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Research Paper

Geocaching as a route to fresh learning and exploration experiences: a systematic literature review

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ABSTRACT

This study conducts a systematic literature review to examine geocaching as a form of technology-mediated experiential communication, analysing how location-based gamified practices shape consumer engagement, behavioural decisions and place-related meaning-making, with implications for destination marketing, digital engagement and communication strategies. Following the SPAR-4-SLR protocol and applying the Antecedents–Decisions–Outcomes (ADO) framework as both a structuring and analytical lens, the review synthesises 30 studies published between 2010 and 2025 to clarify the mechanisms linking motivations, technological affordances and engagement decisions to communication-related outcomes. The findings reveal three interconnected thematic clusters. First, location-based technologies function as experiential communication devices that reconfigure place exploration, spatial consumption and destination perception. Second, mobile and augmented reality applications operate as engagement infrastructures, fostering active participation, co-creation and narrative interaction with place. Third, digital participation in tourism demonstrates how gamified, location-based services enhance visibility, stimulate user-generated content and promote sustained digital involvement. Collectively, the results show that geocaching extends existing research on gamification and location-based services by evidencing how engagement unfolds through spatially embedded communication processes.

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Despite these contributions, evidence regarding long-term environmental impacts, sustained learning outcomes and cross-national differences remains limited, highlighting the need for longitudinal and multi-level research designs. From a practical perspective, geocaching presents opportunities for destination diversification, educational enrichment and community-level value creation through technology-supported outdoor experiences. The originality of this review lies in reframing geocaching as a strategic form of experiential and place-based communication, with the ADO-based synthesis elucidating how digital engagement mechanisms connect individual motivations to behavioural, spatial and communicational outcomes, thereby advancing debates in gamification, destination marketing and location-based digital engagement.

Keywords: Geocaching, Consumer Engagement, Destination Marketing, Digital Communication, Gamification, Location-Based Services.

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1. INTRODUCTION

Spending time outdoors is widely recognised as beneficial for humans, reflecting a deep-rooted connection with nature that operates at multiple psychological and experiential levels (Baird et al., 2022). Engagement with natural environments contributes to stress reduction and long-term health benefits (Kondo et al., 2018; Buckley, 2021), while also promoting well-being and environmentally responsible attitudes and behaviours, generating positive effects for both individuals and ecosystems (Hanna et al., 2019). In addition, outdoor contexts have been increasingly mobilised for educational purposes, either through organised initiatives or school-based activities, reinforcing their role as experiential settings for learning and personal development (Buckley, 2021). Within tourism, nature-based and adventure-oriented experiences leverage physical activity, environmental immersion and elements of challenge to evoke emotional and experiential responses, including excitement, risk and exploration (Mykletun, 2018). At the same time, nature-based tourism also attracts visitors seeking alternative forms of engagement, such as learning, social connection, competence development or relaxation, highlighting the

diversity of experiential motivations associated with outdoor environments (Buckley, 2021; Carvache-Franco et al., 2022).

Outdoor adventure tourism has been shown to strengthen connections between tourists and specific regions, fostering local economic and social dynamics through visitor engagement with natural and rural environments (Buckley & Ollenburg, 2013). Such activities can also contribute to territorial development in less populated areas by promoting cultural heritage and supporting local economies and social cohesion (Costantino et al., 2022). Although outdoor adventure tourism encompasses a wide range of activities, from relatively stationary practices such as bird watching to more exploratory and movement-based experiences, location-based activities such as geocaching occupy a distinctive position within this spectrum (Christiansen et al., 2023). Geocaching represents a global outdoor recreational activity in which participants use global positioning system technology to locate hidden containers, or "geocaches", placed at specific coordinates (Cord et al., 2015). Through mobile applications, participants access location-based information that can support educational, promotional, narrative or recreational purposes, enabling interaction with places through digitally mediated exploration (Hubackova, 2016; Pisuła et al., 2023).

In today's world, human life is more digitalised than ever. Convenience, speed, and instant global reach make technology an essential part of nearly every aspect of daily living, which positively drives screen time. Higher increases were noted in younger generations, and increasing screen time is observed as a cross-generational phenomenon (Trott et al., 2022). Although this can raise concerns for excessive screen time and have negative health outcomes (Radesky & Christakis, 2016), digital technology has also become deeply integrated into outdoor experiences, bringing exciting opportunities and enhancing the outdoor experience and making outdoor experiences memorable (Arts et al., 2021). Tourists can utilise technology for enhanced learning experiences, later sharing these special moments on social media (Arts et al., 2021; Hills & Thomas, 2020).

With an increasing interest in outdoor activities and the advantages of the digital world, geocaching positively contributes to enhanced outdoor activities, bridging nature and technology, while offering an engaging and educational environment for tourists to explore landscapes and strengthen connections with the place. Considering the characteristics of this activity, this systematic literature review aims to present and describe the main thematic groups of the relationship between geocaching and outdoor tourism, through the SPAR-4-SLR protocol (Paul et

al., 2021). Additionally, this process is structured through the Antecedents, Decisions, and Outcomes (ADO) model (Paul & Benito, 2018), which is employed as an integrative analytical lens rather than as a theory-building framework. In this review, the ADO model supports the systematic organisation and interpretation of fragmented literatures, enabling a process-oriented understanding of how motivations, design choices and engagement outcomes are connected in technology-mediated tourism experiences.

Considering the objective of this systematic literature review, the following research questions (RQ) are presented:

RQ1. How do antecedents, decisions and outcomes interact in geocaching practices to shape consumer engagement, behavioural responses and place-related meaning within technology-mediated communication experiences?

RQ2. How does geocaching function as a communication and experience design strategy in tourism contexts, and what implications does this have for destination marketing, digital engagement and place-based communication?

Although geocaching has been examined across tourism, education and territorial management literatures, this review adopts a marketing and communication perspective. Education and territorial outcomes are therefore treated as contextual domains through which communication, engagement and experience design processes unfold, rather than as independent analytical objectives.

