

Article

How Do Visitors to Mountain Museums Think? A Cross-Country Perspective on the Sentiments Decoded from TripAdvisor Reviews

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Abstract: In the digital era, user-generated online reviews serve as a valuable resource for understanding visitor experiences in cultural institutions. This study analyses sentiments and thematic trends in TripAdvisor reviews of mountain museums, using Latent Dirichlet Allocation topic modelling and sentiment analysis. A dataset of 2157 reviews from ten museums was classified into local and non-local perspectives, revealing significant differences in visitor expectations. Findings indicate that local visitors prioritize historical authenticity and educational value, whereas non-local visitors emphasize aesthetic appeal, interactivity, and cultural immersion. Sentiment analysis highlights generally positive perceptions, with business travellers and groups of friends reporting the highest satisfaction levels. Comparative analysis across visitor types reveals distinct engagement patterns, with families valuing child-friendly exhibits, couples seeking cultural enrichment, and solo travellers focusing on intellectual depth. These insights inform strategic recommendations for museum management, including multilingual content, interactive elements, and guided tours dedicated to specific visitor profiles. Despite limitations related to lack of real-time feedback, this research demonstrates the potential of sentiment analysis in enhancing museum experiences. Future studies should integrate multimodal analysis and real-time tracking to further refine visitor experience evaluation.

Keywords: online reviews; sentiment analysis; topic modelling; mountain museum experience; TripAdvisor; human–computer interaction



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1. Introduction

In today’s competitive environment, museums should determine specific goals and develop strategies to enhance their attractiveness and increase numbers of visitors along with their revenue [1]. The museum experience is a combination of cognitive and affective factors [2] and it correlates with visitors’ unique personal context (e.g., motivations, attitudes, emotions, prior knowledge) and the museums’ collections, services, practices, spatial context, and staff [3]. Assessing visitors’ experiences helps museum managers and curators to design and redesign exhibits [4] and to improve the overall attractiveness of

the museum [5,6]. To improve and develop the quality of visitor experiences, museums must systematically collect and analyze customer satisfaction data from exhibitions and programs, providing valuable insights for making decisions and enhancing management practices [7,8].

During a museum visit, the experience unfolds through encounters with objects, interpretive texts, staff, other visitors, and additional services like souvenir shops and cafés [9]. This experience extends into the post-visit phase, where memories and online activities, such as social media posts and visitor online reviews on platforms, influence future visitors' pre-visit perceptions [9]. Improving museum offerings and visitor experiences requires systematic evaluation of satisfaction indicators, as visitor impressions are shaped by staff interaction, ambiance, complementary services, and a high tendency to capture and share experiences on social media during or after visits [8].

Traditionally, museum visit experience has been assessed using direct surveys of visitors focusing on a predefined set of dimensions [10,11]. However, digital and online technologies and data offer new opportunities for analyzing the visit experience [12,13]. In today's digitized and social media-dominated era, museums need to pay close attention to details at the micro-level, ensuring an impeccable visitor experience [14] as these experiences are increasingly being disseminated and discussed on digital platforms. Interpretation of visitors' reviews may contribute valuable information to understanding visitors' experience [9] and may have a significant impact on the decisions of other potential visitors [14].

Online museum reviews have become a crucial indicator of museum service quality, visitor experience, and public feedback in the digital age [15,16]. Analyzing online reviews on social media platforms can assist museums in developing appropriate management strategies [12,15]. TripAdvisor is one of the most popular travel and tourism sites worldwide [17–20]; it serves as an online platform for digital reviews, with over 1 billion reviews and 900 million registered users [21]. TripAdvisor comments can serve as an authentic and valuable tool for evaluating museum experiences [22,23], as the content extracted from this platform may capture visitor satisfaction and cultural perceptions, offering valuable and actionable insights for museum managers [24–26]. The platform can provide valuable insights into museum visitor experiences, helping potential visitors make informed decisions before their visit by relying on authentic perspectives rather than official narratives. Framed within a wider travel context [27] highlighted TripAdvisor's role as a trusted intermediary for independent travelers, offering user-generated reviews and rankings that often challenge traditional expertise.

Given its vast repository of user-generated content, TripAdvisor serves as a powerful tool for extracting data-driven insights into visitor sentiments and cultural perceptions, making it an essential resource for studying museum experiences in the digital era [15,28]. Within this context, the current study aims to explore the sentiments of visitors to mountain museums by analyzing online reviews from TripAdvisor.

Mountain museums constitute a distinctive segment within cultural tourism, shaped by their geographical context, alpine heritage, and integration into natural landscapes. Unlike urban museums, which often benefit from high visitor flows and broad cultural programming, mountain museums are typically situated in remote or seasonal destinations and serve as gateways to localized identities, ecological narratives, and historical memory tied to highland environments. Their dual role as cultural institutions and place-based heritage ambassadors demands a visitor experience model that accommodates diverse expectations across both local and international audiences [29–32].

Mountain museums were selected as the focus of this study because they represent a distinctive yet underexplored segment within heritage tourism, shaped by remote geogra-

phies, alpine cultures, and seasonally driven visitor flows. These institutions often integrate natural and cultural storytelling, serving as both educational and place-based interpretive centres. While user-generated content (UGC) is increasingly being used to study museum experiences, a review of Web of Science revealed that very few studies ($n = 6$) have applied TripAdvisor data in their research on museums, and none of these have addressed mountain museums specifically. This gap is particularly relevant considering the existence of the International Mountain Museums Alliance (IMMA), which connects institutions sharing similar interpretive missions in mountainous regions worldwide. The authors' attention turned to this network when the newest IMMA member, the Olimpia Museum in Braşov (Romania), opened in early 2024. The authors' proximity to this development, along with direct contact with IMMA's founding members (such as Museo Nazionale della Montagna in Turin), allowed researchers to construct a cross-national comparative dataset. Much like Baleiro [3]'s focus on literary museums, this study investigates a coherent group of specialized institutions with shared thematic identities, offering both geographic diversity and interpretive consistency.

In the context of digital transformation and human–computer interaction, visitor-generated content has become a valuable resource for understanding museum experiences, visitor satisfaction, and intercultural communication in the tourism sector [33–36]. This study identifies key themes and emotions expressed in mountain museum reviews, offering insights for management, cultural experience enhancement, and tourism development strategies. Despite the ongoing academic discourse on the role of TripAdvisor for evaluating museum experiences [37–41], there is limited focus in the specific literature on differences in the latent dimensions perceived by local and non-local visitors, as identified through the language of their reviews. Therefore, this paper aims to fill this gap and investigates the differences in perceptions between local and non-local visitors, examining how cultural and linguistic diversity influences visitors' experiences in mountain museums. The findings contribute to a deeper understanding of the role of digital platforms in shaping visitor expectations, decision-making, and post-visit reflections. In this context, the following research questions were formulated:

RQ1: What are the latent dimensions of the museum visitor experience perceived by visitors who write reviews in the local language?

RQ2: What are the key themes of museum visitor experience perceived by visitors who write reviews in non-local languages?

RQ3: What are (if any) the differences in latent dimensions of museum visitor experience perceived by visitors who write reviews in the local language compared to those who write in non-local languages?

RQ4: How do visitor profile (solo traveller, couples, families, and group of friends) influence perceptions regarding museum visitor experience?

To address these questions, this study aims to achieve the following objectives: (O1) identify and analyze the latent dimensions of visitors' perceptions expressed through reviews written in local languages; (O2) identify and analyze the latent dimensions of visitors' perceptions expressed through reviews written in non-local languages; (O3) compare the key themes and differences in visitor experiences between those who write reviews in the local language and those who write in non-local languages; and (O4) examine the impact of visitors' profiles on their perceptions of the museum experience. To answer to these questions, the research followed the workflow pictured in Figure 1.

Based on the findings, strategic recommendations for museum management to enhance visitor experiences are formulated in the Discussion Section. These recommendations are formulated in relation to visitor expectations, suggesting ways to improve engagement for different visitor types. Specific improvements are proposed, such as enhancing interactive elements for families, refining historical content for solo travelers, and optimizing

museum logistics for business visitors. With reference to these insights in the specialized literature, museums can make data-driven decisions to improve their services, attract more visitors, and ensure a high-quality, memorable experience for all guests.

