

Demographic Analysis of Satisfaction among China Palace Digital Museum Visitors

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Abstract: Visitor satisfaction is a critical determinant of the sustainable development of digital museums because it shapes public engagement with cultural heritage. This study examines the influence of demographic characteristics on user satisfaction with the China Palace Digital Museum's online platform. The research was guided by the End-User Computing Satisfaction (EUCS) model. Data were collected via an online questionnaire structured around the EUCS dimensions, yielding 400 valid responses from participants diverse in gender, age, occupation, and place of residence. Data analysis comprised descriptive statistics, independent-samples t-tests, and one-way analysis of variance. Results indicate that overall user satisfaction ranged from moderate to high. Information timeliness and system responsiveness received the most favorable evaluations, whereas content novelty and update frequency were rated comparatively lower. Statistically significant differences in satisfaction emerged across age groups, employment status, and residential area, while no significant differences were observed for gender or geographic region. Younger users, urban residents, and specific occupational cohorts reported higher satisfaction than older adults, rural residents, and retired participants.

Keywords: Digital museum, End-User Computing Satisfaction (EUCS), Demographic factors, China Palace Digital Museum (CPDM)

1. Introduction

The digital transformation of museums has emerged as a defining trend in contemporary cultural heritage practice, allowing institutions to engage with broader and more diverse audiences through online platforms (Li et al., 2024; Marty, 2008). As a leading example, the China Palace Digital Museum (CPDM) has embraced innovative technologies such as virtual reality (VR), online exhibitions, and interactive displays to deepen visitor engagement and deliver immersive cultural experiences (Gupta & Dubey, 2024). These innovations allow museums to attract not only on-site visitors but also a wide online audience, which is especially valuable during periods of crisis or travel restrictions (Zollo et al., 2022). However, despite the growing availability of digital museum resources, relatively little is known about how visitors interact with these platforms and how demographic characteristics—such as gender, age, and geographic location—affect their satisfaction (Liu & Guo, 2023).

In recent years, visitor satisfaction surveys have been widely applied to evaluate digital cultural services. For instance, studies in European contexts have demonstrated that demographic variables can significantly influence online visitor satisfaction (Monteiro & Borges, 2015; Pereira et al., 2017). While comparative research between developed and developing countries has identified disparities in digital engagement linked to infrastructure quality and digital literacy (Chang et al., 2015; Liu & Guo, 2023). Yet in the Chinese context, empirical studies exploring the intersection of demographic factors and digital museum satisfaction remain limited, leaving a gap in both theoretical understanding and practical guidance.

The primary objective of this study is to assess visitor satisfaction with the CPDM's online platform using the End-User Computing Satisfaction (EUCS) model, which encompasses six dimensions: **Content, Accuracy, Format, Ease of Use, Timeliness, and System Speed**. These dimensions provide a comprehensive framework for evaluating



how well a digital museum meets visitors' needs. The CPDM offers an ideal case for such an evaluation given its significant cultural importance and its pioneering efforts in digital integration. As part of the world-renowned Forbidden City, the CPDM has made remarkable advancements in deploying virtual exhibitions and interactive tools to engage both domestic and international audiences (Kuo et al., 2016; Liu & Guo, 2023). It has also actively worked to reach a broad, diverse visitor base online, making it a valuable subject for studying digital visitor satisfaction in China (Vrije Universiteit Brussel & Dang, 2019). An illustration of the CPDM's digital interface is presented in *Fig 1*, which highlights its online accessibility and interactive design. Insights from this case study can help museum professionals develop effective strategies to improve visitor satisfaction with digital museum resources and optimize digital engagement in cultural heritage institutions.

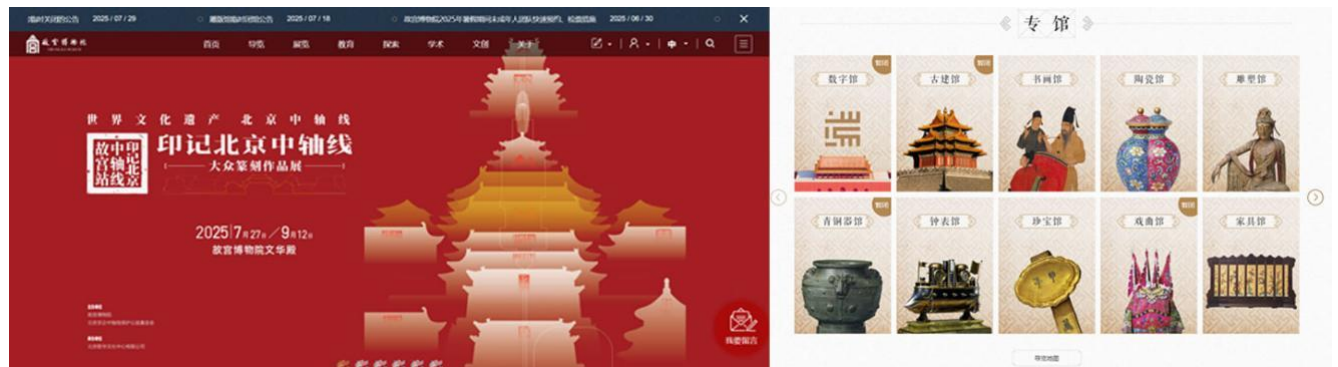


Fig 1. China Palace Digital Museum (CPDM) Homepage.

2. Problem statement

In light of the above, it is crucial to understand how visitor satisfaction may vary across different demographic groups, and what that implies for digital engagement strategies and resource allocation. The following two research questions guided the study:

RQ1: What is the level of satisfaction among CPDM visitors?

RQ2: Do demographic factors (Gender, Age, Employment, Geographic, and Residence) have a significant impact on CPDM visitors' satisfaction?

For RQ2, the following five hypotheses (H-a, H-b, H-c, H-d, and H-e) were formulated :

H-a: The mean satisfaction scores between male and female visitors are not equal.

H-b: A significant difference in the mean satisfaction scores exists among different age groups.

H-c: A significant difference in the mean satisfaction scores exists across different employment statuses.

H-d: A significant difference in the mean satisfaction scores exists across different geographic locations.

H-e: A significant difference in the mean satisfaction scores exists across different residential locations.

These hypotheses, grounded in existing studies (e.g., Gupta & Dubey, 2024), allow us to examine potential disparities in satisfaction across visitor subgroups. By testing these differences, the study aims to reveal how the CPDM's digital engagement can be tailored to meet the needs of various groups of visitors, thereby enhancing overall satisfaction and optimizing the user experience.

