

Audience Stratification and Digital Innovation: Exploring Public Educational Practices in a Regional Museum

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HOW TO CITE:

Yi Qiong Juan, Wan Jamarul
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(2026). Audience Stratification and
Digital Innovation: Exploring Public
Educational Practices in a
Regional Museum.
International Journal of Special
Education, 41(21s), 1674-1686

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ABSTRACT:

Driven by global digital cultural transformation, museums are transforming from collection-oriented repositories into inclusive educational venues. Current research on differentiated museum education mainly focuses on Western or national flagship museums, lacking systematic analysis of audience stratification and low-cost digital practices in Chinese provincial regional museums. This paper constructs a dual analytical framework of audience stratification and lightweight digital museum education. Using multiple qualitative approaches including case study, documentary review and cross-regional comparison, it investigates public education practices at Hunan Museum, a representative regional museum in central China. Results identify a three-tiered education system for child-family, teacher-student and adult visitors, supported by offline outreach activities and systematic low-cost online digital resources. Despite museum administrators' forward-looking digital vision, structural problems remain: resource bias toward juvenile audiences, insufficient in-depth content for adults, limited museum-school partnerships, and absence of quantitative evaluation for long-term educational effects. This study supplements Western audience-stratification theories with China-specific museum-school collaborative experience and offers practical optimisation strategies for global regional museums to realise equitable differentiated low-cost digital education service.

Keywords: museum education; audience stratification; lightweight digital innovation; museum-school collaboration; regional cultural heritage

Introduction

Education is recognised by the International Council of Museums (ICOM) as the core social mission of museums, driving a global shift toward visitor-centred educational practice, a paradigm well-established in Western museum education research (Nichols, 2023). North

American and European regional museums have mature systems of audience stratification and low-barrier digital educational tools, forming inclusive and equitable museum learning models suitable for diverse community groups (Evans, 2022; Carter, 2024). In Western scholarship, audience stratification and lightweight digital innovation are regarded as two core, mutually

supportive pillars of modern museum public education. In contrast, Chinese provincial regional museums face prominent structural constraints in balanced visitor-centred education, including uneven staffing and funding allocation, homogenised educational programming, and underdeveloped differentiated digital resources. While national flagship museums have achieved remarkable digital transformation, existing domestic and international research exhibits two critical gaps. First, cross-cultural studies on museum audience stratification largely overlook Chinese regional museums, which feature unique state-supported museum-school collaborative mechanisms absent from Western community-led models. Second, current Chinese museum digitalisation research separates audience stratification and digital resource development, lacking integrated analysis of how differentiated visitor services interact with lightweight digital innovation at the regional museum level.

- Against this backdrop, Hunan Museum—a representative provincial comprehensive museum in central China renowned for Mawangdui Han cultural heritage—serves as an ideal case to fill the above research gaps. It has systematically constructed tiered audience-oriented education systems and replicable low-cost digital educational resources, providing typical empirical samples for studying regional museum inclusive education. Adopting multiple qualitative methods including case study, documentary analysis, visual analysis and cross-regional comparison, this paper addresses two core research questions: how do Chinese regional museums localise Western audience stratification frameworks through museum-school collaborative mechanisms; and what structural contradictions emerge in the integration of lightweight digital resources and stratified educational services, and how does institutional digital cognition mediate such challenges. This study delivers dual academic contributions. Theoretically, it revises and supplements Western audience stratification theory by incorporating China's museum-school cooperation mechanism, enriching cross-cultural museum education research. Practically, it proposes

targeted optimisation strategies for resource-limited regional museums worldwide to develop equitable, differentiated and low-cost digital educational services.

- Western museum-education research establishes visitor-centred inclusive frameworks, stressing multi-generational, community-oriented services and context-tailored educational design (Simon, 2021; Harris, 2025). Related audience-stratification studies suggest segmentation should integrate age, motivation and educational background instead of mere demographic labels; mobile outreach can mitigate cultural access inequality (Brown & Taylor, 2022; Evans, 2022; Nguyen & Jones, 2024). For resource-constrained regional museums, lightweight, low-cost digital tools deliver more sustainable daily educational value than costly temporary immersive installations (Carter, 2024; Ortega et al., 2025). However, Western literature focuses largely on individual and family visitors, with limited discussion of institutional museum-school collaboration. Chinese domestic research remains fragmented. Provincial-museum studies tend to emphasise macro-level policy and exhibition planning rather than micro-level stratified educational operation. Local audience-stratification analysis mostly stays at simple age categorisation, lacking holistic links between visitor grouping, spatial arrangement, activity design and digital allocation. Moreover, existing Chinese digital-museum research seldom investigates the mismatch between digital-resource supply and stratified visitor demands, and the common youth-oriented bias in regional-museum digital content has not received adequate critical attention (Wang et al., 2022). Few empirical works systematically unpack Hunan Museum's complete stratified-digital education ecosystem. Against this literature background, this study adopts multiple qualitative approaches including case study, documentary analysis, visual analysis and cross-regional comparison. Theoretically, it expands Western audience-stratification theory by embedding

China's museum-school collaborative context. Practically, it offers actionable suggestions for resource-constrained regional museums globally to deliver fair, differentiated and low-cost digital educational services.