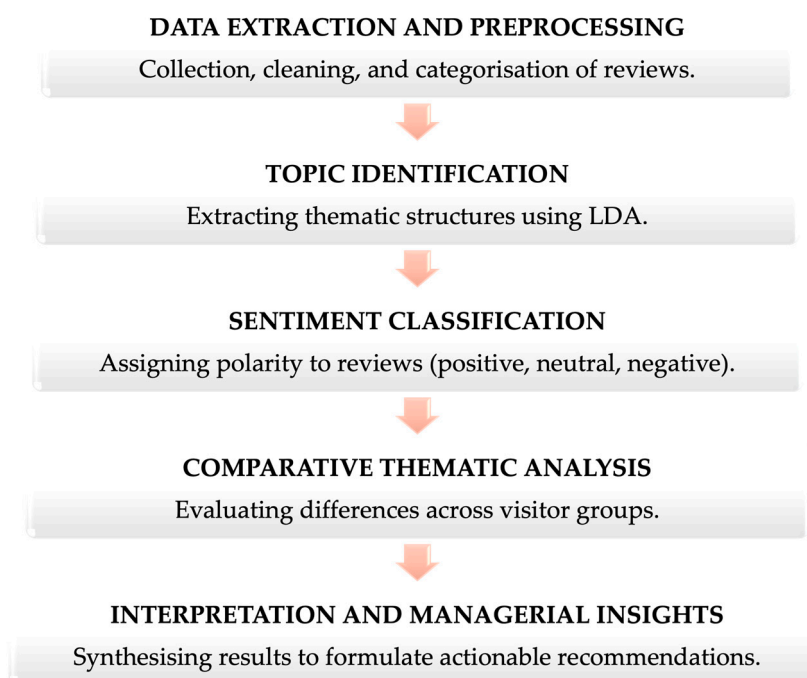


Figure 1. The research workflow. Conceptualized by authors.

2. Literature Review

The latest definition of museums, approved on 24 August 2022 during the 26th ICOM General Conference held in Prague [42], includes the concept of “experience”, stating that museums offer varied experiences for education, enjoyment, reflection, and knowledge sharing [43]. Currently, museums are transforming from object-centred institutions to visitor-focused, interactive spaces, emphasizing engagement, community impact, and experiential value. Modern museum experiences blend cognitive and affective elements, intertwining with visitors’ personal and sociocultural contexts while fostering adventure, learning, and social connections, redefining the museum–visitor relationship with a client-centered approach [44,45]. Drawing on Pine and Gilmore’s (1998) [46] framework, modern museums deliver diverse values—education, entertainment, escapism, and aesthetics—that enhance perceived visitor benefits through engagement with their personal, sociocultural, and physical contexts. Recent studies have revealed that museums are perceived as unique, multidimensional spaces with exceptional qualities that captivate visitors [47].

2.1. The Museum Experience

Packer and Ballantyne [48] define the museum visitor experience as an individual’s personal and immediate response to activities or settings outside their usual environment, characterized by ten facets: physical, sensory, restorative, introspective, transformative, hedonic, emotional, relational, spiritual, and cognitive. The museum experience now extends beyond the visit itself [49,50], beginning with pre-visit activities like online research for hours, location, ticket prices, and reviews from other travelers, and continuing afterward [9,44].

Godovykh and Tasci [51] define the museum experience as the totality of cognitive, affective, sensory, and conative responses across pre-visit, on-site, and post-visit stages, influenced by situational and personal factors, providing a comprehensive framework for

explaining and measuring visitor experiences. Conti, Pencarelli, and Vesci [52], building on prior research by Falk and Dierking [44], Sheng and Chen [53], and Pine and Gilmore [46], introduced socialization as a fifth experiential dimension, emphasizing interaction between visitors and staff or among visitors. Guo et al. [54] highlight that visual and auditory cues are the most impactful in enhancing visitor experiences, mediated by emotional state and sense of presence. Joviality, personal escapism, and localness are identified as key evaluative dimensions, providing insights for designing immersive, hedonic experiences that cater to visitors' emotional and physiological needs. Understanding which of these dimensions are important for visitors helps museum managers tailor their offerings effectively. Ducros and Euzéby [55] explored how visitors perceived and experienced hybrid museums, emphasizing the dual cognitive and sensory stimulation offered, and found that while these venues provided edutainment value, they often fell short of delivering the promised immersive and memorable experiences due to design elements such as spatial freedom, digital scenarization, and reliance on passive individual engagement, which limit active participation and social interaction.

Antón, Camarero, and Garrido [56] argue that museum visitors actively co-create their experiences across three stages: before the visit, through knowledge, planning, and involvement; during the visit, through participation and interaction; and after the visit, by engaging with social networks and sharing opinions, which intensifies their connection with the museum. These active experiences foster a stronger intention to revisit, seek additional information, and recommend the museum to others [57–60]. Moreover, Yin, Chen, and Ni [61] concluded that museum experiences significantly influence word-of-mouth (WOM) recommendations in relation to brand image and museum attractiveness, with temporary experiences amplifying this effect.

2.2. *The Role of Visitor Online Reviews in Decoding the Museum Experience*

Visitor online review (VOR) platforms like TripAdvisor serve as judgment devices, enabling visitors to widely share experiences and foster new social interactions. Tourists often write reviews with an awareness of their audience, using various strategies to engage readers they may never meet [62]. VOR websites highlight user-generated content as a public voice for visitors, but accessing this space requires technological literacy, registration, and acceptance of the platform's terms [63]. Notably, these platforms often assign badges and awards to prolific contributors, elevating their influence through visible markers and user feedback [64,65]. VOR sites not only facilitate visitor expression but also help establish collective perspectives on travel experiences.

Marques [39] considers that museum visitors use reviews to share personal experiences that guide and inform future visitors, establishing a bridge across time. Despite the increase in research on online reviews, studies focusing specifically on museums and cultural sites remain limited. Research has identified key themes in these reviews, such as practical advice, exhibits, the overall experience, and logistical aspects like buildings, shopping experience, and ticketing [3,41,66]. Emotional engagement has become central to museum experiences, shifting the focus from simply conveying historical knowledge to fostering empathy [67]. For example, Lee et al. [40] categorized emotions in museum reviews and found a strong alignment between positive emotions and TripAdvisor ratings, though some nuanced feelings defied standard classification.

Shao et al. [41] found that analyzing user-generated reviews of the National Gallery in London using topic modeling and sentiment analysis provided valuable insights into improving museum shopping experiences, emphasizing the importance of addressing visitors' specific needs to enhance satisfaction and support museum tourism development. Furthermore, Riva and Agostino's [68] study highlights the value of user-generated data in

assessing museum experiences and offers actionable insights for museum management. By analyzing 36,460 TripAdvisor reviews of 30 popular Italian museums using latent Dirichlet allocation, they explored differences between local and non-local visitors. The results revealed three shared dimensions of museum experience (cultural heritage, personal experience, and services) and unique dimensions for locals (e.g., 'wow effect') and non-locals (e.g., time management). Su and Teng [46] used content analysis of negative TripAdvisor reviews and document analysis of related studies to identify categories of service failure in museums. They extracted 12 dimensions of museum service quality, incorporating SERVQUAL dimensions (reliability, tangibles, communication, empathy) and HISTOQUAL dimensions (responsiveness, communication, consumables) tailored for cultural heritage tourism.

Alexander et al. [9] noted that reviews of cultural sites in London tended to focus on practical aspects and personal experiences rather than deep engagement with cultural content. Ramírez-Gutiérrez et al. [69] similarly found that reviews blended emotional reactions with practical insights, often advising future visitors while occasionally critiquing management. Huo et al. [15] propose a comprehensive model linking museum attributes, visitor experience, and satisfaction; they analyzed TripAdvisor reviews of four UK museums using structural topic modelling, identifying 19 topics. Their findings reveal that core offerings, peripheral services, and ambiance positively influence visitor experience and satisfaction, with experience strongly impacting satisfaction.