3. Literature Review and Conceptual Background

Digital museums are credited with greatly expanding access to cultural heritage; by digitizing collections and offering virtual exhibitions, they allow users worldwide to engage with museum content without the constraints of location or time (Zheng et al., 2024). Visitor satisfaction with these digital platforms is critical for ongoing

engagement. Research shows that satisfaction depends on factors like information/content quality, system quality (responsiveness/reliability), and usability (Segers & Dang, 2020; Zahidi et al., 2014). For example, Segers and Dang (2020) found that museum website visitor satisfaction is significantly influenced by information quality, system quality, and perceived usability (Segers & Dang, 2020). The End-User Computing Satisfaction (EUCS) model is often used to assess such satisfaction: its dimensions (including content accuracy and system performance) align closely with what influences users' approval of digital systems (Zahidi et al., 2014). Recent studies also highlight demographic effects – for instance, younger and more tech-savvy visitors tend to report higher satisfaction. Zhu *et al.* (2024) observe that greater technological fluency boosts visitors' "flow" experiences in digital museums, which in turn increases satisfaction and intent to return (Zhu et al., 2024). These findings underscore the relevance of the EUCS framework for understanding visitor satisfaction and motivate the current study's focus on the CPDM.

3.1 Importance of Visitor Satisfaction in Digital Museums

Visitor satisfaction is pivotal for the success of digital museum platforms, as it directly drives engagement and sustainability. By offering virtual exhibitions and interactive resources online, digital museums make cultural heritage content more accessible and inclusive; Zheng *et al.* (2024) note that digitizing heritage lets it "transcend the boundaries of time and space," enabling broader public access (Zheng et al., 2024). Empirical evidence shows that satisfied digital visitors are more likely to engage deeply with content, revisit the platform, and recommend it to others (Zhu et al., 2024). For instance, prior work found that enhanced visitor experiences in digital settings (through rich content and smooth interactivity) lead to higher satisfaction and stronger intent to return (Zhu et al., 2024). As museums continue adopting new technologies, it is thus crucial to optimize factors like content quality, system responsiveness, and ease of use to maximize satisfaction (Segers & Dang, 2020; Zahidi et al., 2014). Demographic variables also play a role; for example, younger users who are more familiar with digital media typically report better experiences (Zhu et al., 2024). Overall, assessing and improving visitor satisfaction—using models like EUCS—is key to ensuring the continued growth, reach, and accessibility of digital museums.

3.1.1 Theoretical Framework: EUCS Model and Its Relevance to Visitor Satisfaction

The End-User Computing Satisfaction (EUCS) model, introduced by (Doll & Torkzadeh, 1988), is widely used for evaluating user satisfaction with computing systems, and it has been effectively applied to digital museum environments. The EUCS model posits that user satisfaction is influenced by six critical dimensions: Content, Accuracy, Format, Ease of Use, Timeliness, and System Speed. In the context of digital museums, these dimensions assess how well the platform meets user expectations regarding the quality and accessibility of digital content, the ease of navigating the platform, and the responsiveness of the system. The model's comprehensive approach enables a deep understanding of the multiple factors that contribute to user satisfaction, making it a valuable tool for museums aiming to improve their digital offerings (Doll & Torkzadeh, 1988).

Visitor satisfaction in digital museums is significantly impacted by the quality of digital resources provided. According to the EUCS model, Content relates to the relevance and value of the digital information presented, while Accuracy ensures the reliability and correctness of this information. Format refers to the way information is presented and structured, including layout, clarity of text and visual content, and integration of multimedia resources. Ease of Use measures how intuitive and user-friendly the platform is, and Timeliness refers to how often the content is updated to stay current with new exhibits and features. Satisfaction with System Speed reflects how quickly the digital system responds to user inputs, which can affect the overall experience, particularly for visitors with limited time or slower internet connections (Doll & Torkzadeh, 1988). Together, these dimensions provide a well-rounded framework to assess how digital museum platforms align with visitors' needs and expectations. Figure 2 displays the full visitor navigation journey map of CPDM, covering all platform functional modules and interactive service entries.

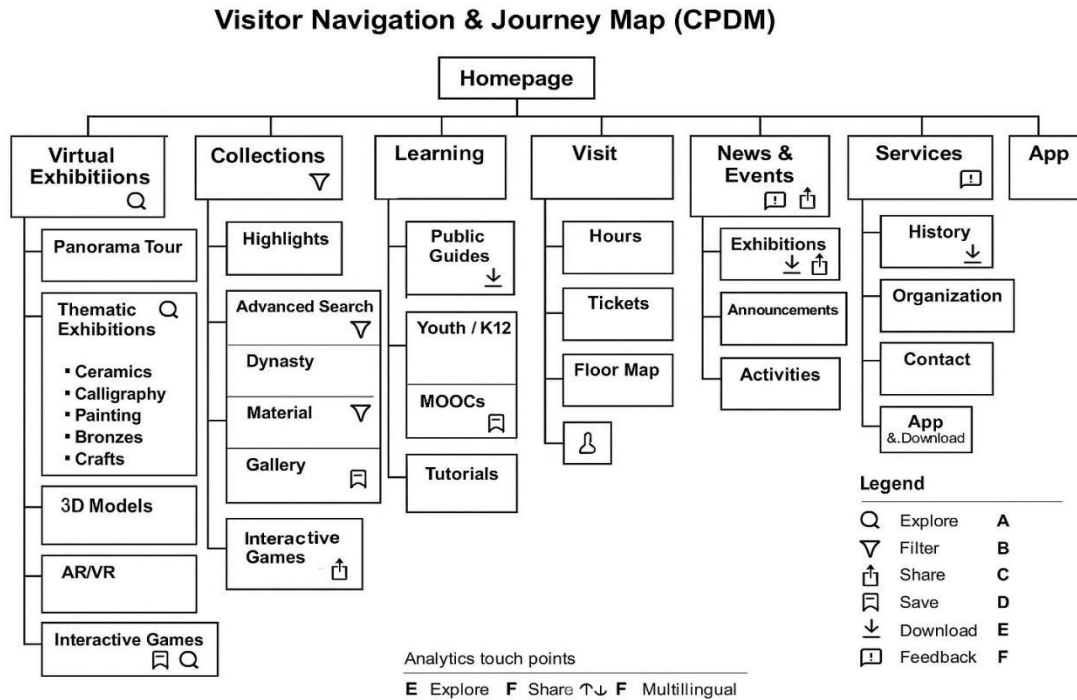


Fig 2. Visitor Navigation&Journey Map (CPDM) Source: Authors' own work

According to (Torkzadeh & Doll, 1999), the EUCS model has been successfully applied in diverse fields to measure user satisfaction, from online banking to e-commerce platforms. In the context of digital museums, applying the EUCS model allows researchers to explore how different aspects of a museum's digital platform contribute to visitor satisfaction. This model not only helps identify which factors are most influential but also offers insights into how demographic characteristics, such as age, technology proficiency, and geographic location, influence satisfaction levels with digital museum offerings. By employing the EUCS model, museum professionals can gather actionable data to improve their digital resources, enhance user engagement, and ensure that visitors' experiences align with their expectations (Wati Khotimah & Marlina, 2023). To clarify this study's research framework, *Figure 3* illustrates the conceptual model, showing how EUCS dimensions and demographic variables together influence Visitor Satisfaction.