2. Methodology

- **Design:** This study adopts a **qualitative multi-method instrumental case-study design** to explore stratified public education and lightweight-digital innovation within Hunan Museum. Multiple complementary qualitative techniques are integrated for data triangulation, which enhances overall data trustworthiness, analytical depth, and internal validity for this cross-cultural museum-education investigation. The whole empirical work is guided consistently by a pre-established dual deductive theoretical framework: audience stratification theory and lightweight-digital museum-education theory. This dual framework runs through every phase including data collection, open coding, thematic categorisation, empirical interpretation, and cross-national comparative discussion. Rather than offering merely descriptive institutional reporting, the design enables balanced critical evaluation of both institutional strengths and embedded structural contradictions inside the museum's public-education ecosystem.

- **Participants/Sample:** No human research participants, interviewees or questionnaire respondents are recruited for this research. The unit of analysis is the complete public-education system of Hunan Museum, a representative provincial-level regional museum in central China famous for Mawangdui Han-dynasty heritage. The sampled corpus consists of publicly accessible institutional materials: archived educational activity records, museum-school cooperation memoranda, digital resource briefings, public-service bulletins, onsite spatial photographs, and lightweight-digital media outputs released on the official website. Selection criteria for materials: open, official, publicly-released documents and visual resources that directly record tiered audience-oriented educational practices and digital-education

construction; non-official media commentaries and second-hand subjective reviews are excluded from the analysis dataset.

- **Instruments:** Three major sets of research instruments are deployed. First, official open-access documentary archives from Hunan Museum, which provide primary textual evidence for activity arrangements, cooperative mechanisms and institutional management logics. Second, visual-recording materials including screenshots of relic-themed animations, educational mini-game interfaces, online handicraft workshop templates, and photographs of on-site educational spaces and outreach events. Third, a deductive codebook with six predefined analytical themes derived from the dual theoretical framework: differentiated design for segmented visitor cohorts; museum-school collaborative outreach mechanisms; development and deployment of lightweight-digital educational assets; spatial configuration of on-site educational facilities; institutional managers' digital cognition and operational strategies; cross-regional comparative evaluation of stratified-digital education models. This codebook is used to conduct unified coding for all textual and visual source materials.

- **Procedure:** First, Hunan Museum is selected as the instrumental case on account of its typical characteristics: complete three-tier audience-stratification practice and mature low-cost lightweight-digital education construction. Second, primary textual documents are collected and screened according to inclusion criteria, covering educational archives, cooperation agreements and digital-construction briefing papers. Third, visual materials of digital products and onsite educational scenarios are gathered from official open-access channels. Fourth, all collected textual and visual raw materials are coded item-by-item by applying the six-theme deductive codebook under the guidance of audience-stratification and lightweight-digital-education theories. Fifth, coded data are synthesised to sort out practical advantages and structural tensions of the

museum's stratified educational services. Sixth, cross-national comparative analysis is implemented by comparing Hunan Museum's practical model with educational cases from Western and Southeast-Asian regional museums, distinguishing context-specific local features and internationally transferable experience.

- **Data Analysis:** Documentary analysis systematically codes institutional archival texts to interpret formal operational rules, resource-allocation logics and hierarchical service arrangements for child-family, teacher-student and adult visitor cohorts, avoiding over-reliance on superficial onsite impressions. Visual analysis assesses the design logic and actual educational effects of various lightweight-digital media, identifying age-oriented design bias embedded in digital resource outputs. Structured qualitative content analysis categorises all offline and online educational initiatives by visitor group, activity form and embedded digital components, sorting out imbalances of human and financial resource distribution across different audience segments. Reflexive thematic analysis serves as the core integrating procedure, merging documentary and visual evidence into six predefined themes to guarantee theoretical consistency across the whole empirical chapter. Finally, cross-national comparative analysis contrasts local Chinese practice with overseas museum models,

highlighting institutional differences between community-driven Western museums and China's administratively-supported museum-school collaboration system, so as to draw cross-cultural implications for inclusive regional-museum education.