Gerrard, Sykora, and Jackson [70] concluded that the gap between real and expressed experiences on Twitter requires further exploration. Analyzing data extracted from Instagram, Rhee, Pianzola, and Choi [71] concluded that hashtags, particularly geo-related and city-specific tags, highlight the cultural and touristic influence of museum locations and help identify spaces that attract the most visitor attention. Baniya, Dogru-Dastan, and Thapa [72] analyzed TripAdvisor reviews by separating one-to-three-star ratings from four-and-five-star ones, revealing that 96% gave high ratings, while low ratings primarily cited issues with ticket prices, crowding, and persistent selling. Catir [73] used text mining on TripAdvisor reviews to reveal five key themes of the Topkapı Palace Museum experience: easiness and fun, cultural entertainment, personal identification, historical reminiscences, and escapism. The results show that visitors appreciate the museum's convenience, cultural insights, immersive storytelling, and unique atmosphere, while fostering both personal connections and a sense of escape.

Agostino et al. [74] analysed 47,993 TripAdvisor reviews of 100 Italian museums, comparing 'top-down' (policy-driven) and 'bottom-up' (user-driven) approaches to identifying quality dimensions. They found significant differences, with visitors prioritizing cultural heritage and personal experiences over museum services. That study highlights the limitations of predefined quality assessments, emphasizing the importance of user-generated content in identifying emergent, visitor-centric dimensions and contributing to data-driven decision-making and the cultural tourism literature.

2.3. Cultural Differences in the Museum Visitor Experience

Numerous studies on cultural tourism indicate that the experiences of tourists are influenced by their cultural backgrounds [75,76]. In the context of museums, this is especially relevant, as visitors' cultural backgrounds influence how they view, understand, and filter their sociocultural distance from the location [68]. While demographic characteristics have been used to identify inter-group specificities in visitor motivations, behaviors, and expectations [39] other traits can also be attributed to differences (e.g., local versus non-local visitors) [77].

Museums attract both local and non-local domestic visitors and face distinct challenges [77]. The different backgrounds and experiences of local and non-local visitors shape how they assess museums. For example, the extent to which local visitors ‘own’ indigenous heritage assets at sites of national significance is challenged when non-local domestic visitors also consider them an important part of their heritage [78]. Non-local visitors are often partly or wholly unfamiliar with indigenous culture, and the knowledge they do possess may be based on inaccurate cultural stereotypes regarding locals’ attitudes, service quality expectations, and safety [79]. Furthermore, local visitors typically have a unique viewpoint on the traditions and expectations of the places they visit, which could lead to more enjoyable, memorable, and relaxing experiences [80].

Despite the relevance of differences in the latent perceptions on the parts of local and non-local visitors, as identified through the language of their reviews, there is very limited empirical research that investigates the importance of language as a proxy for cultural background. Focusing on Italian museums, [68] used the language of museum visitors in their online reviews to indicate cultural background and compared the latent dimensions of the experience between those writing in the local language and visitors writing in non-local languages.

The present study takes a further step in the analysis of latent dimensions within the perceptions held by local and non-local visitors from different countries to 10 mountain museums, revealing significant differences in visitor evaluations of the museum experience.

3. Materials and Methods

This study employed a computational text analysis approach to examine visitor experiences, utilizing user-generated content from TripAdvisor. The International Mountain Museums Alliance (IMMA) provides an ideal case for computational text analysis of visitor experiences due to its unique combination of thematic homogeneity and geographic diversity. Museums that are members of IMMA are all specialized in mountain culture and present similar content, yet they are situated in distinct cultural and touristic contexts. This enables comparative analysis of how visitors sharing common interests perceive and engage with mountain heritage across different locations [81].

To decode visitor sentiments, identify key experiential themes, and compare the perceptions of local and non-local visitors, as well as different visitor profiles, the methodology of the analysis comprised five steps, as shown in Figure 2. This approach enables a data-driven understanding of how a specialized yet internationally dispersed museum network shapes visitor engagement, offering insights into experiences within a shared curatorial framework.

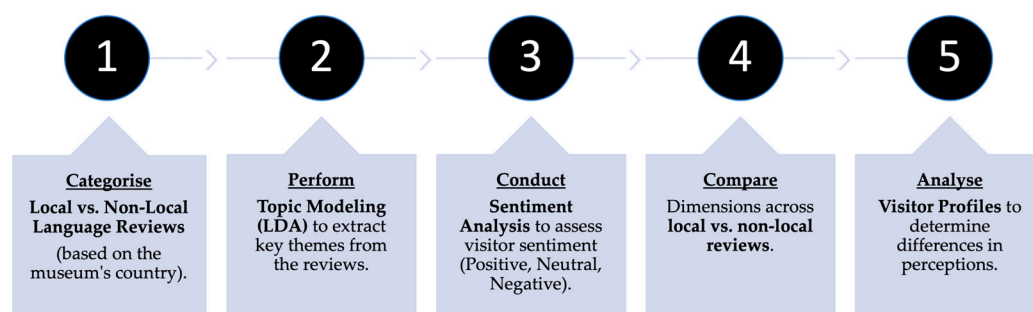


Figure 2. Data analysis flow. Conceptualized by authors.

The dataset comprised 2157 reviews of 10 mountain museums (Table 1), ensuring the inclusion of a diverse range of visitor experiences. The data were collected between 15 and 20 September 2024.

Table 1. Number of reviews for each mountain museum.

Museum Name	No. of Reviews
Museo Nazionale della Montagna	164
Musee Alpin Chamonix	91
Whyte Museum of the Canadian Rockies	595
Tatra Museum in Zakopane	11
Alps Swiss Alpine Museum	102
Museo degli Usi e Costumi della Gente Trentina	80
International Mountain Museum	972
Musée Savoisien	55
Museo Valtellinese di Storia e Arte (Valtellina Museum of History and Art)	41
Olimpia—Muzeul Sportului și Turismului Montan	46

Source: Data retrieved from public TripAdvisor accounts of the museums. Table created by the authors.

Reviews were extracted using a web-scraping method via the console.apify.com application, generating ten separate files corresponding to each observation. All reviews analyzed in this study were publicly available on TripAdvisor and were accessed in accordance with the platform's terms of use at the time of data collection. No personally identifiable information was collected or stored, and all user identifiers were excluded from the dataset. Data were extracted using Apify's public scraping interface, and the dataset was anonymized during pre-processing to ensure compliance with ethical standards for user-generated content analysis.

These files were subsequently merged into a unified dataset to facilitate comprehensive analysis. To ensure data accuracy and reliability, a systematic extraction process was implemented, incorporating criteria such as relevance, linguistic categorization, length threshold, and potential applicability for sentiment analysis. Reviews were required to explicitly reference aspects of the museum experience to qualify for classification into local and non-local language categories, thereby ensuring the inclusion of meaningful content. To ensure data accuracy and analytical relevance, a character length threshold of ≥ 50 was established to filter out excessively brief or generic reviews, which typically lack substantive insights. This approach aligns with prior research that similarly applied length-based filters to exclude non-informative or low-quality content from sentiment and topic modelling analysis [41,72,73]. This 50-character minimum was chosen as a balanced threshold that retains meaningful feedback while minimizing noise, in accordance with common practices in tourism and museum-related text mining studies.

The dataset underwent preliminary pre-processing, including the removal of stop words, punctuation, and special characters. Additionally, lemmatization was performed to standardise textual content, improving consistency for subsequent linguistic and sentiment analysis.

To classify visitor types (solo travelers, couples, families with children, groups of friends, and business travelers), rule-based textual analysis was applied to the review content. Specific keywords and linguistic patterns were used to infer the profile of the reviewer. For example, phrases such as "I visited alone", "went with my partner", "our children enjoyed", "we were a group of friends", or "visited during a business trip" were extracted to determine the visitor category. Each review was manually or semi-automatically labelled based on these indicators. This approach is in line with methods applied in previous studies that have used self-reported information in online reviews to infer demographic or behavioral profiles [68].