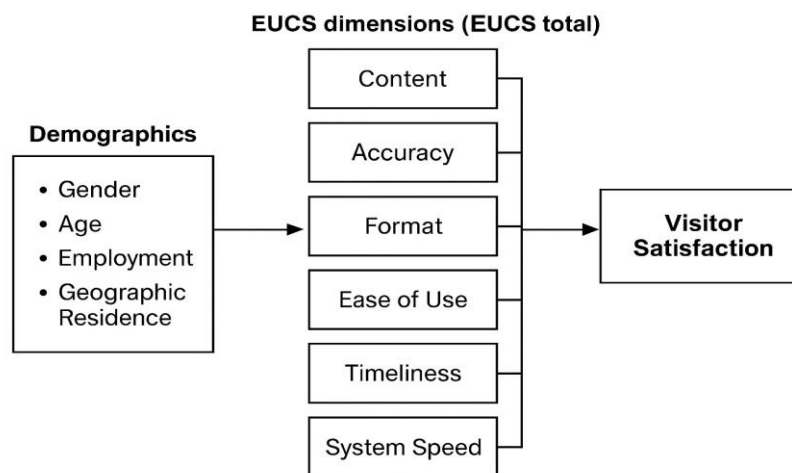


Figure 1 Conceptual model of visitor satisfaction

Fig.3. Conceptual framework integrating EUCS dimensions and demographic factors affecting Visitor Satisfaction.

Source: Authors' own work

3.1.2 Recent Empirical Studies on Digital Museum Visitors' Satisfaction

Recent empirical studies have provided valuable insights into the factors influencing visitor satisfaction with digital museum experiences (Elgammal et al., 2020), in their study involving 300 visitors to both digital and traditional museums, found that digital museum platforms generally result in higher visitor satisfaction due to their enhanced interactivity and flexibility. The study showed that digital platforms allowed for more engaging and personalized experiences, which positively impacted visitors' satisfaction and their likelihood to revisit. Similarly, (Masnadi et al., 2023) focused on 160 visitors to the Puppet Museum Jakarta, which collaborated with Google Arts & Culture to create a digital experience. Their findings revealed a positive correlation between the quality of digital content and visitor satisfaction, with system usability also significantly affecting the satisfaction levels of visitors. Additionally, (Vrije Universiteit Brussel & Dang, 2019) examined 557 users of the Palace Museum's website in China and found that system quality, perceived usability, and the museum's image positively impacted visitor satisfaction, with significant implications for continued engagement and revisit intentions.

In order to investigate the relationship between demographic variables and visitor satisfaction with digital museum platforms, (Kim, Hyung-Jun, 2015) conducted a study on 400 visitors to various digital museum exhibits, including both VR and non-VR experiences. The study found that younger visitors and those with higher levels of digital literacy reported significantly higher satisfaction levels (Jia et al., 2023). Further explored the role of social media in enhancing visitor satisfaction, surveying 602 visitors to the China Palace Museum and demonstrating that the perceived ease of use and usefulness of social media platforms contributed to higher satisfaction. Moreover (Rhee, 2013), conducted a usability study of mobile apps used by museum visitors, focusing on apps from the Guggenheim Bilbao and the American Museum of Natural History. Their results indicated that user-friendly app design significantly enhanced visitor satisfaction and intent to visit the museums physically. These studies emphasize the importance of adapting digital experiences to various demographic groups and enhancing platform usability to increase overall visitor satisfaction.

However, there is a notable research gap regarding the systematic exploration of how specific design elements and usability features influence digital museum visitor satisfaction. Most existing studies focus on general digital technology impacts on visitor experiences, but little research has systematically examined specific aspects such as content quality, system speed, and interface design across diverse demographic groups. This study adapted the satisfaction measurement scale into a 34-item instrument based on expert recommendations. The revised scale underwent rigorous validity and reliability testing. This enhanced tool provides a new perspective for evaluating visitor satisfaction with digital museums and offers practical implications for developers to optimize user experiences and better address audience needs.

4. Methodology

4.1 Research Design

This study employed a convergent mixed-methods design to obtain a comprehensive understanding of visitor satisfaction at the CPDM. In this design, we collected and analyzed quantitative survey data and qualitative feedback in parallel, and then merged the results for interpretation. The quantitative component measured visitor satisfaction across the EUCS dimensions and tested the hypotheses about demographic differences. The qualitative component gathered open-ended responses from visitors to provide deeper insights and context for the quantitative findings. Combining both approaches offers a more nuanced view of the visitor experience, as recommended by mixed-methods researchers (Creswell et al., 2018). This approach allowed us to corroborate and enrich the statistical results with personal narratives and explanations from participants.

4.2 Sampling Technique and Participants

This study targeted CPDM online users, employing convenience sampling to recruit participants through museum online channels, resulting in the collection of 400 questionnaires. The sample encompassed diverse demographics, including gender, age, occupation, and region, ensuring high sample diversity and enhancing the representativeness of the conclusions (Gu & Zhao, 2025). To minimize bias, the survey was conducted over a two-month period, with questionnaires distributed on both weekdays and weekends to avoid the influence of time or seasonal factors (Gu & Zhao, 2025). While convenience sampling may overrepresent active online users, this method is widely adopted in digital platform research due to its ease in obtaining large samples (Gu & Zhao, 2025; Jia et al., 2023). All participants voluntarily and anonymously participated in the survey and completed the questionnaire immediately after using the CPDM website or app to ensure the freshness of feedback; this real-time survey approach aligns with practices in other studies (Jia et al., 2023; Masnadi et al., 2023) and enables the capture of users' current genuine satisfaction levels.

4.3 Data Collection Instrument

The primary data collection instrument for this study was a structured questionnaire adapted from a validated measurement framework for evaluating information and knowledge management systems (Chin & Lee, n.d.). The items were carefully revised to reflect the operational environment and user context of the CPDM while preserving the theoretical constructs of visitor satisfaction. The final questionnaire consisted of 39 items, categorized into six dimensions of the End-User Computing Satisfaction (EUCS) model (Doll & Torkzadeh, 1988): (A) Content, (B) Accuracy, (C) Format, (D) Ease of Use, (E) Timeliness, and (F) System Speed. Each item was measured using a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"), providing a nuanced representation of visitors' perceptions and experiences. **The reliability of the scale was assessed using Cronbach's Alpha, which yielded a value of 0.892**, indicating acceptable to excellent internal consistency (Babin, Money, Samouel, & Hair, 2003). Furthermore, the Kaiser–Meyer–Olkin (KMO) measure was 0.89, and Bartlett's test of sphericity was significant ($\chi^2 = 2564.38$, $df = 741$, $p < 0.001$), confirming the adequacy of the sample and the suitability of the dataset for factor analysis. These findings substantiate the robustness and construct validity of the measurement instrument for assessing user satisfaction in the CPDM context.