From a marketing and communication perspective, this review engages with several established theoretical conversations, including consumer engagement, customer journeys, place branding and persuasive or experience design. While the reviewed studies are predominantly situated within tourism, education and technology-oriented outlets, the analysis deliberately draws on these broader marketing and communication frameworks to interpret their findings. In doing so, the study positions geocaching as an empirical context through which engagement processes, experiential journeys and place-related meaning construction can be examined, rather than as a self-contained niche phenomenon.

This study is divided into four major sections, which give a systematic structure of analysis. The second part, which follows this introduction, outlines the methodological approach, namely the description of the utilisation of SPAR-4-SLR protocol and implementation of the ADO framework. The third section presents the results of the systematic review that combine descriptive statistics

and three thematic clusters identified. The fourth part presents a conceptual framework, which is integrative in nature and describes a future-oriented research agenda. The article ends with a closing section in which the main theoretical input and practical implications of this review are synthesised.

From this standpoint, the review is positioned primarily within marketing and communication research, using tourism and educational settings as empirical domains through which engagement, experience design and place-based communication processes can be analysed.

2. METHOD

The methodological procedure followed in this study is the Scientific Procedures and Rationales of Systematic Literature Reviews (SPAR-4-SLR), as described in Figure 1, a guideline described by Paul et al. (2021). This model has been widely recognised to reinforce transparency, methodological rigour, and replicability in systematic reviews. In its turn, the analytical and interpretative stages of the research are structured based on the ADO (Antecedents, Decisions, Outcomes) model developed by Paul and Benito (2018). With this model, it is possible to adopt a structured and comparative synthesis of existing research, clarifying how different streams of literature conceptualise antecedents, behavioural decisions and outcomes, without implying causal testing. The combined production of these methodological elements, therefore, results in a holistic and systematic synthesis of research that is found at the intersection of geocaching, tourism, and technology-enhanced learning.

The review started with a strict definition of the conceptual field and the formulation of two overarching research questions, which were clearly intended to help determine the personal, circumstantial, and technical factors which precondition the engagement in geocaching. The questions also inquire about the behavioural and spatial choices made during the activity, the experiential and territorial results obtained after the long-term involvement, and how geocaching can be incorporated into the tourism industry, education process or management of territories. To answer these questions, the literature search was conducted exclusively using the Web of Science (WoS) database, ensuring the inclusion of peer-reviewed and high-quality academic sources. While this choice supports methodological rigour and replicability, it also implies that relevant contributions published in marketing and communication journals not indexed in WoS may be underrepresented. Moreover, the search strategy prioritised the term “geocaching” in combination

with tourism, education and technology, related keywords, which may have limited the retrieval of studies framed more broadly around experiential marketing, digital engagement or location-based communication without explicitly using the geocaching label. The search was done up to 7 November 2025, with the use of an extensive list of keywords, including geocaching, tourism, outdoor recreation, education, mobile technologies, and location-based games. The developed plan was carefully designed to include studies related to the study of mobile and GPS-enabled experiences in tourism and education, and the research that focuses on exploring geocaching as a means of delivering territorial interpretation, experiential learning, and interaction with nature.

The first search produced 32 articles upon extraction. These were after that systematically coded in an iterative coding process starting with thematic labelling consonant with geocaching and tourism, and then consonant with the ADO framework. This procedural process ensured that antecedents, behavioural choices, and outcomes were clearly demarcated as they were observed throughout the literature, thus making a basis for future thematic analysis. The purification step involved the use of clear inclusion and exclusion criteria. The sample was narrowed down to the possible studies that did not fit in the relevant WoS fields (Education: Educational Research; Hospitality, Leisure, Sport, Tourism; and Management) and did not have an accessible full text. After such filtering, 30 articles were left, and they formed the final corpus that was to be analysed in detail.

The analytical process followed an iterative and interpretative coding procedure. All selected articles were read in full and initially subjected to open thematic coding, focusing on research objectives, theoretical framing, methodological approach and key findings. In a second stage, these initial codes were systematically mapped onto the Antecedents–Decisions–Outcomes (ADO) framework, allowing each study to be analysed in terms of (i) motivating and contextual antecedents, (ii) behavioural, design-related or strategic decisions, and (iii) reported outcomes (see appendix).

The coding was performed independently by the authors and refined through comparisons and discussions, ensuring consistency in the interpretation of categories and alignment with the research questions. The assessment phase combined descriptive mapping with an interpretative thematic analysis. Following ADO-based coding, studies were compared across recurring patterns of antecedents, decisions and outcomes. Thematic clusters were not defined a priori; instead, they emerged through iterative comparison of conceptual focus, empirical context and analytical

emphasis. Studies were grouped when they exhibited consistent configurations across the ADO dimensions, leading to the identification of three dominant clusters that structure the field.