Lemmatization is a fundamental process in Natural Language Processing (NLP) that converts words into their base forms or lemmas. This text-processing technique reduces words to their root forms, thereby enhancing linguistic analysis. For better conceptualization, an illustrative example is the transformation of "running" to "run" or "better"

to “good”. This standardization ensures that variations of the same word are analyzed collectively, improving the accuracy of sentiment analysis and topic modelling.

In this study, lemmatization facilitated the grouping of related words such as museum and museums, mitigating redundancy within the dataset. By consolidating different inflected forms of a word into a single reference point, lemmatization enhances the efficiency and accuracy of computational linguistic tasks. Lemmatization [82,83] is a crucial post-tokenization technique that refines textual data by converting words into their morphological roots. This process optimizes word classification, thereby facilitating the analysis of meanings, synonyms, and contextual relationships in textual data [84,85].

To determine the optimal number of topics, researchers tested multiple LDA models with topic numbers ranging from 5 to 20. Each configuration was evaluated using the C_v coherence metric, a standard measure for assessing semantic interpretability in topic modelling. Based on these scores and qualitative evaluation of topic coherence, they selected five topics as the most balanced configuration, providing clear thematic structure while avoiding fragmentation. The models were implemented in Python using the Gensim library with default variational Bayes settings (alpha = ‘auto’, eta = ‘auto’, 1000 iterations).

LDA operates by clustering words that frequently co-occur, facilitating the extraction of dominant themes from extensive textual corpora. In this study, LDA was utilized to categorize key visitor concerns based on their reviews, enabling the identification of primary thematic structures within local-language reviews. Consequently, distinct thematic patterns emerged in reviews provided by local and non-local visitors, offering insights into variations in visitor perceptions.

The rationale for employing this method in the study’s methodology was based on the following three key considerations:

- (i) Identification of latent dimensions of visitor experience through clustering words into coherent topics, as LDA facilitates the extraction of dominant themes from extensive textual data;
- (ii) The ability to compare local and non-local visitors within diverse audiences while ensuring an unbiased identification of key aspects valued by different cultural groups;
- (iii) The objective of understanding variations in experience across visitor types, thereby enabling the differentiation of visitor categories and their respective interests.

Sentiment analysis was conducted to classify visitor reviews into positive, neutral, or negative categories. Sentiment analysis is a Natural Language Processing (NLP) technique used to determine the emotional tone of content. In this study, sentiment analysis was employed to categorize reviews based on the words and phrases present in visitor feedback, with sentiment polarity indicating the direction of emotions within the text. This classification enabled objective assessment of overall visitor satisfaction across various demographic groups. Widely applied in consumer behavior research, sentiment analysis systematically extracts subjective opinions from textual data. Given that museum visitor experiences are inherently affective and evaluative, this technique provides a structured approach to categorizing visitor feedback. Specifically, this method facilitated the following:

- (i) Quantification of visitor satisfaction by aggregating sentiment scores to assess overall perceptions of the museum experience;
- (ii) Comparison of perceptions across visitor groups, identifying variations in sentiment polarity based on language (local vs. non-local) and visitor type (solo travelers, families, couples, groups, business visitors);
- (iii) Detection of potential service gaps, as a higher proportion of neutral or negative sentiments within a specific visitor segment may indicate areas requiring improvement.

Sentiment analysis of user-generated content offers an efficient and objective tool for decoding visitor experiences in museums, enabling the identification of key museum

attributes. Gómez Punzón and Recuero Virto [58] used sentiment analysis with a Support Vector Machine (SVM) algorithm to classify user-generated content about museums into positive, negative, and neutral sentiments, revealing visitors' emotional responses to their experiences. Text mining with Atlas.ti and weighted percentage metrics identified frequently repeated words, providing actionable insights into visitor perceptions and feedback.

Sentiment analysis was conducted using TextBlob, a Python 3.11. library for processing textual data, assigning a sentiment score to text based on word associations. TextBlob automatically classified reviews as positive, neutral, or negative by identifying key sentiment-carrying words. To analyze sentiment polarity, reviews were categorized as follows:

- Positive sentiment: reviews containing expressions of satisfaction, enjoyment, or appreciation;
- Neutral sentiment: reviews exhibiting a balanced perspective, neither overtly positive nor negative;
- Negative sentiment: reviews highlighting dissatisfaction, service issues, or unmet expectations.

To enhance analytical depth, comparative analysis was conducted across different visitor profiles. Sentiment trends were examined for solo travelers, couples, families, groups, and business travelers, providing insights into how each group experienced and evaluated their mountain museum visit. Additionally, key themes mentioned by different visitor types were analyzed, identifying dominant topics such as education, interactivity, history, and social experience. This study also investigated variations between local and non-local visitors, assessing how cultural and linguistic factors influenced visitor expectations and satisfaction levels.

4. Results

This study included analysis exploring visitor engagement patterns based on review data. By examining diverse visitor perspectives, it uncovers key aspects that shape museum experiences. The analysis identifies distinct themes and variations in visitor feedback, offering insights into how different audience segments perceive and interact with museum offerings. This exploration provides a structured approach to understanding visitor satisfaction, preferences, and overall engagement.

4.1. Reviews Categorisation

Understanding the composition of visitor reviews is essential for analysing museum engagement and visitor perceptions. The dataset consisted of 2157 reviews collected from 10 mountain museums, written in multiple languages. To distinguish between local and international perspectives, reviews were categorized based on language: those written in the local language were considered local, while those in any other language were classified as non-local. The analysis reveals that a significant majority (87.44%) of reviews come from non-local visitors, while only 12.56% originated from local visitors. This distribution highlights the strong international appeal of these museums, indicating that they attract a diverse audience beyond their immediate geographical region. The difference in representation suggests potential variations in visitor expectations, satisfaction levels, and review characteristics, which will be explored in subsequent analyses.

A visual representation of this distribution is provided in Figure 3, illustrating the dominance of non-local reviews in the dataset. Subsequent sections present the differences between local and non-local reviews in terms of sentiment and thematic content.

Proportion Of Local Vs. Non-local Reviews

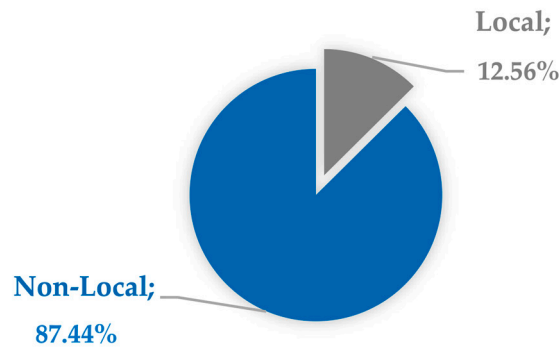


Figure 3. Proportion of Local vs. Non-Local reviews. Conceptualized by authors.

4.2. Latent Dirichlet Allocation Topic Modelling

By applying topic modeling to the reviews, the researchers identified the common themes and topics that each visitor segment emphasized in their feedback. Each group tended to highlight slightly different aspects of the museum experience. Based on these findings, researchers determined distinct thematic patterns in visitor feedback, focusing on differences in priorities and experiences between local and non-local visitors (Figures 4 and 5).



Figure 4. Five latent dimensions in local reviews of mountain museums. Authors’ conceptualization.

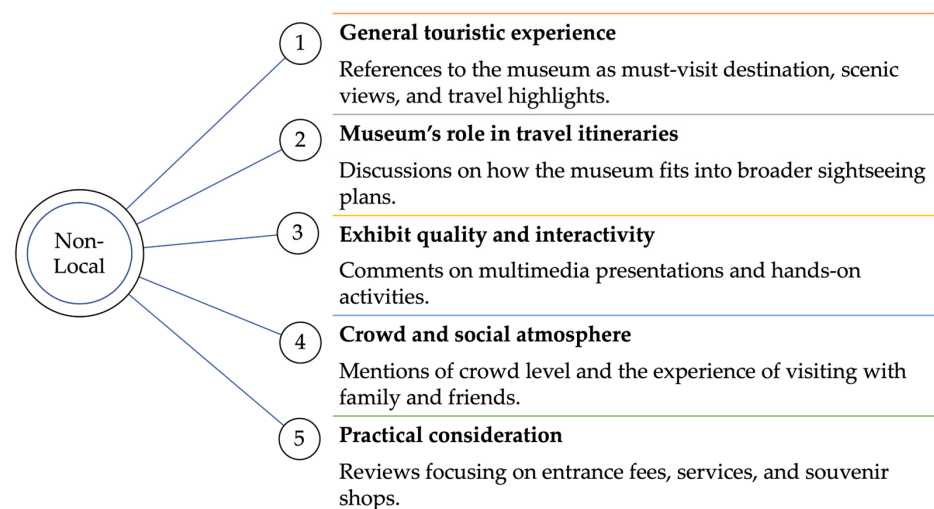


Figure 5. Five latent dimensions in non-local reviews about mountain museums. Authors’ conceptualisation.