To complement the quantitative findings, a qualitative component was incorporated into the study. This involved follow-up interviews with 30 visitors (selected from diverse demographic groups) who had previously engaged with the CPDM platform, either through its website or mobile application. The interviews, guided by open-ended questions, explored in-depth perceptions of system content, usability, and service quality. Detailed insights and coded thematic results are provided in Appendix Tables A6–A9, enabling data triangulation and enhancing the explanatory power of the statistical analyses.

4.4 Data Collection Procedure

Data collection occurred in two phases. The quantitative phase involved an online survey via Questionnaire Star (January 15–March 15, 2024), distributed through CPDM's social media, email newsletter, and pop-up invitations on its website and app, following multi-channel recruitment practices (Dillman et al., 2015). Invitations appeared immediately after platform use and at varied times to minimize recall bias (Shiffman et al., 2008). Of 427 responses, 400 valid cases remained after data screening. The qualitative phase (March 20–31, 2024) recruited 30 participants from consenting respondents, ensuring diversity in age, gender, employment status, and residence type. They completed four open-ended questions on definitions of satisfaction, notable experiences, demographic influences, and improvement suggestions. This approach supports data triangulation (Braun et al., 2021; Thomas et al., 2024). Ethical standards were observed, with informed consent, voluntary participation, withdrawal rights, and anonymized aggregate analysis.

4.5 Data Analysis

The quantitative data will be analyzed using descriptive statistics, such as mean scores and standard deviations, to summarize visitor satisfaction across the six dimensions of the EUCS model. Inferential statistics, including T-tests and ANOVA, will be used to explore potential differences in satisfaction across various demographic groups (e.g., age, gender, geographic location). The qualitative data from the open-ended questions will be analyzed using thematic analysis, which involves identifying common themes and patterns in the responses (Zhu et al., 2024). By integrating both quantitative and qualitative analyses, this study will provide a holistic view of visitor satisfaction, allowing for more nuanced insights into how specific factors, such as system usability and content quality, affect overall satisfaction (Singh et al., 2021).

5. Results

Table 1. presents the demographic profile of the 400 participants surveyed in the CPDM study. Among them, 217 were male (54.3%) and 183 were female (45.8%), reflecting a relatively balanced gender distribution. Participant ages ranged from under 13 to over 70 years old, with a majority (54.8%) between 20 and 49 years, suggesting a digitally engaged and tech-savvy user base. Geographically, respondents represented a wide distribution across Chinese provinces (e.g., Anhui, Guangdong, Sichuan), with participation ranging from 2 to 28 individuals per region.

5.1 RQ1: What is the level of visitor satisfaction with the CPDM's online resources?

Table.1. displays the overall mean scores for the six EUCS-based satisfaction dimensions (Content, Accuracy, Format, Ease of Use, Timeliness, and System Speed). Following the approach of Prabowo et al. (2024), we examined satisfaction across these dimensions. As shown in Table 2, participants reported the highest satisfaction with the timely availability of information (E31, M = 4.42) and the system's ability to meet their information needs (A9, M = 4.39). However, lower satisfaction was reported regarding the currency of the platform's content (E34, M = 3.66) and the timeliness of updates (E35, M = 3.62). These findings indicate that while users generally appreciated the platform's usability and information accuracy, concerns remain regarding the freshness and update speed of the content.

Table 1. Demographic information of the participants.

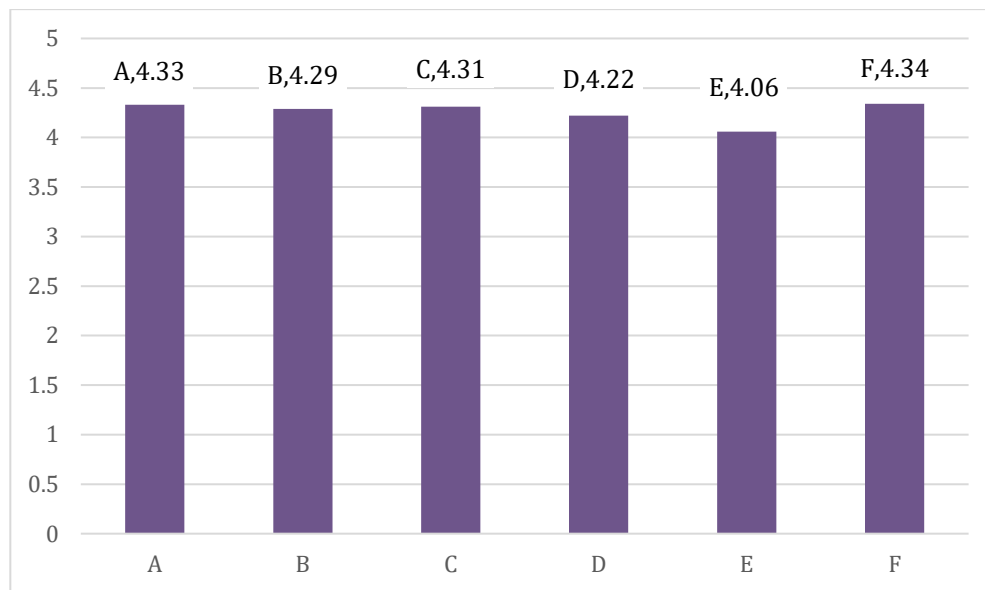
No.	Variables	Frequency	Percent	Cumulative Percent
1.	Gender			
	Male	217	54.3	54.3
	Female	183	45.8	100.0
2.	Age			
	Under 13	25	6.3	6.3
	13-19	50	12.5	18.8
	20-29	78	19.5	38.3
	30-39	79	19.8	58.0
	40-49	62	15.5	73.5
	50-59	51	12.8	86.3
	60-69	35	8.8	95.0
	70 and over	20	5.0	100.0
3.	Geographical (Province)			

	Anhui	18	4.5	4.5
	Fujian	9	2.25	6.75
	Gansu	20	5	11.75
	Guangdong	21	5.25	17
	Guangxi	15	3.75	20.75
	Guizhou	17	4.25	25
	Hainan	21	5.25	30.25
	Hebei	5	1.25	31.5
	Henan	28	7	38.5
	Heilongjiang	11	2.75	41.25
	Hubei	25	6.25	47.5
	Hunan	17	4.25	51.75
	Jilin	6	1.5	53.25
	Jiangsu	13	3.25	56.5
	Jiangxi	20	5	61.5
	Shanxi	6	1.5	63
	Sichuan	26	6.5	69.5
	Xizang	5	1.25	70.75
	Xinjiang	16	4	74.75
	Yunnan	19	4.75	79.5
	Zhejiang	15	3.75	83.25
	Chongqing	2	0.5	83.75
	Liaoning	9	2.25	86
	Inner Mongolia	16	4	90
	Ningxia	3	0.75	90.75
	Qinghai	8	2	92.75
	Shandong	15	3.75	96.5
	Shanxi	14	3.5	100
4.	Residence		20.5	
	Main urban area	82		20.5
	Urban - rural fringe area	88	22.0	42.5
	Town central area	74	18.5	61.0

	Town - township fringe area	62	15.5	76.5
	Township central area	72	18.0	94.5
	Village	22	5.5	100.0
5.	Employ			
	Student	28	7.0	7.0
	Employee	113	28.3	35.3
	Executive manager	43	10.8	46.0
	Civil servant	49	12.3	58.3
	Freelancer	37	9.3	67.5
	Pensioner	4	1.0	68.5
	Self-employed	43	10.8	79.3
	Unemployed	35	8.8	88.0
	Other, N/A	48	12.0	100.0

Note: N = 400.