3. Results

- This chapter presents the empirical findings derived from documentary archives, visual digital media and institutional operational records of Hunan Museum. All observations are organised under the dual analytical framework of audience stratification and lightweight digital education. Findings are reported descriptively without interpretive discussion; theoretical interpretation and cross-cultural dialogue are reserved for Chapter 4 (Discussion).

3.1 Three-Tiered Stratified Public Educational System

- Hunan Museum operates a three-layered audience service system classified by visitor age, cognitive capacity and learning demand. The three tiers are: (1) child-family audiences, (2) teacher-student groups, and (3) independent adult visitors. Differentiated offline activities and lightweight digital resources are matched to each tier. Table 1 summarises the structural composition of each tier.

• **Table 1. Three-tiered audience stratification system at Hunan Museum**

Audience tier	Core service forms	Offline components	Digital components	Institutional priority
Child-family	Parent-child workshops, mobile outreach, seasonal folk events	Mobile Museum Exploration Vehicles; My Holiday at the Museum; Yearly Diary folk IP	Relic animation series; online handcraft workshops; educational mini-games; themed online columns	Highest
Teacher-student	Museum-school partnership, campus outreach, teacher training	In-house Education Center; mobile museum campus tours; Teacher Salon	Online expert lectures; relic appreciation tutorials; artistic creation guides; downloadable teaching materials	Medium-high

Adult	Public lectures, special exhibition interpretation, scattered online courses	Irregular public lectures; special exhibition guided tours	Scattered high-level online courses; no systematic progressive modules	Lowest (complementary)
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• 3.1.1 Child–Family Educational Activities

- Child–family audiences constitute the museum's highest-priority service group. All activities are designed around low cognitive thresholds and participatory entertainment.
- Offline parent-child programmes. Three flagship offline family programmes are identified: (a) *Mobile Museum Exploration Vehicles*, which transport mini-relic displays and interactive teaching aids to suburban communities; (b) *My Holiday at the Museum*, a vacation series integrating play and historical learning; and (c) *Yearly Diary*, a long-term folk IP

combining handicraft creation and folk-custom interpretation across seasonal festivals.

- Lightweight digital learning resources. A full digital matrix for juvenile and family users is hosted on the museum's official website, comprising relic animation series, online handicraft workshops, educational mini-games and themed online columns. Figure 1 and Figure 2 illustrate representative samples of these digital resources. All digital lightweight products are designed for minors; no parallel progressive digital courses targeting adult aesthetic research are identified.



Figure 1.Collection of Lightweight Digital Resources: Animations (Image: Hunan Museum official website)



Figure 2. Collection of lightweight digital educational resources: mini-games and cartoon pages of cultural relics (Image: Hunan Museum official website)

• 3.1.2 Museum–School Collaborative Education for Teachers and Students

Formal school groups are integrated as a standalone tier in the audience stratification system. The museum–school cooperation framework comprises campus outreach, in-house teaching venues, teacher training mechanisms and shared online teaching resources.

Diversified teaching activities and spatial support. The Education Center is equipped with multi-functional museum classrooms, art corridors and creative workshops.

Three independent classrooms contain multimedia recording equipment supporting both offline teaching and remote online courses. Flexible partition designs accommodate students of different ages. The art corridor displays micro-exhibition works; the creative workshop provides venues for pottery, painting and calligraphy creation. Figure 3 shows onsite scenes of museum cart displays and traditional festival-themed educational activities. Resource input is concentrated on urban primary and secondary schools; rural campus outreach coverage is limited.



• **Figure 3.** On-site scenes of museum cart displays and traditional festival-themed educational activities (Image: Hunan Museum official website)

• **Mobile museum and teacher development mechanism.** Mobile Museum teams transport exhibition boards, multimedia materials and professional interpreters to off-campus sites, delivering customised interactive courses (Figure 4). The Teacher Salon

institutionalises long-term cooperation with local educators, offering priority resource access, exclusive seminars and joint curriculum development opportunities (Figure 5). The salon partners with urban core schools; rural educators and students are not covered.



Figure 4. On-site photograph of Mobile Museum outreach exhibition (Image: Hunan Museum official website)



Figure 5. Scene photograph of on-site Teacher Salon activities (Image: Hunan Museum official website)

- **Systematic online teaching courses.**

A library of online expert lectures, relic appreciation tutorials and artistic creation guides is open to teachers and adolescent students. Authorised professional instructors deliver asynchronous courses with downloadable teaching materials. Advanced modules for adult independent learners are absent.