These findings indicate that local visitors engage deeply with the cultural and educational dimensions of the museums, emphasising the role of museums in preserving and promoting local and national identity.

These insights suggest that non-local visitors primarily perceive the museums as part of their travel experience, with greater emphasis on interactivity, convenience, and overall ambiance.

Table 2 provides a better understanding of the perceptions of each visitor type.

Table 2. LDA topic modelling results.

Type of Visitors	Content Category	Perceptions
Solo travelers (Often appreciate the depth and detail of the museum content)	Historical and informative exhibitions	Many solo reviewers mention the rich history on display and detailed exhibits, valuing how informative and “interesting” the collections are. They often dive deep into museum content, indicating that they enjoy absorbing information at their own pace.
	Personal experience	They frequently comment that the visit was “worth the time” and “worth the money”, suggesting a strong focus on the value of the experience. They typically spend substantial time (often a few hours) and note that the visit met their personal expectations for learning or enjoyment.
	Photography and reflection	There are mentions of photos and taking the time to observe. This implies solo travelers may engage in photography and quiet reflection. They enjoy being able to linger and truly take in the exhibits (appreciating art or artifacts without rush).
Couples (Tend to enjoy a leisure experience)	Cultural and historical enrichment	Like solo travelers, couples frequently highlight history and interesting information. They also often note art displays or local culture (regional art, heritage exhibits), indicating that a blend of history and art appeals to them.
	Contextual elements	They mention the area or context of the museum (such as a museum’s setting or theme like mountaineering in the Himalayas or Rockies). They appreciate it when the museum visit complements their travel itinerary, such as learning about the local history of a place they are vacationing in.
	Overall enjoyment and value	Couples use words like “nice”, “great”, and “worth it” to describe their experience. They often recommend a visit as a good way to spend part of the day. Some mention going early in the day, suggesting they plan visits to avoid crowds or to fit into a day’s schedule conveniently.
Families with children (Focus on engagement and educational value)	Child-friendly exhibitions	One of the key themes is how well the museums cater to children. Families frequently mention interactive displays and exhibitions that can hold children’s attention. Reviews from this category highlight when children have enjoyed specific sections or activities. When a museum offers hands-on multimedia resources, families’ notes reflect this positively.
	Educational experience	Parents appreciate it when the museum is informative and engaging. Topics like mountaineering history or natural history are mentioned alongside comments about learning. Families often value that the visit was “educational for children and adults alike”, indicating that they seek a learning experience that is also fun.
	Practical aspects	Families often plan their visit length and logistics. Reviews mention spending a couple of hours and sometimes note facilities (such as availability of coffee shops or rest areas). Keeping kids engaged for the whole visit is a common concern. When a museum succeeds in this (through child-friendly content or play areas), it is highlighted as a positive. Conversely, any lack of amenities for children or exhibits that are not engaging might be pointed out by this group.

Table 2. Cont.

Type of Visitors	Content Category	Perceptions
Groups of friends (Emphasize fun and social activities)	Variety and “must-see” highlights	Groups of friends often talk about specific exhibits or exhibitions that stand out, using terms like “worth the visit” or even naming unique displays. They seem to enjoy a broad variety of content, possibly because each person in the group finds something of interest. A common theme is that visiting together is “fun and interesting” for everyone.
	Social experiences	These visitors sometimes mention the museum shop or coffee shops. For example, a group might note enjoying the gift shop or grabbing a snack together. This suggests that for groups of friends, the museum visit is a social outing, and things like cafes, rest areas, and souvenir shops add to their experience.
	Guided tours and explorations	Some groups of friends take tours. They mention guided tours’ availability and how these have added to their understanding (such as learning a lot from a tour guide). In general, friends appreciate an experience that is easy to navigate as a group (clear information and engaging guides help keep everyone in the group interested).
Business travelers (Values efficiency)	Guided experiences	These groups often mention taking a “tour” or having a limited time frame. Business reviewers frequently praise guided tours or well-organized exhibits that allow them to experience the museum in a short visit. They appreciate when the museum offers a quick yet enriching overview. For instance, a guided walk through key exhibits or an informative highlight the museum’s best feature.
	Unique local highlights	Even on business, these visitors notice standout aspects like historic houses or special exhibits. For example, if the museum includes a tour of a historical building or a famous artifact, business travelers point it out as a high point. They often use words like “amazing” or note something memorable they can share when they get back home. Since their time is limited, impactful displays that leave an impression (an iconic mountain climbing exhibit or a life-size model) are particularly appreciated.
	High satisfaction	It is worth noting that despite shorter visits, business travelers give very positive reviews. This suggests that when museums provide convenient options (like luggage storage, flexible hours, or quick tours), business visitors can comfortably fit a museum visit into their trip and end up very satisfied.

Source: Conceptualized by authors.

4.3. Sentiment Analysis

The sentiment analysis revealed that overall visitor satisfaction was high, with the majority of reviews exhibiting positive sentiment (Table 3).

Table 3. The overall sentiment of the reviewers by visitors’ type.

Visitor Type	Negative Reviews	Neutral Reviews	Positive Reviews
Solo	12	98	144
Couples	48	172	571
Families	20	93	221
Groups of friends	22	111	292
Business	1	98	144

Authors’ computation based on TripAdvisor reviews dataset.

Groups of friends and business travellers were especially positive, with nearly nine out of ten giving a favourable review. Solo travelers, couples, and families also showed strong positivity (around four in five were positive). Neutral sentiments (mixed or average experiences) made up roughly 8–14% of reviews depending on the group. Negative

experiences were uncommon across the board (under 7% for leisure travellers, and only ~3–4% for friends and business visitors). This suggests that museums in the dataset are generally meeting or exceeding visitor expectations regardless of who is visiting. Most reviewers in every group gave positive feedback, while negative opinions were relatively rare (Figure 6).

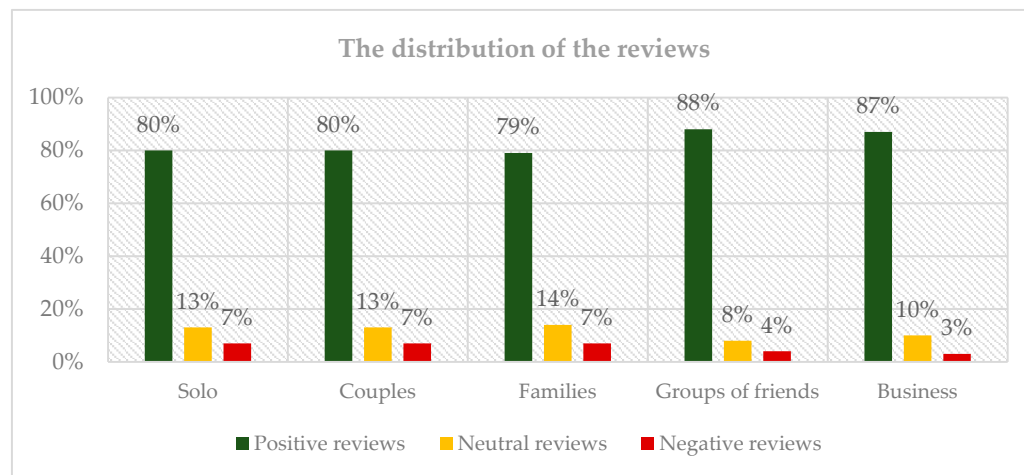


Figure 6. The distribution of the reviews—sentiment analysis by visitor type. Conceptualized by authors.