Table 2 . Mean score for each aspects of visitor satisfaction



5.2 RQ2: Do demographic factors influence visitor satisfaction?

Table. 3 shows the results of the hypothesis testing for the five demographic factors considered. The analysis indicated that significant differences in visitor satisfaction were observed across different age groups (H-b), employment statuses (H-c), and residential locations (H-e). However, gender (H-a) and geographic location (province) (H-d) showed no significant impact on satisfaction scores. The detailed results for each hypothesis are presented in the following sub-sections.

Table 3. Summary of hypothesis testing results

No.	Research hypothesis		<i>P</i>	Result
H-a	The mean satisfaction scores between male and female visitors are not equal.	$t = -0.54$	0.59	NOT supported
H-b	A significant difference in the mean satisfaction scores exists among different age groups.	$F = 3.02$	0.004 *	Supported
H-c	A significant difference in the mean satisfaction scores exists across different employment statuses.	$F = 2.22$	0.025*	Supported
H-d	A significant difference in the mean satisfaction scores exists across different geographic locations.	$F = 1.047$	0.404	NOT supported
H-e	A significant difference in the mean satisfaction scores exists across different residential locations.	$F = 3.65$	0.003*	Supported

Note: * $p < 0.05$.

5.2.1. No significant influencing factors: gender (H-a) and geographical region (H-d)

Independent-samples *t* tests indicated no significant differences in satisfaction scores between male ($M = 4.07$ – 4.33 across dimensions) and female visitors ($M = 4.04$ – 4.44). Both groups expressed relatively higher satisfaction with the content and accuracy dimensions, while giving comparatively lower ratings on timeliness, with the difference between genders remaining non-significant ($t = -0.54$, $p = .59$). These results suggest that perceptions of content quality and accuracy were shared across genders, but timeliness was consistently rated as weaker, regardless of gender differences.

Similarly, a one-way ANOVA revealed no significant variation in satisfaction levels across different provinces, $F(n, \dots) = 1.05$, $p = .404$ (see Appendix Table A2). This finding indicates that geographical region did not substantially influence visitors' evaluations, and overall satisfaction remained relatively consistent across locations.

5.2.2. Testing H-b: A significant difference exists in the mean satisfaction scores among different age groups

Table A3 (in the Appendix) summarizes the ANOVA results examining visitor satisfaction across different age groups. The analysis indicated a significant difference among these groups ($F = 3.024$, $p = 0.004$). Therefore, hypothesis H-b was supported. Specifically, visitors aged 20–29 years ($M = 4.46$, $SD = 0.76$) and 30–39 years ($M = 4.36$, $SD = 0.78$) reported relatively higher satisfaction levels, whereas visitors aged 70 and over ($M = 3.88$, $SD = 0.63$) and those 60–69 years old ($M = 4.04$, $SD = 0.71$) reported lower satisfaction. This result suggests that age significantly influences visitor perceptions and experiences with the digital museum platform, highlighting the necessity of considering age-specific preferences when designing digital museum resources.

5.2.3. Testing H-c: A significant difference exists in the mean satisfaction scores across different employment statuses

Table A4 (in the Appendix) presents the ANOVA results for visitor satisfaction across various employment statuses. The findings indicated significant differences among employment groups ($F = 2.221$, $p = 0.025$). Hence, hypothesis H-c was supported. Specifically, pensioners (retirees) reported the lowest satisfaction scores ($M = 3.76$, $SD = 0.41$), whereas civil servants showed the highest satisfaction levels ($M = 4.64$, $SD = 0.77$). A post-hoc analysis using Hochberg's GT2 test could further clarify specific differences between these groups, which could in turn guide the tailoring of digital strategies for different occupational demographics.

5.2.4. Testing H-e: A significant difference exists in the mean satisfaction scores across different residential locations

Table A5 (in the Appendix) presents the ANOVA results comparing visitor satisfaction across six types of residential locations. The analysis revealed significant differences among these groups ($F = 3.65$, $p = 0.003$), so

hypothesis H-e was supported. Visitors from main urban areas reported the highest satisfaction ($M = 4.50$, $SD = 0.69$), while those from villages showed the lowest satisfaction levels ($M = 3.89$, $SD = 0.52$). Visitors from urban–rural fringe areas, towns, and township fringe areas reported intermediate satisfaction levels (M ranging from 4.24 to 4.28). These findings suggest that residential context plays a significant role in shaping digital museum experiences. Future digital design strategies should account for disparities in accessibility, digital literacy, and infrastructure between urban and rural users to ensure inclusive and equitable cultural engagement.

5.3 Qualitative Findings from Follow-up Survey

To complement the quantitative results, we analyzed open-ended responses from 30 visitors (see Appendix Tables A6–A9 for summarized qualitative data). The qualitative findings provide deeper insight into why certain patterns emerged and highlight aspects of the digital experience that matter most to users.

5.3.1 Visitors’ Understanding of Digital Museum Satisfaction

All visitors demonstrated a clear understanding of digital museum experiences, particularly in terms of system usability, content quality, and digital engagement. When asked to define their perception of “digital museum satisfaction,” many respondents emphasized intuitive operation, content richness, and emotional resonance with exhibits. This aligns with high quantitative scores in Dimensions A (Content) and B (Accuracy). Table A6 (in the Appendix) summarizes these understandings into three key aspects: “Satisfaction,” “Usability,” and “Emotional Experience.” For example, one visitor explained that satisfaction comes from “having rich content and [a site that] runs smoothly.” A few also highlighted emotional connection as part of satisfaction, noting that immersive features (e.g., interactive 3D artifact views or storytelling elements) made the experience more memorable and personally meaningful.

5.3.2 Positive Experiences and Engagement Strategies

Visitors’ experiences were examined by focusing on Dimension B (Accuracy), which received the highest satisfaction score ($M = 4.44$), and Dimension E (Timeliness), which received the lowest ($M = 3.62$) (see Table A6 in the Appendix). Visitors generally praised the platform’s accurate and well-structured content, describing it as consistent with physical exhibitions and supportive of repeated engagement. The establishment of trust was facilitated, and the significance of precise information was emphasised (as evidenced by the elevated Accuracy ratings in the survey). However, concerns were raised regarding outdated information and infrequent updates. Visitors suggested adding a “Latest Update” section and notification features to improve responsiveness.

