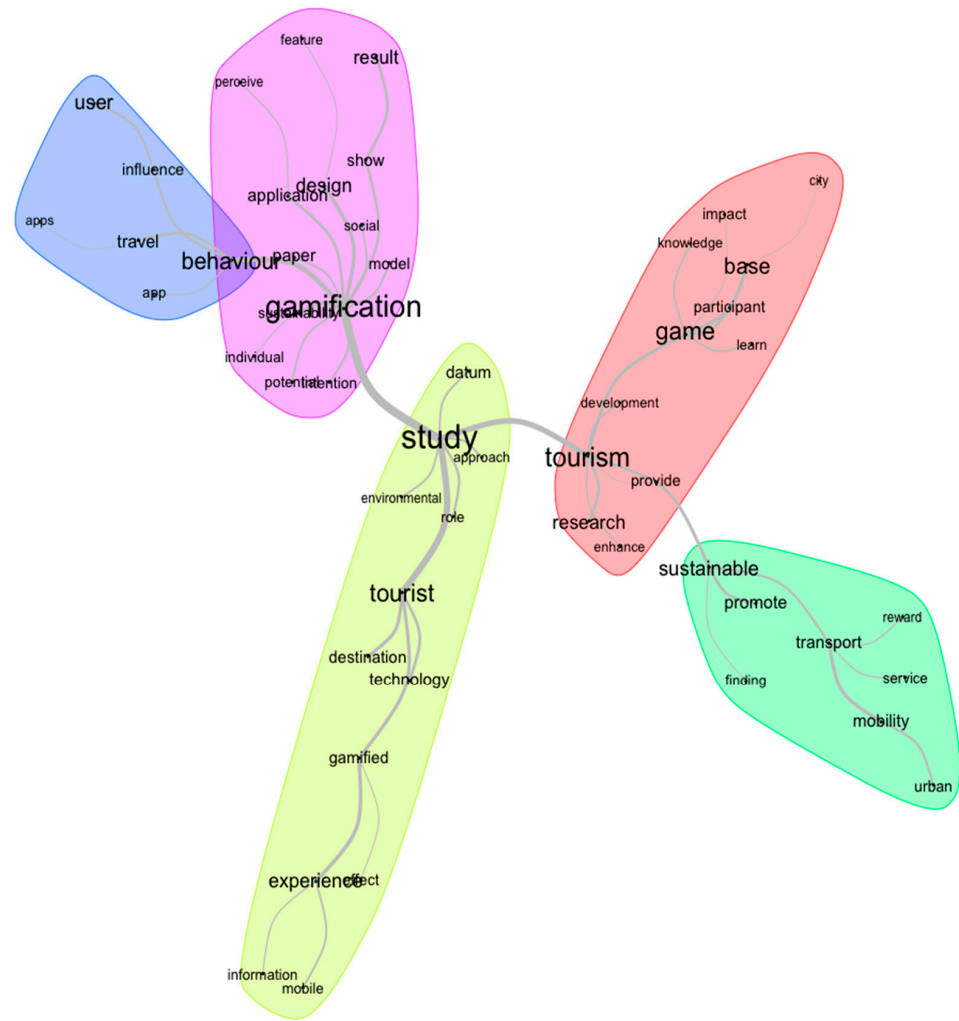


Figure 4. Similarity analysis (AS). Source: Iramuteq version 0.7 Alpha 2.

Table 5. Abstract evidence by halos.

Halos	Abstract Evidence
1. Study	A first connection is made with the word environment, followed by a stronger connection with tourist, which in turn is linked to destination, technology, gamified and experience. It turns out that the technology in question is the mobile phone/information.
2. Gamification	Gamification is directly linked to behaviour and recovers two key perspectives when thinking about gamification as a strategy: design and model.
3. Behaviour	The central word behaviour has three connections: app, travel and user influence.
4. Tourism	The tourism has a direct connection with the game and several ramifications with the words development, enhance, learn, knowledge and impact.
5. Sustainable	Sustainability has three branches: finding, promote and transport. The ramification of transport connects with service, mobility, reward and urban.

#### 4.4. Identifying Gamification Strategies for Urban Sustainability

The main findings for the urban tourism education through gamification view were as follows: (a) the role of the Global North (North America and Europe); (b) convergence and divergence among real, virtual and imaginary, including the discussions of smartphones, mobile phones, e-learning and games based on scenarios; (c) the need to improve a critical view about “gamipulation”; (d) the conceptualization of neologism as ecogamification and gamipulation, among others; (e) the study of emotions in the gamification perspectives;

(f) the alignment of gamification with Sustainable Development Goals (SDG); (g) hot topics such as transport and mobility; (h) deepening behaviour studies, considering the gamification of three main aspects: travel, user influence and application (app), and (i) expanding the study to a hospitality context. Thus, mapping gamification for sustainable urban development from these techniques generated eight new insights for urban tourism education according to Table 6.