The sentiment analysis of museum visitor reviews revealed distinct patterns among different visitor types. Couples and groups of friends exhibited the highest levels of positive sentiment, primarily due to their enjoyment of the social aspects of the museum experience. They were likely to view the visit as an opportunity for shared exploration, which enhanced their overall satisfaction. Families, on the other hand, tended to leave more neutral reviews, which may be attributed to the challenges of keeping children engaged and managing logistical concerns such as facilities, accessibility, and exhibit interactivity. Their experience is shaped not only by the museum’s offerings but also by practical factors that influence the ease and comfort of their visit. Business travellers generally provide neutral feedback, reflecting the fact that their visits are often brief and more observational rather than immersive. While business travellers typically spend less time in museums, the data show surprisingly high levels of satisfaction. This may appear contradictory at first glance, but their needs and expectations differ significantly from other visitor groups. This paradox is explained by the type of museum experiences they seek: efficient, focused, and high-impact. Reviews often praised well-structured guided tours, curated highlights, and clear wayfinding that allowed them to enjoy a meaningful visit within a limited time window. These visitors appreciate “just enough” storytelling, minimal cognitive load, and visual summaries that offer a “TL;DR” (too long; didn’t read) version of the museum narrative. Since they typically visit museums within tight schedules, their engagement is likely to be limited, leading to less emotional investment in the experience. Finally, solo travelers demonstrate a more analytical approach, resulting in a higher proportion of neutral reviews. Their feedback suggests that they critically assess the depth and quality of exhibits, focusing on educational value and self-paced exploration rather than the social or logistical aspects that influence other visitor groups. Their high satisfaction suggests that mountain museums offering condensed, high-quality experiences like top-exhibit routes or thematic overviews effectively meet the needs of this segment. Such findings underline the value of efficiency-driven design for time-sensitive visitors.

4.4. Comparative Analysis of Visitors' Perceptions

Bringing all these findings together, a comparison reveals how each visitor profile's experience converges or diverges. Firstly, all groups generally enjoyed the museums, with positive sentiment around 80% or higher for each. Groups of friends and business travelers were most satisfied, possibly because they self-selected into visiting only if they were truly interested or because they had limited time and thus appreciated the opportunity. Solo travelers, couples, and family visitors, while still largely happy, had slightly more mixed feelings as indicated by higher proportions of neutral/negative reviews, indicating a few more critiques or unmet expectations in those groups.

Secondly, focusing on the content confronting the amenities, solo travelers and couples put a lot of emphasis on the content (history, art, or information). They rarely mentioned practical details; their satisfaction resulted from the depth of the exhibits and intellectual or cultural fulfilment. Families and friends also valued the content but were more likely to mention amenities (places to rest, eat, shop) and interactive or social aspects. For example, families care about children-friendly facilities and friends enjoy coffee shops or the gift shop as part of the outing. Business travelers are an interesting mix. They focus on efficiently delivered content because they want the highlights without the clamour.

Thirdly, specific interests differentiate the categories; families stand out by frequently discussing children's engagement. If exhibits are too static or scholarly, families might be less satisfied, whereas other groups might not mind. Otherwise, friends sometimes mentioned enjoying specific special exhibits or the fact that a visit was a fun group activity, which solo travelers might not have experienced in the same way. Business travelers often explicitly mentioned being on a tight schedule, so they appreciated elements that others might not have mentioned, like concise tours or easy access.

Regarding complaints or neutral tones, these differed by group. For instance, a couple or a solo traveler might say an exhibit was not detailed enough or the museum was smaller than expected, determining content-focused critique, whereas a family might comment that their toddler was bored or there was not enough interactivity, generating engagement-focused critique. A group of friends might be disappointed if the outing wasn't as exciting as hoped or if a key exhibit was closed (experience-focused), and a business traveler might note if the visit felt like wasted time in a packed schedule (efficiency-focused). These nuances show that the satisfaction of each visitor type is dependent on different aspects of the museum experience.

Lastly, in addition to sentiment analysis, a keyword cloud was generated to visualize the most frequently occurring terms in the reviews. The word cloud was created using WordCloud and Matplotlib Python 3.11. libraries, which extracted and displayed key terms based on their prominence in the dataset. The size of each word in the cloud correlates with its frequency in the reviews, making it easier to identify common themes and repeated discussions among visitors. Key terms such as "museum", "exhibits", "interesting", and "history" suggest that visitors frequently discussed the nature of the collections and their overall experiences. Additionally, some sentiment-driven words like "amazing", "beautiful", and "small" provided an initial impression of how visitors perceive the museums. The visualization revealed that "Banff" was one of the most dominant words, reinforcing the strong geographical association with the Whyte Museum of the Canadian Rockies, located in Banff National Park, Canada.

In addition to sentiment and topic modelling analysis, a keyword cloud (Figure 7), was generated to visually indicate the most frequently used content-bearing words in the visitor reviews. The word cloud was created using Python 3.11 (WordCloud and Matplotlib libraries), following standard text preprocessing steps such as lowercasing, lemmatization, and removal of stopwords and punctuation. High-frequency function words and generic

and non-local languages, researchers identified key themes reflecting varying expectations and preferences. For a better understanding of the overall context, the authors created Figure 8 to logically present the aims of the study and the results of the research questions.

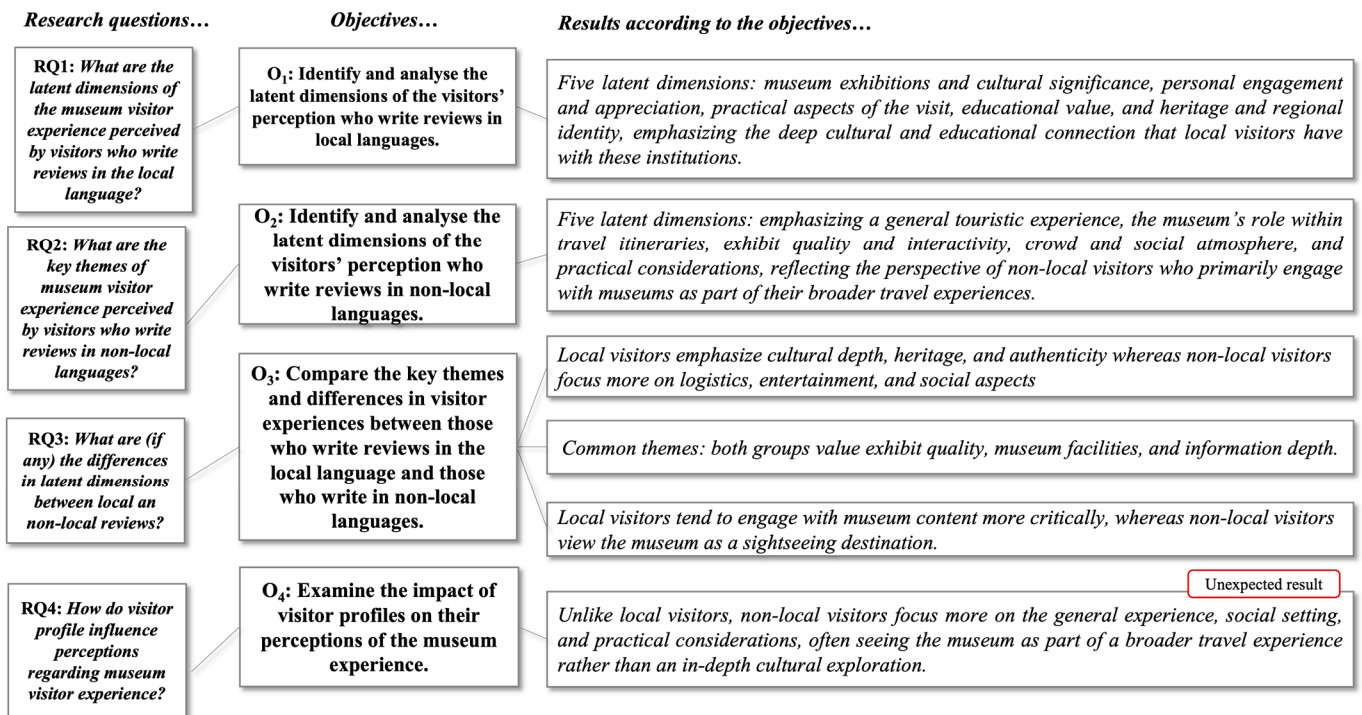


Figure 8. The research questions of the study, objectives, and results. Authors' conceptualization.