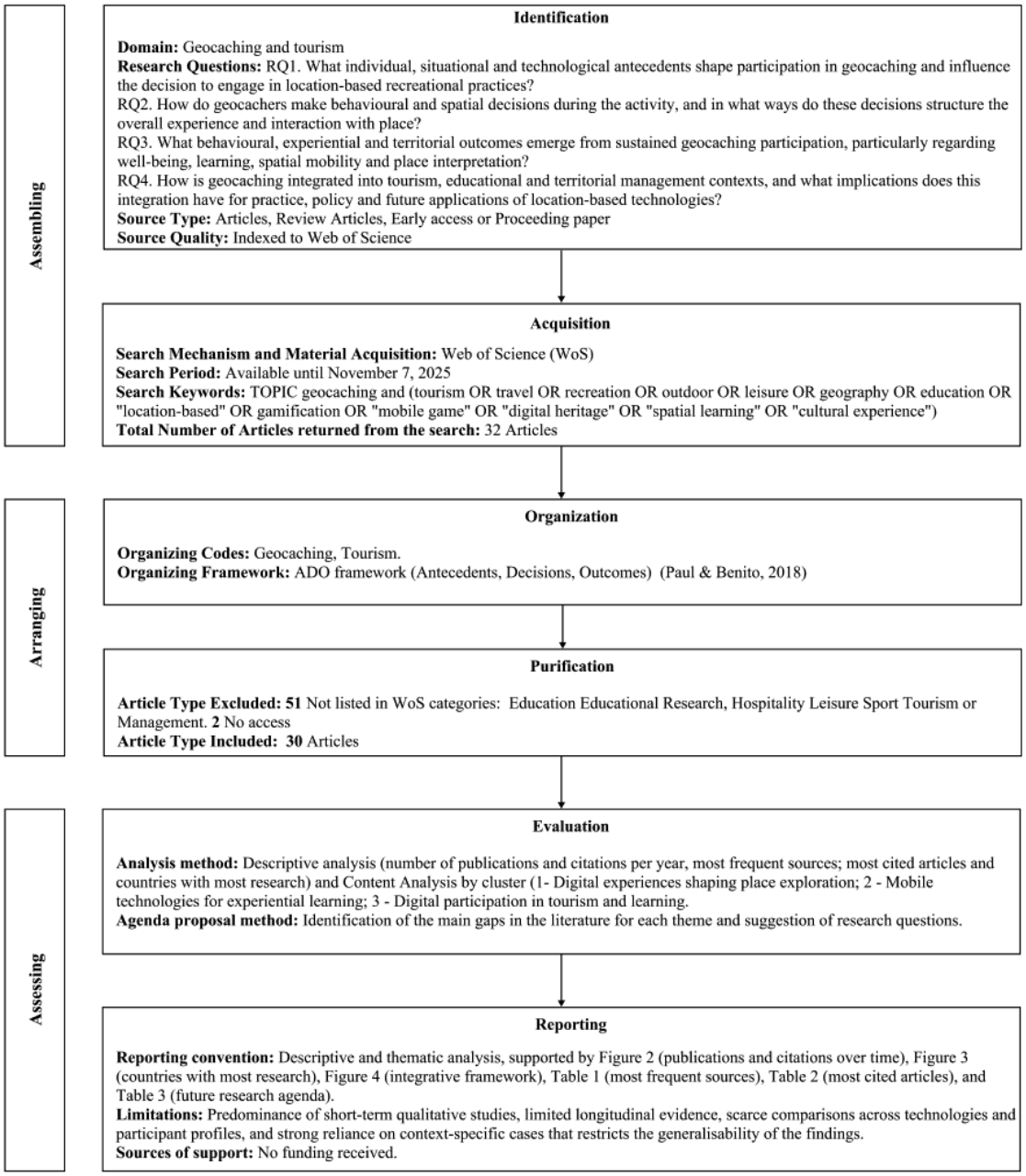

Figure 1. Overview of the SPAR-4-SLR Procedure Structured Through the ADO Framework

Source. Authors based on Paul et al. (2021)

Together, these procedures were designed to maximise transparency and analytical traceability, allowing readers to follow how interpretations emerged from the underlying studies rather than from intuitive aggregation.

3. RESULTS

3.1 Descriptive results

This section presents the descriptive findings of the literature related to geocaching and tourism. The results are structured into four key dimensions: the temporal evolution of publications and citations, the primary publication sources, an identification of the most influential studies in the field, and an analysis of the geographical distribution of the research

3.1.1 Publications and Citations

The evolution of publications and citations over time is illustrated in Figure 2. Literature around the theme started in 2010, despite Geocaching as an activity start began in 2010, despite Geocaching as an activity dating back to 2000 (Geocaching, 2025). Between 2010 and 2016, the field exhibited a slow initial growth, indicating an early exploratory phase.

A significant shift occurred in 2017, which marks the peak of publications and citations on the theme. In the following years, up to 2025, the number of publications decreased, while citations remained at a robust level. This demonstrates that while new research only occasionally occurs, the impact of the field remains relatively higher, as existing literature is foundational.

Figure 2. Publications and Citations over time

Source. Authors

3.1.2 Publication Sources

The most frequent publication sources are available in Table 1. The "Journal of Outdoor Recreation and Tourism-Research Planning and Management" is the most common in the sample. This journal focuses on research relevant to nature-based tourism and outdoor recreation. The second most common journal is the "Annals of Leisure Research", a multidisciplinary journal that covers research from recreation, arts, sports, culture and play to tourism and hospitality. The third most common source is the "Journal of Hospitality and Tourism Technology", a journal that covers topics such as e-business, technology, and innovation in tourism and hospitality. There are a total of 17 journal articles and 13 proceedings articles.

Table 1. Most Frequent Sources

Rank	Source Title	Total Citations
1	Journal of Outdoor Recreation and Tourism-Research Planning and Management	3
2	Annals of Leisure Research	2

3	Journal of Hospitality and Tourism Technology	2
4	2013 International Conference on Virtual and Augmented Reality in Education	1
5	2017 International Symposium on Computers in Education (SIIE)	1

Source. Authors

3.1.3 Most cited articles

The most cited articles are present on table 2. Two articles exceed 100 citations and provide a comprehensive examination of social media as a tool for monitoring and analysing nature-based tourism, identifying research advances and future directions (De Mota & Pickering, 2020). The other study develops a conceptual framework centred on gamification in tourism through mobile-enabled geocaching activities, with particular emphasis on Millennials and Generation Z (Skinner et al., 2018). From rank three onwards, citation frequency declines sharply, with studies ranging from 45 to 8 citations, as these studies investigate deeper Geocaching as an activity, demonstrating how it represents a vehicle for tourism development, visitor engagement and learning enhancement.

Table 2. Most cited articles in the sample

Rank	Article	Authors	Cit.
1	Using social media to assess nature-based tourism: Current research and future trends	De Mota & Pickering (2020)	131
2	Meeting the needs of the Millennials and Generation Z: gamification in tourism through geocaching	Skinner et al. (2018)	101
3	Geolearners: Location-Based Informal Learning with Mobile and Social Technologies	Clough (2010)	45
4	Geocachers: the creative tourism experience	Ihamäki (2012)	36
5	Fostering rural and agricultural tourism: exploring the potential of geocaching	Boys et al. (2017)	22
6	Is This Exercise? No, It's Geocaching! Exploring Factors Related to Aspects of Geocaching Participation	Battista et al. (2016)	14
7	Moving learning into a smart urban park: students' perceptions of the Augmented Reality EduPARK mobile game	Pombo et al. (2017)	11
8	The potential of treasure hunt games to generate positive emotions in learners: experiencing local geography and history using GPS devices	Grüntjens et al. (2013)	11
9	Marker-based augmented reality application for mobile learning in an urban park: Steps to make it real under the EduPARK project	Michalakis et al., (2020)	9
10	Fast Authoring for Mobile Gamebased City Tours	Falcão et al. (2017)	8

Source. Authors

3.1.4 Countries with the most research

Research is found to be exclusively conducted in North America or the European continent. Most studies were found to be conducted in Portugal (5), followed by the United States of America (4), Finland (3), the Czech Republic, Greece, Poland (2), and Canada, Germany, Slovenia and Slovakia (1). 8 studies did not have an available location. As shown in Figure 3, the geographical spread of research seems to mirror the saturation level of geocache locations. Regions with higher geocache density also appear to produce a greater volume of research, suggesting that research interest may be close to geocache interest and nature-based tourism.