- **3.1.3 Educational Services for Adult Audiences**

- Adult visitor programming is positioned as a complementary tier. It centres on offline public lectures, special exhibition interpretive

activities and scattered high-level online courses. Adult education consists of irregular, fragmented academic activities without progressive learning frameworks. No systematic tiered service standards for adult visitors are identified.

- **3.2 Digital Innovation Practice**

- The museum's digital education system follows a dual development logic: low-cost lightweight digital assets as the dominant component, supplemented by small-scale high-tech immersive exhibitions. Table 2 categorises the digital resource portfolio.

Table 2. Digital educational resource portfolio at Hunan Museum

Resource category	Cost level	Sustainability	Primary audience	Representative forms
Lightweight digital products	Low	High (daily operation)	Juvenile / family	Relic animations; mini-games; online handicraft tutorials; graphic interpretive materials
High-tech immersive exhibitions	High	Low (temporary)	General visitors	Holographic scanning; dynamic installation; interactive projection (Wandering Digital Art in Historical Spacetime)
Online teaching courses	Medium	Medium	Teachers / students	Expert lectures; relic appreciation tutorials; downloadable teaching materials

3.2.1 Lightweight Digital Educational Products

• Animated relic stories, interactive mini-games, online handicraft tutorials and graphic interpretive materials form the core daily digital education portfolio. These tools require minimal long-term maintenance funding and support continuous public popularisation work. The unified juvenile-oriented design logic is observed across all lightweight digital assets; adult-oriented in-depth historical and aesthetic interpretation is not present.

3.2.2 High-Tech Immersive Digital Exhibition

• Select core special exhibitions deploy holographic scanning and dynamic installation technologies to reconstruct relic scenes. The exhibition *Wandering Digital Art in Historical Spacetime* is identified as a representative case (Figure 6). Immersive digital installations are high-cost temporary projects and are not designed to sustain daily public education. Targeted design for adult research audiences is not observed.



Figure 6. On-site view of the interactive immersive digital exhibition (Image: Author)

3.3 Managerial Cognition and Behavioural Strategies

• 3.3.1 Digital Cognition of Museum Managers

- Administrators recognise digitalisation's capacity to break time-space restrictions and lower public participation thresholds. They actively track global museum digital education trends and maintain an open attitude toward technological iteration. This forward-facing mindset is identified as a factor distinguishing Hunan Museum from more conservative regional venues in central China.

• 3.3.2 Practical Behaviours and Institutional Measures

- Operationally, the museum continuously optimises official website infrastructure, digital databases and mobile terminal platforms, integrating collection resources to produce short videos, interactive graphics and online courses. Cross-industry cooperation with cultural enterprises and systematic employee digital literacy training are in place to stabilise long-term digital education operation. Managerial decision-making prioritises youth education performance indicators set by cultural authorities.

• 3.4 Comprehensive Findings: Advantages and Deficiencies

• 3.4.1 Identified Operational Advantages

- Four operational advantages are identified through systematic coding:
 1. A three-tiered audience stratification system establishing differentiated service standards for child–family, teacher–student and adult groups — a structural model not commonly observed in other provincial regional museums in central China.
 2. A lightweight digital resource matrix providing a low-cost, sustainable digital education solution.
 3. Integrated offline educational spaces and mobile outreach vehicles expanding cultural education coverage beyond fixed exhibition halls.

- 4. Managers' systematic digital cognition delivering stable institutional guarantees for long-term digital education iteration.

• 3.4.2 Identified Deficiencies and Constraints

- Four interrelated structural contradictions are identified through theoretical coding and comparative analysis:

- **1.Age bias in resource allocation.** Nearly all offline and digital resources prioritise juvenile visitors; systematic progressive educational programmes for adult learners are absent.

- **2.Unbalanced digital resource supply.** Lightweight digital assets are fully developed for minors; deep digital learning materials targeting adult aesthetic research remain scarce.

- **3.Uneven museum–school cooperation coverage.** Partnerships are concentrated in urban schools; sustained outreach for rural student groups is insufficient.

- **4.Absence of long-term quantitative evaluation mechanisms.** The museum relies solely on participation volume statistics to judge activity effectiveness; visitor tracking, satisfaction surveys and knowledge retention assessments are not in place.

4. Discussion

- This section interprets the empirical findings against the study's two core research questions and existing museum-education literature, elaborates theoretical and practical implications, and addresses study limitations.