The Discussion Section explores how these insights can inform museum strategies to create more inclusive, engaging, and enhanced experiences for diverse visitor segments. The thematic differences between local and non-local reviews reflect distinct visitor motivations. Local visitors engage with museums as cultural and educational institutions, valuing their contribution to heritage and knowledge. In contrast, non-local visitors experience museums more as tourist attractions, prioritizing factors such as exhibit interactivity, itinerary fit, and atmosphere. These findings provide valuable insights for museum management, allowing the development of enhanced strategies to improve visitor experiences based on audience type. Local visitors may benefit from more in-depth cultural programs, while non-local tourists might appreciate improved accessibility, multilingual guides, and interactive exhibits.

Local visitors primarily engage with mountain museums as cultural institutions, placing strong emphasis on historical significance, personal appreciation, educational value, and heritage preservation, according to responses relating to the first research question (RQ1). Reviews written by local visitors reflect a deep interest in authenticity, knowledge acquisition, and national identity, suggesting that they perceive museums as repositories of cultural heritage rather than mere attractions, which strengthens the existing literature.

In contrast, exploring the second research question (RQ2) reveals that non-local visitors approach museums through a touristic lens, focusing on their role within travel itineraries, exhibits' interactivity, social atmosphere, and practical considerations. Their experiences are shaped by factors such as ease of access, entertainment value, and logistical convenience, reflecting an engagement style that aligns with sightseeing priorities rather than cultural immersion.

As outlined by addressing the third research question (RQ3), researchers state that clear distinctions exist between local and non-local visitor expectations. Despite these

differences, both local and non-local visitors share a common appreciation for high-quality museum exhibits, well-maintained facilities, and comprehensive information delivery. Regardless of their background, visitors value engaging displays, clear and accessible interpretive materials, and a well-curated museum environment overall. This suggests that exhibit quality, infrastructure, and visitor support services are key determinants of visitor satisfaction across all audience types. Museums that prioritize these aspects can effectively cater to a diverse audience, ensuring that both culturally invested locals and experience-driven tourists find meaningful engagement in their visits.

Analyzing how visitor profiles shape museum experiences (RQ4) reveals distinct engagement styles. Solo travelers seek in-depth learning, valuing immersive storytelling, quiet reflection, and taking photos. Couples integrate museum visits into their broader travel experiences, appreciating history, regional identity, and convenience. Families prioritize interactive, child-friendly exhibits, emphasizing education and amenities that enhance engagement. Groups of friends experience museums as social outings, enjoying diverse exhibits, cafes, and guided tours that enrich shared visits. These variations highlight how visitor expectations influence satisfaction, providing museums with insights for tailoring their content and designing engagement strategies to enhance experiences for different audience types.

Analysis of visitor-generated reviews also contributes to ongoing debates in museology regarding the shifting boundaries of cultural authority. Traditionally, museum narratives have been curated and controlled by experts, with limited input from audiences. However, platforms like TripAdvisor enable visitors to publicly evaluate, interpret, and reframe cultural experiences based on personal perceptions. The fact that these reviews can be mined for sentiment and thematic structure through tools like LDA gives voice to audiences that have historically been passive recipients. The outcomes of this study, which reveal nuanced, experience-driven patterns in feedback, suggest that online reviews are increasingly shaping the public meaning of museum content, thereby challenging top-down curatorial hierarchies and contributing to a more participatory, decentralized model of meaning-making in heritage spaces.

Based on these findings, the authors propose actionable insights for museum management to optimize offerings for each type of visitor by considering five dimensions comprised in the model pictured in Figure 9.

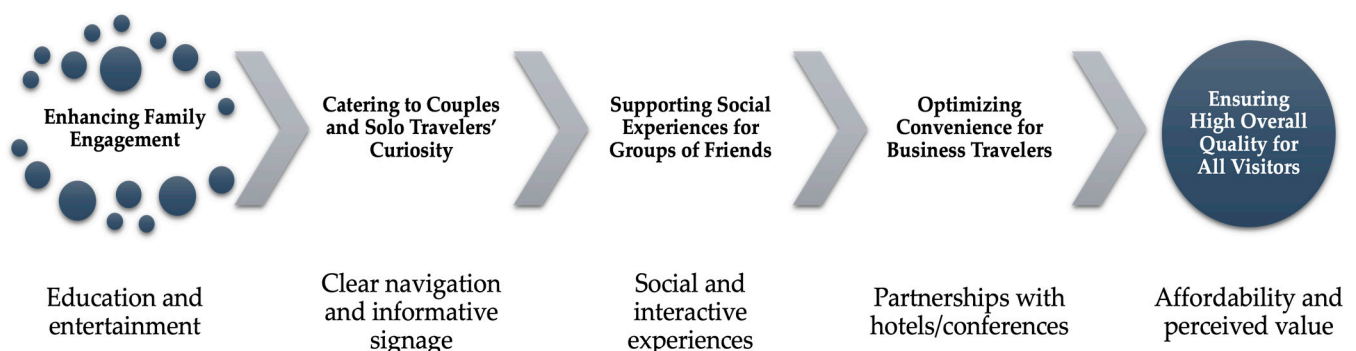


Figure 9. The dimensions for optimisation. Authors' conceptualization.

5.1. Enhancing Family Engagement

Families' prioritize both education and entertainment for their children when visiting museums. To meet these needs, museums should implement interactive exhibits, hands-on activities, and family-oriented guides. Offering family-friendly ticket options, dedicated learning areas for kids, and seating areas for parents can enhance the overall experience. Additionally, clear signage highlighting exhibits that appeal to younger visitors

can ensure a more structured and enjoyable visit. These efforts will keep children engaged, leading to a positive experience for the whole family and encouraging word-of-mouth recommendations among parents.

5.2. Catering to Couples and Solo Travelers

Adult leisure travellers, including both couples and solo visitors, tend to be drawn to rich content and immersive storytelling. Museums should invest in high-quality exhibits featuring detailed information panels, multilingual audio guides, and well-curated collections. Couples particularly enjoy cultural and artistic elements, making it beneficial to integrate local art, history, and thematic storytelling into exhibitions. For solo travelers, creating quiet corners with reading materials and ensuring an intuitive layout for self-paced exploration will enhance their engagement. These strategies cater to inquisitive visitors seeking a deeper understanding of the exhibits.

5.3. Facilitating Social Experiences for Groups of Friends

For groups of friends, museum visits often serve as a social outing rather than just an educational experience. Museums can cater to these groups by creating spaces for social interactions, such as cosy coffee shops, scenic courtyards, or communal seating areas. Offering group discounts and visually engaging, Instagrammable exhibits may encourage social sharing and word-of-mouth promotion. Additionally, museums can host special events, scavenger hunts, or trivia nights to make visits more interactive and appealing to groups looking for a fun and engaging experience.

5.4. Optimizing the Efficiency for Business Travelers

Business travelers, often on tight schedules, value efficiency and convenience. Museums can accommodate these visitors by introducing short, structured guided tours (30 min highlight tours at predictable times) that allow visitors to experience key exhibits efficiently. Providing lockers for briefcases/luggage and ensuring strong wi-fi connectivity can further enhance the convenience of a visit. Additionally, forming partnerships with conference organizers and hotels could introduce unique opportunities such as after-hours networking events or discounted entry for conference attendees. These initiatives can turn business travellers into enthusiastic advocates for the museum.

5.5. Maintaining High Overall Quality Standards

Across all visitor categories, several universal expectations emerged from the analysis, including cleanliness, knowledgeable and friendly staff, and clear visitor information. Museums should continue to train staff to provide excellent customer service and maintain an environment that meets high-quality standards. Pricing should remain transparent and reasonable, with clear communication of the value offered. Where feedback suggests areas for improvement (families desiring more interactive exhibits or solo travelers seeking more in-depth content), targeted refinements can enhance the visitor experience. Even small adjustments dedicated to each visitor segment can contribute to greater overall satisfaction.