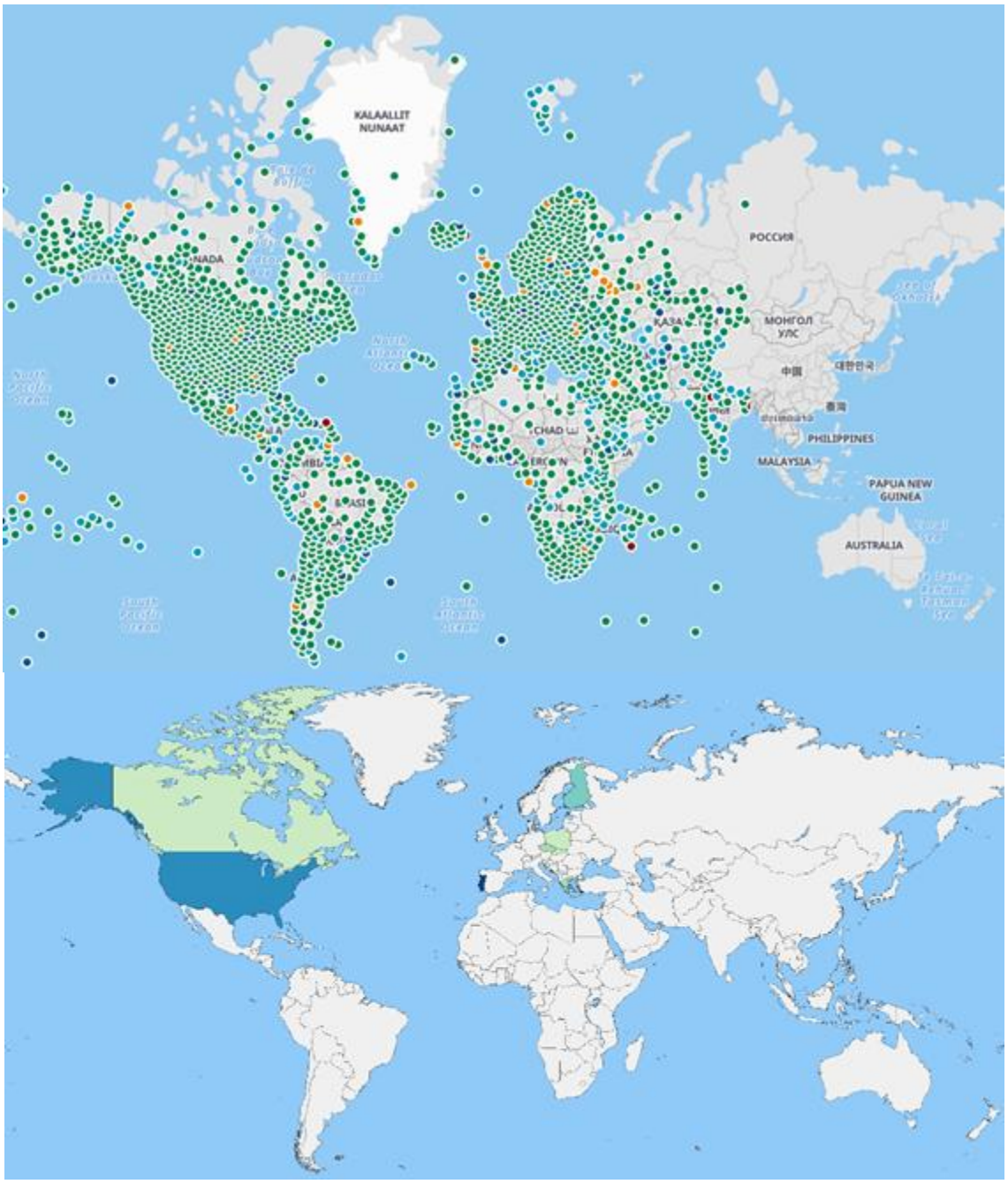

Figure 3. Geocache presence map (top). Frequency of studies: darker blue is higher, lighter green is lowest (bottom)

Sources. Geocaching.com (2025) (top), Authors (bottom)

3.2 Thematic Clusters

In this part, we describe the thematic groups that came out of a systematic thematic analysis, in which the articles selected were aggregated into specific keywords, recurrent conceptual interests

and methodological proximities that were defined throughout the literature. Through mapping this process onto the ADO model, we could afford to carry out an ordered comparison of antecedents, behavioural decisions and findings in each article, and this found consistent settings of contributions that were structured around three major themes. These groups indicate the way different strands of research are pulled together in the analysis of technology-mediated outdoor experiences, experiences of learning supported by mobile technologies, and digitally mediated engagement in tourism. Their identification provides a synthesis of the field, both in its convergences and divergences, and in its gaps, which guide the conceptualised framework in the latter section.

3.2.1 Thematic Cluster 1 – Digital experiences shaping place exploration

From a marketing and communication perspective, this cluster speaks to how spatial experiences function as extended customer journeys, in which movement, discovery and interaction operate as communicational touchpoints.