5.3.3 Visitors’ perceptions of the demographic factors

Table A7 (in the Appendix) summarizes visitors’ perceptions of the impact of demographics on their satisfaction with the digital museum. Regarding gender, most participants ($N = 28$) believed that it had little effect on their experience. However, a small number of visitors ($N = 2$) argued that male visitors might have an easier time navigating the platform, given their greater familiarity with digital tools. Most participants, however, felt that other factors—such as digital literacy, previous museum experience, and access to technology—played a more significant role in shaping their experience.

In terms of age, more than half of the visitors ($N = 18$) stated that younger users (ages 18–40) were more likely to have higher satisfaction levels because they were more comfortable with digital platforms. Older participants ($N = 12$) reported some difficulties with system navigation and interaction, which they attributed to lower digital literacy. This observation aligns with the quantitative results, which showed lower satisfaction among older age groups.

As for employment status, those working in technology and media-related fields ($N = 15$) expressed the highest levels of satisfaction, citing their familiarity with digital systems and platforms. Retirees ($N = 5$), on the other hand, reported lower satisfaction due to difficulties navigating the platform and less frequent use of digital tools. This also mirrored the quantitative findings, where significant differences in satisfaction were observed between professional groups.

Regarding residential location, most participants (N = 26) acknowledged that urban visitors had better access to high-speed internet and modern devices, leading to a significantly smoother experience. These findings were consistent with the quantitative analysis, which showed that urban visitors reported higher satisfaction than rural visitors.

5.3.4. Visitors' perspectives on support and improvements enhancing satisfaction with CPDM

In follow-up discussions, participants were asked to suggest improvements and additional support for the digital museum. Among the 30 respondents, most emphasized the importance of maintaining an intuitive, user-friendly interface. They praised the platform's easy navigation, noting that it was "very simple to use" and made it effortless to find desired content (Visitor A7). Interactive features were likewise highlighted as crucial for engagement; participants enjoyed virtual tours and live exhibits that made them feel "like I was visiting in person" and significantly enhanced their engagement (Visitor B3). While the platform's content richness was widely appreciated, several participants expressed a desire for more frequent content updates and better tailored offerings. One interviewee envisioned that "it would be perfect if the exhibition was updated in real time and relevant exhibits were recommended based on interest" (Visitor C6), underscoring the value of timely, personalized content to sustain long-term interest.

Beyond design and content improvements, social interaction emerged as another key support factor. Some participants noted that discussing the exhibits with friends deepened their understanding of the content and boosted their confidence in using the platform (Visitor D2). Access to technology was also identified as a major influence on satisfaction. Urban users acknowledged that high-speed internet and modern devices made the digital experience smoother. As one interviewee from an urban area observed, "Urban areas have better internet conditions and modern equipment, which makes the experience very smooth" (Visitor E8). In contrast, rural users faced challenges with slow connectivity. To assist those with limited internet access, several interviewees suggested providing offline resources such as downloadable content or printable guides. As one rural participant explained, "when the internet is slow, having downloadable resources or printable guides would help us understand the content better" (Visitor F1). Table A9 in the Appendix provides an overview of these suggestions, revealing that participants primarily called for an intuitive and interactive user experience, improved technology access, and more up-to-date, personalized content.

6. Discussion

This study set out to evaluate visitor satisfaction with a national-level digital museum platform in China, using the EUCS model and examining demographic influences. The mixed-methods approach provides a holistic view of how visitors perceive the CPDM's online offerings. In this section, we interpret the findings in light of prior research and discuss implications for digital museum management and future research.

6.1. Visitor satisfaction with the digital museum

Results from this study revealed that visitors generally expressed high satisfaction with the digital museum, with most dimension scores exceeding 4 out of 5. These findings are consistent with Zollo et al. (2021), who found that reliability, usability, and aesthetic appeal are critical to sustaining positive visitor experiences in digital museums. In the current study, the highest-rated dimension was content accuracy (B3; ranked 1st out of 6), followed closely by system usability (C5; ranked 2nd out of 6). This indicates that the provision of reliable information and an easy-to-navigate interface are central to enhancing visitor engagement and trust.

Conversely, the lowest-rated dimension was content timeliness (E2; ranked 6th out of 6), suggesting that the perceived lack of frequent updates and fresh materials may weaken long-term engagement. Similar results were reported by Zhang et al. (2025), who observed that insufficient content updates reduced revisit intentions in their study of World Heritage Sites' digital platforms. Interestingly, interactive features (D4) scored relatively high in this study (ranked 3rd), in contrast to Zhang et al. (2025), where interactivity ranked among the lowest dimensions. This difference suggests that the current platform's interactive design may already be better aligned with visitor expectations, though the timeliness of content remains a critical area for improvement.

6.2 Demographic Differences in Visitor Satisfaction

Previous research has suggested that gender may influence users' perceptions and engagement with digital cultural heritage platforms (Navarrete & Villaespesa, 2020). However, the findings of this study did not reveal any significant differences in visitor satisfaction between male and female participants. This observation is in line with Hargittai and Shafer (2006), who found that gender disparities in digital skills and evaluations tend to diminish when access and experience are similar. In the qualitative responses, visitors frequently emphasised that factors such as prior exposure to digital tools and the quality of the platform interface played a more critical role in shaping their satisfaction than gender itself.

In contrast, age emerged as a factor with a notable influence on satisfaction levels. Younger visitors, particularly those in their twenties and thirties, generally expressed higher satisfaction, often citing ease of navigation and engaging interactive features. Older visitors, especially those over sixty, tended to report lower satisfaction, pointing to challenges with navigation complexity and the timeliness of content updates. These findings align with prior studies highlighting that older adults may face greater difficulties when interacting with complex digital interfaces, often due to differences in cognitive processing and familiarity with technology (Czaja et al., 2006; Pew Research Center, 2024). While such patterns indicate the importance of age-sensitive design strategies, they also suggest opportunities to improve inclusivity without compromising the experience for younger audiences.

Occupational background, however, introduced clearer contrasts. Respondents employed in education, research, or cultural industries tended to rate the system more positively, often emphasizing the platform's usefulness for professional or academic purposes. By contrast, retirees or individuals in non-specialist occupations expressed relatively lower satisfaction, frequently mentioning that some functions appeared overly complex or less relevant to their needs. Previous work has noted similar patterns, where professional familiarity with cultural resources enhances the perceived value of digital museums (Liew, 2014; Styliani et al., 2009).

Residential location also shaped perceptions in significant ways. Urban respondents consistently reported higher satisfaction compared to rural participants, who frequently raised concerns about slower loading times and limited internet stability. One rural participant mentioned difficulties accessing multimedia elements due to bandwidth constraints, underscoring the persistence of the digital divide in cultural participation (Norris, 2001; Reynolds, 2021). These observations suggest that infrastructural factors continue to play a decisive role in shaping digital heritage experiences.