**Table 6.** Top eight new insights for gamification in an urban tourism education context.

Top Eight	Gamification on Urban Tourism Education Context
1. Union between Global South and North	Create a collaborative network aimed at teaching and learning about the issue, fostering the exchange of experiences and practical collaborations involving various stakeholders from the Global North and South.
2. Local and global participation	Encourage the creation of forums on gamification on different geographical scales, from local to global, with a view to debating gamification and human behaviour (involving all stakeholders, including tourists), covering central themes such as sustainability, playfulness and intelligence.
3. Collaboration with 17 SDGs	Encouraging the study of gamification to collaborate with the fulfilment of the 17 SDGs (sustainable development) in a dialogue with playfulness and intelligence.
4. Marketing of urban destination	Teaching and learning about the ethical use of gamification, combating gamipulation. This is in favour of building and maintaining place brands that are sensitive to the concepts of sustainable and intelligent urban tourist destinations.
5. Disruption technology and ethics	Promoting coherent education in order to draw up planning and management strategies <i>pari passu</i> with technological disruption and the ethical challenges involved
6. Transformation of reality by sciences	Encourage a two-way flow between teaching and research, so that the classroom and scientific research can feed back theoretical and practical lessons, enabling science to be applied to the positive transformation of reality.
7. Interdisciplinary perspectives	Include a less obvious interface between neuroscience and computing to deal with issues such as emotions and behaviour, as neurophysiological data can be useful, if triangulated, to understand more about gamification. In addition, the nuances between online/offline and hybrid, as well as real/virtual and imagined should be taken into account from this interdisciplinary perspective.
8. Tourism and hospitality (T&H) industries	Encouraging the T&H industry to incorporate, in an ethical and responsible manner, the teaching and learning of gamification from the perspective of playfulness, sustainability and intelligence, establishing parameters of how to act in the provision of services in an urban space mediated by the growing need to be more inclusive, participatory and fair. In this way, the T&H industry can contribute to achieving or maintaining titles related to tourism destinations.

This set of eight new insights gleaned from the mixed methodology and various techniques adopted allows tourism education to benefit from various perspectives. For example, teachers and students can and should consider the scientific evidence from this research (a) to compose new agendas for both teaching and research on the subject; (b) to delve into the internationally relevant cases reported in the scientific literature for dealing with topics such as transport, mobility, recycling, etc.; and (c) to merge face-to-face and virtual realities for simulations that allow students to design or collaborate in the construction of new games, especially for educational purposes. In line with this, any didactic pedagogical practice in tourism education encourages a critical view of the role of interdisciplinarity (including, but not restricted to, less obvious areas such as neuroscience and computing) and ethical principles in dealing with challenges and opportunities beyond trends and fads.

## 5. Conclusions

Tourism education is a challenge in the 21st century, but gamification has proven to be a useful educational tool (Fraga et al., 2012). In an increasingly urbanised world and in search of sustainable development, guided by the 17 SDGs of the 2030 Agenda

(United Nation, 2015), it is necessary to discuss specific topics such as the role of gamification for tourism and sustainable urban development.

The evidence from this research into the trends and spatial patterns of gamification strategies in sustainable urban development reveals some points that could serve as a basis for future discussions on how gamification can contribute more broadly and equitably to sustainable development and tourism education. The main points are as follows: (1) sustainable tourism education: gamification has the potential to enrich urban tourism education, promoting sustainable strategies and enhancing cultural and heritage experiences; (2) sustainable mobility: examples such as GoEco and Mobile Geo-games highlight the importance of integrating ecological transport solutions into sustainable urban tourism; (3) eco-gaming: combining technology, entertainment and the environment is essential for promoting sustainable behaviours, such as recycling, in urban environments; (4) ethical challenges: “gamification” raises ethical concerns that require debate, especially in educational contexts; (5) real and virtual: technologies such as augmented and virtual reality must connect physical and digital spaces to maximise their impact on gamification education; (6) serious games: these games can facilitate sustainable planning by uniting education, research and practice in urban tourism; and (7) geographical diversification: the lack of strategies in some regions reinforces the importance of sharing and adapting lessons for different contexts.