Thematic Cluster 1, which consists of 11 peer-reviewed studies, brings together studies that use the ADO framework to question the impact of location-based technologies, for example, geocaching and mobile games, on tourism and recreational behaviours. All these studies together prove that individual driving factors, situational limitations and technological factors co-create participation choices and bring forth results that pertain to the user experience, learning and territorial management. The salience of outdoor, technology-mediated activity motivations (Boys et al., 2017; Falcão et al., 2017; Ihamäki, 2012; Puhakka, 2025; Skinner et al., 2018), the relationship between digital practices and place interpretation in natural, rural, and urban settings (Bajer et al., 2017; Lorencová et al., 2017; Pisula, 2021) and the problem.

The identified antecedents are personal motivations and technological curiosity, which have been constantly highlighted in geocaching and creative exploration research, and external pressures, including pandemic restrictions (Kosmaczewska, 2024), environmental concerns (Lorencová et al., 2017), and institutional reluctance toward technology use (KC & Leung, 2022). Additional antecedents are due to the technological developments, as well as the growing popularity of learning and experience of interpretation (Bajer et al., 2017; Grüntjens et al., 2013; Pisula, 2021). The choices that were analysed in the studies include those made by the participants, which include the degree of engagement, the choice of the cache, and the manner in which the participants interact with the environment (Boys et al., 2017; Falcão et al., 2017; Ihamäki, 2012; Puhakka, 2025;

Skinner et al., 2018), behavioural changes on the constraints of the external environment (Kosmaczewska, 2024), and institutional choices. Other choices are related to planning and development of digital tools (Grüntjens et al., 2013), the strategic application of geocaching as a form of education and promotion (Pisula, 2021), as well as planning in the protected areas (Bajer et al., 2017).

Among the reported outcomes are improved user experiences, including well-being, nature connectedness and learning and satisfaction (Boys et al., 2017; Falcão et al., 2017; Ihamäki, 2012; Puhakka, 2025; Skinner et al., 2018). Other results refer to the scope of regional visibility and redistribution of visitors (Bajer et al., 2017; Pisula, 2021), as well as the tensions concerning the environmental hazards (Lorencová et al., 2017) and resistance to change at the institutional level (KC & Leung, 2022). There are also positive results of the tools that democratise and promote creative participation in the experiences of digital tourism (Grüntjens et al., 2013).

Methodologically, the cluster is a synthesis of qualitative and mixed methods based on motivations, perceptions and behaviours (Boys et al., 2017; Falcão et al., 2017; Puhakka, 2025), and spatial analysis that used GIS (Bajer et al., 2017). The gaps in the research are a lack of evidence of the long-term environmental effects, a lack of knowledge on the effectiveness of gamification among user profiles, and a gap in comparing the outcomes of various types of location-based games. Although the general convergence between the value of location-based technologies is possible, a few differences persist in terms of ecological impacts (Lorencová et al., 2017) and institutional ability to adopt technology (KC & Leung, 2022; Pisula, 2021).

From a marketing standpoint, the studies in this cluster resonate with customer journey perspectives that conceptualise consumption as a sequence of experiential touchpoints distributed across space. Geocaching-based exploration reframes destinations not as static brands, but as navigable narratives, where movement, discovery and interaction become central elements of place branding and experiential value creation.

Despite a convergence around the capacity of location-based technologies to enhance place exploration, engagement and visitor experiences, the evidence in this cluster is not uniformly positive nor unconditional. Several studies highlight environmental pressures, governance constraints and institutional resistance that may limit the scalability or sustainability of geocaching-based interventions. Moreover, positive spatial outcomes, such as visitor redistribution or increased destination visibility, appear to be highly context-dependent, varying according to

environmental sensitivity, technological readiness and local management practices. These findings suggest that geocaching does not inherently produce desirable territorial outcomes; rather, its effectiveness depends on how technological affordances are aligned with spatial planning, institutional frameworks and destination strategies.

3.2.2 Thematic Cluster 2 – Mobile technologies for experiential learning

This thematic cluster 2 brings together 12 studies that comprehensively incorporate mobile technologies, augmented and geocached in various educational settings, thus aligning with theoretical views that promote experiential, autonomous and situated learning.

The major antecedents supporting the current cluster are the omnipresence of GPS-capable mobile gadgets, the incentivising nature of geocaching as a kind of outdoor inquiry activity and the effect of constructivist and collaborative pedagogies (Clough, 2010; Michalakis et al., 2017; Pombo et al., 2017, 2018). Other motivations are based on a concerted action of modernising the practices of pedagogy and increasing the level of engagement in different areas, including history, environmental education, and teacher preparation (Adeyemi & Hui, 2023; Gandy & Stobaugh, 2013; Smith et al., 2021). Psychological influences, including enjoyment of outdoor activities, attraction to digital technologies and positive attitudes towards playful technology-supported tasks, also emerge as relevant motivational precursors (Battista et al., 2016).

The design solutions that may be traced throughout the studies include the development of augmented reality apps, the implementation of GPS-based learning paths, and the creation of available digital tools. There are applications such as the EduPARK application suite (Pombo et al., 2017, 2018), historically oriented AR applications (Michalakis et al., 2020), and interdisciplinary geocaching activities that contribute to problem-solving skills (Ihamäki, 2014; Michalakis et al., 2017; Palmárová & Lovászová, 2012; Zemko et al., 2016). Other studies focus on the preparation of teachers and hybrid QR-code outdoor learning (Adeyemi & Hui, 2023; Gandy & Stobaugh, 2013). Informal learning environments also play a central role, as illustrated in location-based systems that combine real-world navigation with multimedia and social interaction (Clough, 2010). Decisions relating to learner willingness to engage in geocaching are also examined through psychometric approaches (Battista et al., 2016).

The empirical results found in the literature are invariably positive, as they demonstrate improved motivation, strong involvement, and the perceptions of the learners on the positive effect of substantive learning (Ihamäki, 2014; Pombo et al., 2017, 2018; Zemko et al., 2016). Some studies

describe the emergence of transversal skills, such as collaboration, spatial reasoning, and problem-solving (Ihamäki, 2014; Michalakis et al., 2020; Zemko et al., 2016). Outreach activities based on geocaching are cost-efficient (Smith et al., 2021), and teacher-training programs increase confidence in digital integration (Gandy & Stobaugh, 2013). The main limitations found are associated with technical restrictions and constant operation of physical resources (Adeyemi & Hui, 2023).