- Interpreted against the first research question concerning local adaptation of Western audience-stratification frameworks, the three-tier educational system observed at Hunan Museum offers a non-Western real-world case. Western scholarship mostly frames museum audiences around independent family and individual visitors (Evans, 2022; Nichols, 2023), with formal school-based groups rarely treated as a primary,

standalone service cohort. Consistent with prior Chinese museum research (Luo & Chen, 2025; Xiang, 2025), this study's results illustrate how institutionalised museum-school partnerships reshape local audience stratification. Hunan Museum integrates teacher-student groups as an independent service tier, relying on administrative-backed outreach and teacher salons rather than community volunteer-driven operations common in Western regional museums. This empirical outcome complements cross-cultural museum-education discourse (Harris, 2025), showing that audience-stratification theory cannot be directly copied; it requires adjustment for state-supported formal-school educational contexts.

- For the second research question on structural tensions between lightweight digital resources and stratified programming, findings confirm notable age-oriented resource bias. Although lightweight digital tools deliver low-threshold learning for children and families (Carter, 2024; Ortega et al., 2025), nearly all such digital outputs target juvenile audiences, while deep-learning materials for adults remain scarce. This imbalance aligns with domestic literature noting performance-driven priorities favouring youth popularisation within Chinese cultural institutions (Wang et al., 2022; Zeng & Liu, 2025). Even with positive digital cognition among museum administrators, institutional assessment logics steer resource allocation toward children and youth, creating persistent tensions between multi-group inclusive goals and actual digital-resource supply. In addition, museum-school collaboration is geographically skewed toward urban schools, which widens educational-equity gaps identified in prior equity-focused outreach research (Nguyen & Jones, 2024). The absence of quantitative evaluation systems further means educational outcomes cannot be reliably measured, hindering data-driven optimisation for stratified services.

- The study yields both theoretical and practical implications. Theoretically, it expands audience-stratification theory by adding formal

institutional school groups as a core visitor category, providing empirical evidence for non-Western museum-education contexts. It also adds a critical perspective to lightweight-digital-education research: low-cost digital innovation should not only lower barriers for young visitors but also accommodate adults' advanced aesthetic-historical learning needs. Practically, for resource-limited regional museums globally, Hunan Museum's lightweight-digital toolkit and mobile-museum outreach represent transferable practice. At the same time, practitioners need to guard against age-biased resource allocation and build mixed-method evaluation frameworks to track long-term educational impact. For policy-makers overseeing Chinese regional museums, results suggest performance appraisal systems should incorporate indicators for adult-oriented education and rural outreach, rather than over-emphasising youth-activity participation metrics.

- This study has inherent limitations. Empirical evidence draws exclusively from publicly available archival and visual materials; no interviews or visitor questionnaires were conducted, so direct subjective feedback from visitors and front-line museum staff is absent. Moreover, evidence is derived from a single provincial museum case. Consequently, observed structural tensions are illustrative rather than universally generalisable across all Chinese regional museums. Future multi-case and mixed-methods research could combine field interviews and visitor surveys to further validate and deepen the present findings.

5. Conclusion

- Taking Hunan Museum as a typical case, this study systematically analyses the stratified public education and lightweight digital innovation practices of Chinese regional museums based on an integrated dual theoretical framework. The museum has built a complete online-offline integrated educational system covering child-family, teacher-student and adult

audiences, with mature lightweight digital resource matrices and stable institutional operational guarantees, forming distinctive localised educational advantages different from Western regional museums. At the same time, systematic structural contradictions including age-biased resource allocation, insufficient adult educational supply, unbalanced school cooperation coverage and missing quantitative evaluation mechanisms are prominent, restricting the realisation of equitable inclusive museum education. Suggest recommendations or future research directions.

• 5.1 Research Contributions

- Theoretically, this study constructs a targeted analytical framework for Chinese regional museum stratified digital education, revises Western audience stratification theory through local museum-school collaborative mechanisms, and enriches cross-cultural museum education research systems. Practically, it summarises replicable low-cost digital innovation and stratified service optimisation paths for Chinese and global grassroots museums,

providing targeted strategies to resolve systemic inequities in regional museum public education.

• 5.2 Research Limitations

- This research has three limitations: it only adopts official public data without visitor interviews and questionnaire data, lacking subjective visitor feedback; it focuses on a single case, with limited cross-museum comparative generality; it captures only static current operational status, without long-term longitudinal tracking of educational effects.

• 5.3 Future Research

- Future research can adopt mixed methods to supplement subjective visitor evaluation data, carry out multi-case horizontal comparison of provincial museums, and build long-term dynamic evaluation systems for museum educational effects. Regional museums should further optimise multi-group balanced educational resource allocation, expand rural educational coverage, and realise sustainable, equitable and high-quality development of stratified digital public education.

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7. Acknowledgements (Optional)

- Mention any funding, assistance, or institutional support

8. Author Declaration

- The author declares that this work is original and has not been submitted elsewhere for publication. There are no conflicts of interest to declare.