5.6. Aligning Museum Offerings with Visitor Expectations

By aligning museum services and exhibits with these visitor-specific insights, mountain museums can provide a more personalized and memorable experience. This means delivering core museum content via multiple modes, such as hands-on and immersive for families, in-depth and research-focused for history enthusiasts, socially engaging for groups of friends, and time-efficient for business travellers. Such improvements will not only enhance visitor satisfaction but also determine repeat visits and positive online reviews, creating a cycle of continuous engagement and growth for the mountain museum sector.

6. Conclusions

This study provides valuable insights into how visitor experiences vary by language and visitor type, highlighting the importance of customized museum offerings. By adapting museum services and exhibits to different visitor segments, mountain museums can enhance engagement, improve satisfaction, and create multiple memorable experiences for all guests. This research contributes to the knowledge on mountain museum visitor experiences, sentiment analysis, and intercultural communication. By deploying human-computer interaction techniques and text mining, the study provides a data-driven approach to understanding visitor perceptions, bridging the gap between digital analytics and mountain museum management. The findings highlight the role of TripAdvisor reviews as an alternative data source for visitor experience evaluation, contributing to advancements in tourism and cultural studies.

From a theoretical perspective, this study reinforces the importance of user-generated content in tourism research. The application of latent Dirichlet allocation topic modelling and sentiment analysis demonstrates how natural language processing can decode visitor emotions and preferences in a cross-cultural context. The results contribute to the understanding of how language and cultural background shape visitor satisfaction and expectations, offering new insights for researchers in the fields of tourism, communication, and museum studies.

The findings provide practical recommendations for mountain museum managers aiming to optimise visitor experiences. Museums should invest in interactive exhibits and child-friendly spaces to improve family satisfaction. By creating engaging, hands-on experiences, museums can better cater to families, ensuring that both children and adults enjoy their visit. Providing designated play areas and structured learning activities can significantly enhance family engagement and increase repeat visits. Museums can meet the needs of solo travelers by offering short, guided tours, self-guided digital experiences, and quiet study areas where visitors can explore at their own pace. Creating flexible visiting options ensures that these visitor segments can engage with museum content efficiently, even on limited time. For couples and groups of friends, a mountain museum visit is often a social activity. Museums can enhance this experience by providing photo opportunities, themed tours, and interactive engagement activities. Incorporating elements that encourage social interactions, such as shared activities, group challenges, or social media-friendly installations, can increase visitor engagement and create lasting memories.

To communicate to local and international audiences, museums should develop multilingual and culturally immersive exhibits. Providing translated materials, multilingual guides, and digital resources can make exhibits more accessible and enjoyable for diverse audiences. Culturally contextualized storytelling, featuring both local and global perspectives, can help bridge the gap between different visitor expectations, providing a more inclusive museum experience. By deploying these strategies, mountain museums can increase engagement, visitor satisfaction, and overall attendance rates, while also using insights gained from human-computer interaction to support continuous improvement.

While this study provides valuable insights, it has some limitations. One acknowledged limitation is the exclusive reliance on TripAdvisor as the sole source of user-generated reviews. While TripAdvisor is not a museum-specific platform and covers a wide range of tourism and hospitality experiences, its extensive user base and broad geographic coverage provide a valuable source of authentic visitor feedback. Prior research has also validated TripAdvisor as a meaningful source of insights for museum and cultural tourism analysis [9,20,39].

Nonetheless, future research could enhance robustness by incorporating data from other specialized review platforms, museum websites, or real-time feedback tools to tri-

angulate findings and explore deeper qualitative dimensions. Meanwhile, TripAdvisor review may not capture the perspectives of visitors who do not engage with online review platforms. This may result in sample bias, where only digitally active visitors' opinions are reflected in the findings. As with all studies relying on user-generated content, TripAdvisor users do not represent the full spectrum of museum visitors; individuals who post reviews tend to be more digitally engaged, vocal, and motivated to share their opinions, while families with toddlers, elderly visitors, or those less comfortable with online platforms may be underrepresented. This introduces a potential sampling bias, skewing the data toward particular demographic and behavioral profiles. Furthermore, the multilingual nature of the dataset presents additional challenges. Cultural and linguistic norms influence how emotions and experiences are articulated; what is framed as neutral in German may imply satisfaction, while Spanish reviews may express enthusiasm more vividly due to cultural conventions. Even with translation and manual validation, these nuances are difficult to fully capture with standard NLP tools. Future research could mitigate these limitations by incorporating in-person surveys, multilingual sentiment models, or native-language analysis to ensure broader inclusivity and cultural sensitivity.

Thus, where language-based segmentation was applied, some nuances in sentiment and cultural expression may not have been fully captured. Differences in linguistic structures and tone may influence how sentiment is interpreted across languages. Also, the current findings are based on mountain museums, which may limit the generalizability of the results to other types of museums or cultural institutions. Future studies could expand the research scope to include a variety of museum types in order to compare findings. Moreover, this study used historical reviews, meaning that the findings do not account for real-time changes in visitor sentiment or immediate reactions to exhibits. The incorporation of real-time feedback mechanisms could further enhance the accuracy and applicability of insights. The dataset included reviews written in multiple languages, reflecting the international reach of the museums. To ensure the reliability of sentiment analysis, the authors restricted this step to reviews originally written in English, as the TextBlob classifier is designed and optimized for English-language input. For non-English reviews, initial translation was performed using the Google Translate API to support thematic comparison in the topic modeling and cross-segment analysis. During preprocessing, the researchers removed or standardized non-standard characters, emojis, and informal expressions, though they acknowledge that linguistic nuances may have been lost or distorted in translation. To assess the accuracy of the sentiment classification process, the authors manually validated a random sample of 100 reviews (including both English and translated non-English entries). In over 85% of cases, TextBlob's automated sentiment classification aligned with human-coded judgments, suggesting that, despite limitations, the tool provided a reasonable approximation of visitor sentiment for the purpose of this study. Other options could be determined from multilingual sentiment models or native-language classifiers to capture cultural and emotional subtleties more accurately.

Future research can explore several promising directions. Firstly, investigating how machine learning and artificial intelligence can track sentiment changes in real time may provide dynamic insights into visitor experiences. Through analyzing trends over time, mountain museums can adapt more proactively to visitor feedback. Secondly, implementing interactive digital feedback mechanisms within museums should allow visitors to provide immediate feedback, enabling real-time adjustments to improve engagement and satisfaction. Furthermore, refinements could include categorising words by sentiment, filtering out common location names, or grouping words by contextual themes, such as positive experiences, criticisms, or exhibit-related discussions. Also, expanding the analysis

to art museums, science museums, and historical sites would help determine whether the findings of this study are applicable across different types of cultural institutions.

Moreover, by integrating direct survey data with online review analysis, future research can overcome the current study's limitations. Demographic data can enable refined analysis of sentiment and experience, revealing, for instance, whether certain age groups consistently report more positive sentiments about educational exhibits or whether family visitors emphasize different aspects of satisfaction than solo travelers. In sum, survey platforms (such as Qualtrics, Google Forms) and distribution channels (museum websites, email invitations, on-site QR codes) to collect visitor demographics and feedback can greatly enhance the depth of sentiment analysis. This approach should allow researchers and museum managers to identify segment-specific trends and employ interpretive strategies or services accordingly, ultimately providing a richer, evidence-based understanding of the mountain museum visitor experience. Also, incorporating visual and audio reviews (social media videos, voice reviews) can offer a more comprehensive understanding of visitor feedback. This approach can capture non-verbal cues and emotional expressions that are not always evident in written reviews. Finally, location-based tracking and digital engagement metrics may help museums understand visitor movement patterns, dwell times, and levels of interaction with different exhibits. These insights could be used to optimize exhibit layouts and improve visitor flow within museums. By pursuing these future directions, researchers can further enhance understanding of museum visitor behavior, helping institutions adapt to evolving digital trends and cultural expectations.

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