Although the cluster tends to focus on the pedagogical worth of mobile technologies, it is still heterogeneous in the context of the target audiences, learning objectives, and technological design options. There remains a salient gap in the lack of rigorous, longitudinal measures of learning outcomes. Nevertheless, the cluster highlights the possibility of new technologies to enhance the teaching practice and develop more interest and situational-based learning experiences.

Although studies in this cluster consistently report positive effects on motivation, engagement and perceived learning, the empirical evidence remains largely short-term and context specific. Learning outcomes are often measured through self-reported perceptions rather than longitudinal or objective assessments, which limits conclusions regarding durability and transferability. In addition, technological constraints, resource dependency and uneven digital competencies among educators and learners introduce important boundary conditions. The predominance of favourable findings should therefore be interpreted with caution, as pedagogical effectiveness appears contingent upon instructional design quality, technological stability and sustained institutional support rather than the mere adoption of mobile or geocaching-based tools.

Beyond educational outcomes, the findings in this cluster contribute to engagement theory by illustrating how designed experiences foster sustained involvement through autonomy, challenge and feedback. From a communication perspective, mobile and geocaching-based learning environments operate as experience design systems that structure attention, participation and meaning-making, aligning closely with broader discussions on persuasive and experiential design.

3.2.3 Thematic Cluster 3 – Digital participation in tourism and learning

Cluster 3 is a group of seven studies that concentrate on digitally mediated practices in geocaching, tourism and situated learning. The studies are analysed within the ADO framework, and it is possible to see the common themes and significant differences in the range and focus.

The mentioned individual motivation is discovery, challenge, and appreciation of nature (Poženel et al., 2025), which is interconnected with the development of mobile technologies and location-

based features that support such habits (Santos et al., 2012; Teles da Mota & Pickering, 2020). There are also more general structural influences, including the level of economic and personal freedom at the national level that preconditions the global involvement in geocaching (Travnickova, 2018). Community forces within the industry, such as saturation and a decrease in the number of newcomers, also affect the level of activities (Gilburn, 2019). Augmented reality and location-based serious games are suggested in the educational environment as promising but technically limited tools (Pombo & Marques, 2017; Xanthopoulos & Xinogalos, 2019).

The choices that people make concern caches or paths, movement planning, and other choices to move or turn off (Gilburn, 2019; Poženel et al., 2025; Santos et al., 2012; Travnickova, 2018). Some of the most important decisions at the design stage are related to the technological solutions, including marker-based AR, and the organisation of the gameplay (Pombo & Marques, 2017; Xanthopoulos & Xinogalos, 2019). Strategic decisions by tourism organisations are also made to add them to the destination products, thus diversifying them and encouraging less-visited destinations (Santos et al., 2012; Teles da Mota & Pickering, 2020).

The outcomes mentioned above are the shifts in tourist mobility that have manifested as more spatial dispersion and greater discovery of places (Poženel et al., 2025; Teles da Mota & Pickering, 2020). Other results include the indirect economic gains and enhanced destination recognition by user-created content (Santos et al., 2012). The reduction in the position of the cache as described by Gilburn (2019) is an example of the negative effects on the sustainability of the community. Generally, advantages of motivation, situated learning, and collaboration are observed in education, even though usability problems (Pombo & Marques, 2017; Xanthopoulos & Xinogalos, 2019). Travnickova (2018) also unveils the disparities in engagement around the world, which are associated with the level of national freedom.

The articles come to a point of focusing on mobile technologies and self-motivations as driving forces. The main causes of divergences are related to the scale of analysis, i.e. micro-level behavioural points of view (Gilburn, 2019; Poženel et al., 2025) and macro-level cross-national analysis (Travnickova, 2018). One of them is the systematic design frameworks of serious games (Xanthopoulos & Xinogalos, 2019), longer-term evaluations of the long-term impact of the territory and long-term social impact (Poženel et al., 2025; Santos et al., 2012), and dynamics of participation decreases (Gilburn, 2019; Travnickova, 2018).

Overall, this cluster emphasises the role that digital platforms play in defining the patterns of mobility, learning, and involvement and emphasises the need to develop analysis strategies that are more integrated to understand their impact comprehensively.

The studies grouped within this cluster reveal a more heterogeneous and sometimes contradictory picture of digitally mediated participation. While several contributions emphasise enhanced mobility patterns, destination visibility and participatory engagement, others document declining community participation, saturation effects and structural inequalities across national and socio-economic contexts. Macro-level analyses further demonstrate that participation in geocaching and similar digital practices is shaped by broader conditions, such as levels of personal freedom and technological access, which may constrain engagement irrespective of individual motivation. These divergences underline that digital participation outcomes are not linear and should be understood as emerging from the interaction between individual agency, technological design and structural contexts.

The studies in this cluster connect directly with research on digital customer engagement and participatory branding. By highlighting how user-generated content, mobility patterns and platform participation shape destination visibility, this body of work positions geocaching as a form of co-created storytelling, where brand meaning emerges from distributed, bottom-up interactions rather than centrally controlled communication.

3.3 Integrative framework and future research agenda

Taken together, the three clusters describe not isolated domains of activity, but complementary dimensions of how engagement, experience design and place-based communication unfold in technology-mediated contexts.

Figure 4 outlines a synthesised conceptual framework, grounded in the ADO model, that explains geocaching as a process of technology-mediated experiential communication, linking motivations and design choices to engagement, behavioural and place-related outcomes relevant for marketing and destination communication.

While the ADO framework does not introduce new theoretical constructs, its application in this review generates conceptual value by repositioning geocaching within marketing and communication scholarship. Rather than treating geocaching outcomes as isolated effects, the framework foregrounds engagement as a process through which digital affordances, spatial design and consumer decisions interact to produce communicational, behavioural and place-related

outcomes. This process-oriented perspective extends existing work on gamification and location-based services by explicitly linking experience design choices to destination visibility, consumer participation and digital engagement dynamics.