Taken together, these findings suggest that demographic variables such as age, employment status, and residence significantly influence satisfaction, while gender exerts little effect. The results reinforce prior scholarship on digital heritage engagement, highlighting how both socio-technical familiarity and infrastructural context mediate users' evaluations of cultural platforms (Parry, 2013; Sandvik, 2011).

6.3. Implications for enhancing visitor satisfaction in digital museums

Quantitative results revealed notable variations in satisfaction across demographic groups, particularly by age and employment status, with older visitors and employed participants reporting significantly higher satisfaction levels. These findings suggest that life experience, professional background, and established cultural interests may enhance engagement with digital museum content. In contrast, no significant differences were found by gender or residence, indicating that accessibility and appeal are relatively consistent across these groups.

Qualitative feedback further illuminated strategies to improve satisfaction. Visitors emphasized the importance of timely content updates, enhanced interactive features, and user-friendly navigation. Several participants highlighted that outdated exhibits or slow updates reduced their motivation to revisit, a concern echoed in prior research showing that timeliness strongly influences user engagement (Navarrete & Villaespesa, 2020). Others valued immersive tools such as virtual tours and 3D object interactions, consistent with findings by Economou and Meintani (2011), who reported that interactive digital environments foster deeper cultural connection and learning.

To enhance satisfaction, targeted approaches are recommended. First, museums should prioritize content freshness, ensuring regular updates that reflect current exhibitions and cultural events. Second, integrating immersive technologies (e.g., VR, AR) can appeal to younger and tech-savvy audiences, while maintaining clear navigation supports inclusivity for older users (Chung et al., 2023). As illustrated in Figure 4, interactive digital displays in the Palace Museum showcase how VR- and AR-based exhibits can provide engaging and immersive cultural experiences, thereby fostering deeper visitor involvement. Third, creating opportunities for social interaction, such as peer discussions or collaborative online activities, may strengthen visitor engagement, in line with the social constructivist view of museum learning (Hooper-Greenhill, 2007).

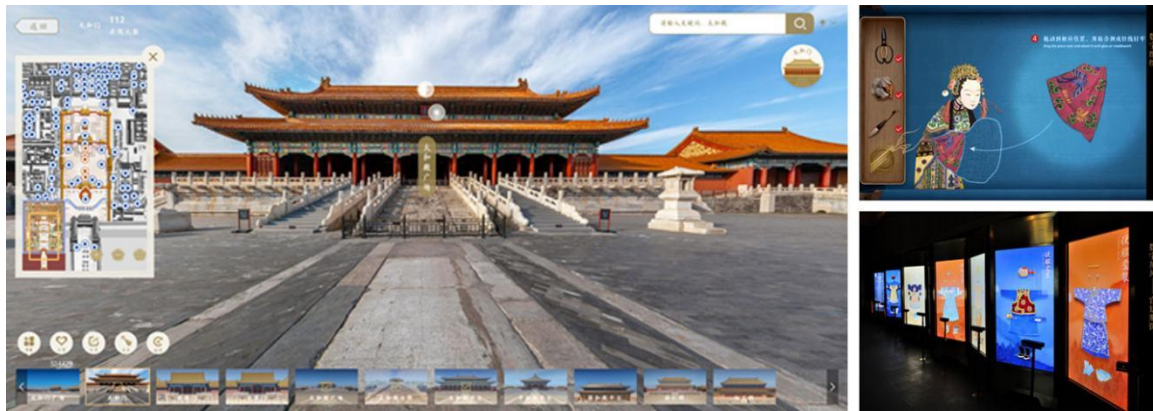


Fig 4 .Immersive digital exhibition interface in the Digital Palace Museum. Reproduced from the CPDM (2025)

Finally, the results suggest that satisfaction is not only a function of content quality but also of the visitor's perceived agency in exploring and interpreting cultural heritage. Encouraging personalization, adaptive recommendations, and participatory features could foster sustained engagement. Furthermore, the Format dimension, which layout of information, emerged as an important but sometimes under-recognized factor in digital museum satisfaction. Interview data revealed that younger visitors often appreciated the multimedia integration and interactive visualization, while older participants emphasized clarity of text and readability of exhibition labels. Although the quantitative results did not show large demographic differences in Format satisfaction, these qualitative insights suggest that well-designed visual presentation remains essential in shaping the visitor experience at CPDM.

6.4 Limitations and recommendations for future research

Despite its contributions to understanding visitor satisfaction with digital museums, this study has several limitations. Similar to Navarrete and Villaespesa's (2020) research on digital heritage consumption, it relied primarily on self-reported survey data, which may be influenced by social desirability bias and fail to fully reflect actual user experiences; future research could integrate behavioral analytics (e.g., clickstream data, time-on-page) or experimental tasks for more objective evidence. In addition, the study focused on a single national-level digital museum platform, which, while enabling in-depth analysis, limits the generalizability of findings to other cultural contexts and technological infrastructures; comparative studies across multiple platforms in different cultural and geographical settings, as suggested by Chung et al. (2023), would provide richer insights. Moreover, only a subset of demographic factors (gender, age, residence, and occupation) was examined, leaving out potentially influential variables such as digital literacy (Zhang et al., 2025), platform usage frequency, and prior museum-visiting experience; future research should include a broader range of demographic and experiential factors to better capture the complex drivers of satisfaction. Finally, as a cross-sectional study, the findings offer only a snapshot of visitor perceptions at one point in time; longitudinal research could track changes in satisfaction over time, particularly as digital museum platforms evolve to incorporate AI-driven personalization and immersive VR experiences.

7. Conclusion

This study examined visitor satisfaction with a national-level digital museum platform in China, focusing on six dimensions derived from the EUCS model: Content, Accuracy, Format, Ease of Use, Timeliness, System Speed. The results revealed an overall high level of satisfaction, with most scores exceeding 4 out of 5. Content accuracy and system usability emerged as the highest-ranked dimensions, while content timeliness scored the lowest. Significant differences were observed across age groups, with older visitors reporting higher satisfaction levels in both quantitative and qualitative findings. In contrast, no significant differences were found between genders, aligning with prior research suggesting that technology accessibility and digital literacy may be more influential than gender alone.

The qualitative analysis further highlighted several factors shaping visitor satisfaction, including the quality and relevance of digital content, the availability of interactive features, and the alignment of platform functions with cultural and educational expectations. Visitors also identified challenges such as delayed updates, inconsistent multimedia quality, and limited personalization features, which may hinder engagement. To address these challenges, platform developers and museum professionals should prioritize timely content updates, integrate user-centered design, expand interactive functions, and enhance personalized services.