The convergence and divergence between key concepts in the literature reflect the duality between studies that reinforce the status quo and those that offer new perspectives on the use of gamification for tourism education and sustainable urban development: (1) Ecogaming and the status quo: The analysis carried out in this study reveals convergence around the concept of ecogaming, which integrates technology, entertainment and the environment. This concept highlights its potential in the context of sustainable development and tourism. (2) Gamified innovations: Outlier studies, such as the one by Garcia et al. (2019), bring innovations such as gamified experiences validated by tourists, focusing on destination marketing and smart tourism, but leaving gaps in the debate on smart cities and sustainable urbanism. (3) Mobility and sustainability: Converging studies reinforce gamification as a tool for changing mobility-related behaviour, including applications for sustainable transport such as cycling and strategies for low-demand schedules. (4) Emotional and educational aspects: Outliers such as Tan and Lu (2021) highlight the role of emotions in gamification, while Chan et al. (2019) connect education and urbanism, exploring the relationship between the real, the virtual and the imaginary. (5) Gamification in the context of the Sustainable Development Goals (SDGs): Converging research in the fourth quadrant shows how gamification can energise sustainability, contributing directly to the SDGs.

Regarding the similarities in research themes and trends that can serve as a basis for innovative strategies for tourism education, this study concludes that gamification can transform educational practices and tourism experiences, encouraging sustainability and innovation in the sector: (1) Integrating gamification with tourism education: The similarity analysis shows how gamification can enrich tourism education by promoting new themes such as behaviour, design, mobility and sustainability, which are central to the connection between technology and gamified experiences. (2) Gamification and behaviour: Gamification influences behaviour by integrating tools such as applications and rewards. This approach can stimulate behavioural changes and engagement through social interaction and user movements. (3) Sustainability and mobility: Terms such as transport and mobility are highlighted, showing how gamification can encourage sustainable practices by connecting urban services with rewards and promoting the adoption of ecological behaviours. (4) Technology and gamified experience: The use of mobile devices is not only functional, but acts as a portal for gamified interactions, expanding the perception of the

brand value of tourist destinations and increasing engagement with enriching experiences. (5) Interactivity and innovation: Gamification in tourism offers potential for interactive activities that promote learning about culture and the environment, fostering growth and innovation in tourist destinations.

### *5.1. Theoretical and Practical Implications*

In terms of theoretical implications, this study expands the concept of ecogamification, integrating technology, entertainment and sustainability as fundamental tools for sustainable urban and tourist development. It highlights the connection between the real, the virtual and the imaginary, opening up new avenues for teaching sustainable urbanism through digital layers that promote greater engagement. Moreover, the geographical dimension emerges as critical, as studies like Lacka (2020) emphasize the role of location-based augmented reality games in bridging digital and physical spaces. This research addresses how gamification strategies differ between regions, shedding light on the asymmetrical adoption of such techniques, particularly between the Global North and South. This highlights the importance of localized approaches in urban tourism education.

In addition, the research findings offer new perspectives for the practical application of gamification in urban and tourism contexts and are useful for educators, city managers, and tourism planners. These insights can guide the engagement of residents and tourists in sustainable practices in innovative ways. For example, gamified transport applications like GoEco (Cellina et al., 2019) in Switzerland have successfully promoted eco-friendly mobility in urban tourist destinations, while Mobile Geo-games (Pajarito & Gould, 2018) have identified barriers to cycling in cities such as Munster, Castello, and Valletta, offering actionable lessons for sustainability education and urban planning.

In terms of practical implications, gamification stands out as an effective tool for promoting sustainability in urban tourism, offering opportunities to educate tourists and managers about sustainable practices such as green mobility and responsible urbanism. Integrating gamification into sustainable transport apps can promote more ecologically responsible behaviour, while gamified experiences and eco-games in tourist destinations create interactivity and cultural appreciation, reinforcing sustainability efforts. Furthermore, the use of serious games and simulated scenarios can train professionals and students in developing sustainable tourism strategies. Destination marketing organisations can also use gamification to reinforce their brand identity and encourage responsible practices. Finally, gamification can be integrated into smart city systems, connecting tourists and residents in experiences that promote more sustainable behaviour. From a global perspective, addressing regional challenges and opportunities, such as the variations observed in the adoption of gamification across different cultural and technological contexts, is crucial for maximizing the impact of these strategies.

### *5.2. Future Lines of Research*

The hegemony of the Global North, i.e., studies on gamification are mainly concentrated in Europe and North America, reveals the need to expand its application to other regions. Although there have been some advances in research, there are gaps in the integration of concepts such as “smart city” and “smart destination” in the context of gamification, suggesting opportunities for future research.

Finally, future theoretical and/or empirical research into tourism education from the perspective of gamification, and especially considering sustainable urban development as a premise, can consider the eight insights pointed out in this study as an initial step towards designing new problems, especially those that are allied to the technological disruptions of the 21st century. From a didactic-pedagogical point of view, these eight insights make it

possible to advance, in an ethical manner, new agendas that fulfil varied interdisciplinary teaching and learning dynamics (exploring convergence and divergence between the real and the virtual, new methods such as neuroscience, the role of nanotechnology for games, etc.), leading to constant critical questioning about gamification in tourism education as a didactic-pedagogical practice that can, in fact, contribute to the world as a better, more sustainable place.

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