Conceptually, the framework advances marketing and communication scholarship by translating a fragmented, domain-specific literature into a set of engagement-relevant mechanisms. Rather than proposing new constructs, it clarifies how established concepts such as engagement intensity, experiential journeys, place meaning and persuasive design manifest in location-based, technology-mediated contexts. In this sense, the contribution lies in reflective synthesis and theoretical alignment, positioning geocaching as an empirical setting through which broader marketing and communication theories can be examined and extended.

Importantly, the contribution of this study should not be interpreted as theory development in the strict sense, but as a reflective and translational contribution. By aligning a fragmented body of tourism and education-oriented research with established marketing and communication constructs, the review provides a conceptual stepping stone that clarifies mechanisms, identifies blind spots and enables more theoretically grounded future research. In this respect, originality lies in theoretical repositioning and synthesis rather than in the introduction of new constructs.

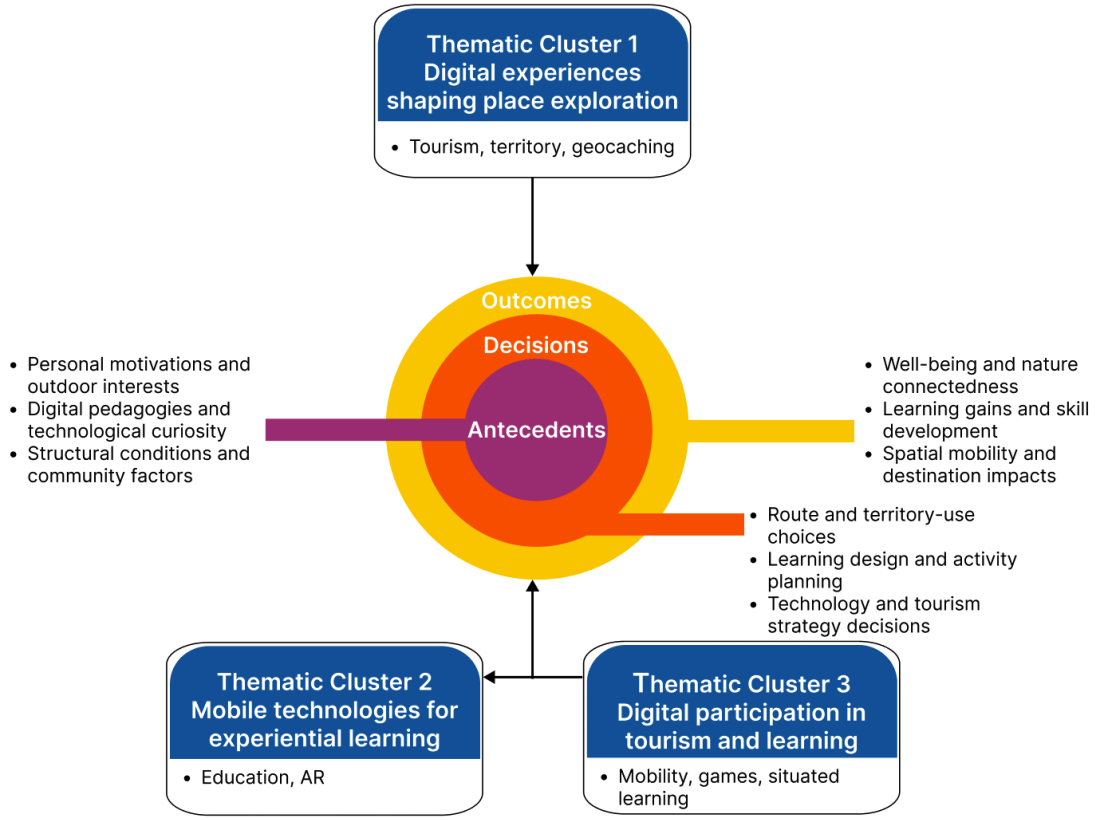

Figure 4. Synthesis of Thematic Clusters Through an ADO-Based Integrative Framework

Sources. Authors

The body of the framework is the Antecedents, which is represented by the circle nearest to the centre. This layer incorporates individual, pedagogical and structural factors that regulate participation, including the personal motivations, outdoor interests, digital pedagogies, interest in technology and systemic circumstances in general, together with the considerations of the community.

These antecedents spiral into the intermediate ring of Decisions that sum the core behavioural and strategic choices that have been reported in the literature. These choices include route choice and geographic exploitation, design of learning and planning of the activities involved and more technology-oriented or even tourism-specific strategic discussions.

The Outcomes are presented in the periphery of the model, and they reflect the consequences of the engagement by means of technology. These consequences include increased well-being and nature connectedness, acquisition of learning with skill acquisition, and spatial mobility or destination-level outcomes of digital engagement.

The 3 thematic circles surrounding the diagram interface are in direct relation to the corresponding strata of the ADO framework.

Cluster 1, which focuses on the digital experience that shapes the exploration of the place, has an impact on the Outcomes and the spatial-strategic choices, which are inherent in the model.

Cluster 2, which is devoted to mobile technologies used in the process of experiential learning, mainly enriches the pedagogical Antecedents and the decision-making processes related to the learning.

Cluster 3, which explores the use of digital in tourism and learning, cuts across all three levels, therefore, shedding light on the interdependence between motivations, behavioural inclinations, and spatial or experiential experiences.

Altogether, Figure 4 clarifies how the examined studies were distributed across the board and the interconnections they had within ADO logic, thus revealing common patterns and complementarities between the scholarly fields of tourism, education, and digital participation. The framework provides a comprehensive view that enables comparative studies and direct future research directions.

From a marketing and communication standpoint, the framework should therefore be read as an interpretative synthesis rather than a comprehensive representation of all relevant theoretical debates. Although core concepts such as experiential marketing, co-created storytelling or digital customer engagement are not always explicitly mobilised in the reviewed studies, the ADO-based synthesis reveals parallel mechanisms through which engagement, spatial experience and communication outcomes are produced. This opens a clear pathway for future research to bridge geocaching-focused studies with broader marketing and communication theories.

At the same time, the review reveals a clear gap in the explicit integration of core marketing and communication theories within geocaching-related research. Foundational debates on customer engagement, experiential marketing, place branding and persuasive design are rarely cited directly in the analysed studies, despite the presence of closely aligned empirical mechanisms. This gap does not undermine the value of the existing literature, but rather highlights the need for theoretical cross-fertilisation, which this review seeks to initiate.