Moreover, future research should extend the scope beyond a single platform to include comparative studies across different types of museums, technological infrastructures, and cultural contexts. Expanding the demographic scope to include variables such as digital literacy, visit frequency, and prior museum experience would deepen the understanding of satisfaction drivers. By combining quantitative assessments with behavioral analytics and longitudinal tracking, researchers can capture more dynamic patterns of visitor engagement. Ultimately, improving satisfaction with digital museums requires a multi-faceted strategy that balances technological innovation, cultural authenticity, and user experience design, ensuring that these platforms serve as accessible, engaging, and culturally enriching resources in the digital era.

Appendix

Table A2. Results of t-test on visitor satisfaction between male and female.

Dimension	Male <i>M</i> (<i>SD</i>)	Female <i>M</i> (<i>SD</i>)	<i>t</i>	<i>p</i>
(A) Content	4.31 (1.27)	4.35 (1.31)	-0.25	0.80
(B) Accuracy	4.33 (1.28)	4.25 (1.29)	0.60	0.55
(C) Format	4.19 (1.33)	4.44 (1.27)	-1.89	0.61
(D) Ease of Use	4.26 (1.31)	4.19 (1.28)	0.54	0.59
(E) Timeliness	4.07 (0.54)	4.04 (0.59)	0.40	0.69
(F) System Speed	4.25 (1.34)	4.44 (1.30)	-1.49	0.14
Overall	4.24 (0.75)	4.28 (0.75)	-0.54	0.59

Note. $N_{\text{Male}} = 217$; $N_{\text{Female}} = 183$.

Table A3. Results of ANOVA on visitor satisfaction among age groups.

Age	<i>N</i>	<i>M</i>	<i>SD</i>	Error	<i>F</i>	<i>p</i>
≤13 years old	25	4.02	0.52	0.10	3.024	0.004*
13-19 years old	50	4.29	0.69	0.10		
20-29 years old	78	4.46	0.76	0.09		
30-39 years old	79	4.36	0.78	0.09		
40-49 years old	62	4.14	0.77	0.10		
50-59 years old	51	4.34	0.78	0.11		
60-69 years old	35	4.04	0.71	0.12		
≥70 years old	20	3.88	0.63	0.14		

Note: $N = 400$; * $p < 0.05$

Table A4. Results of ANOVA on visitor satisfaction among employment statuses.

Employment	<i>N</i>	<i>M</i>	<i>SD</i>	Error	<i>F</i>	Post-hoc [#]
Student	28	4.14	0.62	0.12	2.221	0.025*
Employee	113	4.22	0.75	0.07		
Executive manager	43	4.13	0.76	0.12		
Civil servant	49	4.64	0.77	0.11		
Freelancer	37	4.26	0.81	0.13		
Pensioner	4	3.76	0.41	0.20		
Self-employed	43	4.18	0.67	0.10		
Unemployed	35	4.23	0.73	0.12		
Other, N/A	48	4.29	0.77	0.11		

Note: *p < 0.05; #Post-hoc with Hochberg's GT2 test

Table A5. Results of ANOVA on visitor satisfaction among residential locations.

Resident	<i>N</i>	<i>M</i>	<i>SD</i>	Error	<i>F</i>	Post-hoc [#]
Main urban area	82	4.50	0.69	0.08	3.65	0.003*
Urban - rural fringe area	88	4.28	0.85	0.09		
Town central area	74	4.26	0.74	0.09		
Town - township fringe area	62	4.24	0.65	0.08		
Township central area	72	4.10	0.76	0.09		
Village	22	3.89	0.52	0.11		

Note: *p < 0.05; #Post-hoc with Hochberg's GT2 test

Table A6. Interview summary of participants' understanding of digital museum satisfaction

Aspect	Participants' understanding	Count	Representative quotes
Satisfaction	Positive feelings about digital experience and content diversity	30	'I feel satisfied when the digital museum offers rich content and runs smoothly.' (Visitor A1)
Usability	Ease of navigation, clear interface design	30	'It was easy to find what I was looking for, even for someone not tech-savvy like me.' (Visitor C2)
Emotional Experience	Personal connection to cultural content through immersive features	30	'Seeing ancient artifacts up close with animations made me feel emotionally connected.' (Visitor B4)

Table A7. Visitors' responses on satisfaction dimensions (B and E)

Dimension	Responses	Count	Representative quotes
B	Positive perception of consistent, clear, and authoritative information; trusted digital experience.	30	'The exhibit descriptions are very tightly worded and feel consistent with the information provided in the physical exhibit.' (Visitor A3)
E	Concerns about slow updates; suggestions for real-time notifications and content refresh.	18	'It would be nice to add a 'Recent Updates' section or alert me when new content goes live.' (Visitor D7)

Table A8. Visitors' perceptions of the impact of demographics on digital museum satisfaction

Aspect	Related to Satisfaction	Count	Representative quotes
Gender	No	28	"Gender doesn't affect my experience of using the

			service, it's mainly technical literacy and access that are the key factors." (Visitor A6)
	Yes	2	"Male users may have an easier time adapting to these platforms due to their familiarity with technology." (Visitor B3)
Age	Yes	18	"Younger people are better at using these digital platforms and are naturally more satisfied." (Visitor C1)
	No	12	"I don't think age is a deciding factor, just using it more will improve digital literacy." (Guest D2)
Employment	Yes	15	"I had a much better experience working in a technology related job and the system was much easier to get used to." (Visitor E4)
	No	5	"Having retired and using the platform infrequently, it feels a little difficult to operate." (Visitor F1)
Residential	Yes	26	"City dwellers have better devices and faster internet, which makes the digital museum experience smoother." (Visitor G6)
	No	4	"The internet in rural areas is a little poorer and affects my experience of using the digital museum." (Visitor H2)

Table A9. Visitors' perspectives on support and resources enhancing digital satisfaction

Source of Support	Visitors' Understanding	Count	Representative quotes
User-Friendly Design	A majority emphasized the platform's intuitive layout and ease of navigation.	3	'The platform's interface is designed to be very simple to use and it's a great experience to find the content I want quickly.' (Visitor A7)
Interactive Features	Visitors highlighted the importance of interactive features like virtual tours and live exhibits.	2	'The virtual tour made me feel like I was visiting in person, was interactive and enhanced my engagement. ' (Visitor B3)
Timely Updates	Several participants suggested that more real-time content updates could enhance the experience.	1	'It would be perfect if the exhibition was updated in real time and relevant exhibits were recommended based on interest. ' (Visitor C6)
Peer Discussions	Some participants found discussions with peers to be useful in understanding and enjoying exhibits.	1	'Discussing the exhibits with my friends gave me a deeper understanding of the content and increased my confidence in using the platform. ' (Visitor D2)
Access to Technology	Urban visitors emphasized the role of high-speed internet and modern devices in improving their satisfaction.	2	'Urban areas have better internet conditions and modern equipment which makes the experience very smooth. ' (Visitor E8)
Offline Resources	Rural visitors suggested offering downloadable content or printable guides due to connectivity issues.	1	'When the internet is slow, having downloadable resources or printable guides would help us understand the content better. ' (Guest F1)

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