Table 3 synthesises the main research gaps identified across the three thematic clusters and formulates targeted research questions to guide future work. For Cluster 1 (digital experiences shaping place exploration), the table highlights the lack of longitudinal evidence on the

environmental and spatial impacts of location-based technologies. While existing studies document immediate behavioural effects, little is known about long-term mobility patterns, destination use or ecological consequences. The proposed questions, therefore, call for extended, multi-scalar analyses.

Table 3. Literature Gaps and Research Questions Across the Thematic Clusters

Thematic Cluster	Literature Gap	Research Questions (RQ)
1 – Digital experiences shaping place exploration	Limited evidence on the long-term environmental, behavioural and spatial impacts of location-based technologies in tourism and recreation.	RQ1: How do location-based digital activities influence long-term patterns of spatial behaviour and destination use?
		RQ2: What are the enduring environmental and community-level impacts of sustained participation in geocaching and similar mobile activities?
2 – Mobile technologies for experiential learning	Lack of rigorous longitudinal assessments of learning outcomes and insufficient understanding of how different technological designs shape pedagogical effectiveness.	RQ1: How do mobile and AR-based learning experiences influence knowledge retention and skill development over time?
		RQ2: Which specific design features of mobile learning tools most effectively enhance engagement and substantive learning in outdoor or hybrid educational settings?
3 – Digital participation in tourism and learning	Insufficient research comparing micro-level behavioural processes with macro-level structural determinants of participation in digital and location-based activities.	RQ1: How do individual behavioural decisions interact with national or community-level structural factors to shape patterns of digital participation?
		RQ2: What explains cross-national disparities in engagement with location-based games and digital tourism platforms?

Source. Authors

In Cluster 2 (mobile technologies for experiential learning), the primary gap concerns the limited number of rigorous, long-term evaluations of learning outcomes and insufficient understanding of how specific technological design features influence pedagogical effectiveness. Although short-term benefits are often reported, their durability and underlying mechanisms remain unclear. The research questions thus emphasise sustained learning assessments and design-feature comparisons. For Cluster 3 (digital participation in tourism and learning), the table underscores the need for work that integrates micro-level behavioural processes with macro-level structural determinants. Existing research rarely connects individual decisions with national, community or socio-economic conditions that shape participation. The proposed questions encourage cross-national and multi-level designs to explain disparities in digital engagement.

Overall, Table 3 provides a concise and coherent roadmap for future research, reinforcing gaps identified through the ADO framework and supporting more theoretically robust and empirically comprehensive investigations in tourism, education and digital participation.

4. CONCLUSIONS

This study contributes to marketing and communication research by synthesising how location-based, gamified practices structure engagement, experiential journeys and place-related communication across digital and physical environments. By employing the SPAR-4-SLR protocol and mapping findings onto the ADO framework, this study analyses how geocaching, as an outdoor activity, mediates the relationship between experiences and physical landscapes, revealing that the theme converges into three main themes: the capacity of digital experiences to reshape place exploration; the pedagogical potential of mobile technologies in fostering learning; and the of digital participation in driving tourism development and territorial management. From a marketing and communication perspective, these findings reposition geocaching not merely as a recreational or educational activity, but as a strategic engagement mechanism capable of shaping destination narratives, consumer participation and digital visibility.

Addressing RQ1, "How do antecedents, decisions and outcomes interact in geocaching practices to shape consumer engagement, behavioural responses and place-related meaning within technology-mediated communication experiences?, the literature shows that geocaching operates as a form of technology-mediated experiential communication rather than a purely recreational activity. Participation is shaped by a combination of individual motivations (such as curiosity, enjoyment and interest in exploration), contextual and pedagogical drivers, and broader structural conditions. Within this process, digital technology does not constrain nature-based experiences; instead, it functions as an enabling infrastructure that mediates engagement, supports meaning-making and connects consumers to places through gamified interaction.

Regarding RQ2, "How does geocaching function as a communication and experience design strategy in tourism contexts, and what implications does this have for destination marketing, digital engagement and place-based communication?", the literature highlights decision-making as a dynamic interplay between technological guidance and embodied spatial exploration. Geocachers actively shape their experience by selecting routes, locations and levels of involvement, often extending movement beyond conventional tourist paths. These behavioural decisions generate

communicational outcomes, including enhanced destination visibility, redistribution of visitor flows and opportunities for experiential storytelling. From a marketing perspective, this positions geocaching as a low-cost experience design strategy that can support destination differentiation, stimulate digital engagement and reinforce place-based communication.

The findings offer valuable insights to tourism stakeholders. Geocaching represents a low-cost, low-maintenance, high-impact tool to attract tourism activity, that gamifies regions and their characteristics, leading visitors to uncommon routes and away from typical hotspots. This unlocks exciting opportunities for communities and tourism stakeholders, who can leverage these activities to foster local economic development. Besides, geocaching functions as a valuable educational tool that enhances the tourism experience by representing an alternative way to transmit local culture, knowledge, and environmental characteristics.

From a marketing and communication perspective, the societal relevance of geocaching can be interpreted considering broader sustainability agendas, including the Sustainable Development Goals, particularly those related to well-being, education, sustainable communities and environmental awareness (e.g., SDGs 3, 4, 11 and 15). Rather than constituting direct contributions to these goals, geocaching-based experiences can be understood as forms of societal communication and value co-creation that enable purpose-driven brand narratives and engagement strategies within place-based contexts.

From this perspective, the conceptual reframing of geocaching as an engagement-driven communication process offers a structured basis for future theory development and empirical testing in marketing and destination communication research.

For marketing and communication research, the relevance of this review lies in demonstrating how engagement, customer journeys and place branding processes unfold through spatially embedded, gamified interactions. Geocaching emerges as a concrete example of how persuasive design and experiential communication operate outside traditional media channels, offering insights applicable to a wider range of location-based and digital engagement strategies.

As such, the article speaks primarily to scholars of marketing and communication interested in engagement, experiential design and place-based strategies, while offering tourism and education research a complementary interpretative lens.

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