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Utilization of Digital Immersive Spaces in the Interior Design of Public Spaces in Indonesia: Benefits, Challenges, and Implementation Strategies

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ABSTRACT

Digital transformation expands the role of interior design from the arrangement of physical elements to the design of responsive, narrative, and participatory spatial experiences. This literature-review article examines the use of digital immersive spaces, including virtual reality (VR), augmented reality (AR), mixed reality (MR), interactive projection, 360-degree video mapping, and digital installations in Indonesian public interior settings. A narrative-critical review of scholarly publications and institutional documents, primarily from 2019–2026, is undertaken with attention to museums, cultural galleries, commercial spaces, and educational environments. The synthesis shows that immersive spaces can enhance psychological presence, visitor engagement, narrative comprehension, atmosphere and scale visualization, curatorial flexibility, and opportunities for cultural preservation and interpretation. These benefits, however, do not arise automatically from adding digital devices. Experience quality depends on the fit between content and spatial context, interaction flow, sensory comfort, accessibility, safety, data privacy, operational capacity, and the sustainability of device life cycles. Indonesian examples demonstrate different implementation models: the National Museum's ImersifA employs 360-degree video mapping for historical and cultural storytelling; Galeri Indonesia Kaya uses interactive digital panels for cultural education; and the Sangiran Museum integrates touchscreen media and video mapping in geological interpretation. This article proposes an "experience-, place-, and governance-centred" implementation framework that treats technology as a medium rather than an end. It includes public-goal definition, user and sensory mapping, multimodal narrative development, prototyping and evaluation, universal design, data governance, and an operations-and-maintenance plan. Through such an approach, immersive digital spaces can enrich Indonesian public interiors in an inclusive, meaningful, and sustainable manner.

KEYWORDS

Immersive Space, Interior Design, Virtual Reality, Augmented Reality, Interactive Projection

Introduction

Interior design in public spaces organizes relationships among people, activities, objects, atmosphere, information, and physical boundaries. In museums, galleries, libraries, learning

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centres, commercial spaces, and public-service facilities, visitors assess a space not only through form and material. They also assess orientation, information legibility, safety, opportunities for participation, and the meaning they gain during a visit. Digital technology has expanded this design field. Walls, floors, ceilings, furniture, screens, mobile devices, and sensors can operate as interfaces that communicate stories and respond to users. Digital immersive space sits at the intersection of interior design, interactive media, spatial computing, installation art, and user experience.

The term immersive is often used loosely to describe a spectacular visual experience. More precisely, immersion refers to a state in which a person feels involved in, or present within, an experienced environment. The environment may be fully virtual through a VR head-mounted display. It may add a digital layer to a real space through AR. It may combine physical and digital objects in real time through MR. It may also surround the user through large-scale projection, spatial audio, light, and sensor-based responses. Immersion is not merely a screen quality. It results from the relationship between technical equipment, spatial composition, narrative content, the user's body, and the social context of the experience.

For interior design, immersive technology has value because it can test or shape spatial experience before and during use. During design development, VR can help designers and users examine proportions, circulation, sightlines, lighting, and atmosphere more concretely than two-dimensional drawings. Kalantari and Neo note that fully immersive virtual environments offer significant opportunities for interior-design research, while also requiring attention to experience validity, user navigation, and limitations of digital representation [7]. During operation of public spaces, interactive projection and AR can make previously static information more exploratory and contextual.

In Indonesia, immersive technology is increasingly visible in museums, galleries, festivals, and commercial spaces. ImersifA at the National Museum of Indonesia is a permanent installation measuring 12 × 21 metres. It uses 360-degree video mapping, including projection onto the floor, to narrate Indonesian nature, society, history, and culture [12]. Galeri Indonesia Kaya in Jakarta applies a different model through a digital and interactive edutainment ecosystem that introduces Indonesia's cultural diversity. Its Jelajah Indonesia Kaya programme offers several digital activities that visitors can explore independently [6]. These cases show that immersive space is not synonymous with VR headsets. It ranges from the transformation of architectural interiors through projection to screen-based digital interaction in real space.

Despite its potential, immersive space also introduces risks. Strong visual experiences can produce sensory fatigue, orientation problems, or cybersickness, particularly in VR experiences that include camera movement, rotation, speed, and acceleration that conflict with bodily movement. Research shows that cybersickness can reduce presence, enjoyment, and intention to use VR again [17], [9]. In public space, these issues intersect with accessibility for visitors with diverse abilities, privacy concerns related to cameras and sensors, crowd management, device maintenance, energy use, and rapidly outdated content. Discussion therefore needs to move beyond the question of which technology is used. It must ask which public experience is intended, for whom it is designed, what risks it creates, and how the space will be governed.

This article aims to: (1) explain the concept and components of digital immersive spaces in interior design; (2) analyse their benefits for public spaces; (3) identify technical, user-experience, social, ethical, and operational challenges; (4) examine examples from Indonesian public spaces; and (5) formulate implementation strategies relevant to interior designers and public-space managers. The article is based on a literature review. It does not report field measurements from a single site.

Methods

This article uses a narrative-critical literature review. This approach was selected because digital immersive space intersects several disciplines, including interior design, architecture, human-computer interaction, museum studies, media studies, and extended reality technologies. These fields use different terms, methods, and measures of success. A narrative-critical review makes it possible to connect cross-disciplinary findings and formulate design implications that are applicable to Indonesian public spaces.

The source search prioritized publications from 2019 to 2026 in order to reflect recent developments in XR devices, experience-evaluation methods, and digital-space practice. Search keywords included immersive space, immersive virtual reality, augmented reality, mixed reality, interior design, public space, interactive projection, digital installation, cybersickness, accessibility, and privacy, together with Indonesian-language equivalents. Academic sources were selected for their relevance to interior design, user experience, spatial evaluation, or risks associated with immersive technology. Primary documents from Indonesian public-space institutions were used to verify the characteristics of the cases, especially the National Museum of Indonesia, Galeri Indonesia Kaya, and the Sangiran Early Man Museum.

The analysis followed four stages. First, sources were grouped by technology and application context. Second, findings were extracted into themes: experience and engagement, narrative communication, design process, accessibility, health and safety, privacy, operation, and sustainability. Third, these themes were compared with the characteristics of Indonesian public spaces. Fourth, the synthesis was translated into principles and an implementation framework. This article does not claim to be a systematic literature review using a full PRISMA protocol. Its findings should therefore be read as a conceptual-critical mapping intended to support design decisions and further research.

Result

1. Immersive space as spatial experience

Digital immersive space can be defined as an interior or hybrid environment that integrates digital media, interactive responses, and spatial elements to create strong perceptual engagement. This definition contains three elements. First, the environment has an enveloping quality. Visuals, sound, light, or information extend beyond a single viewpoint and can occupy the user's field of view and attention. Second, the user can act or respond through body movement, touch, position, gaze, control devices, or mobile devices. Third, digital content and physical conditions are coherent, so the experience makes narrative and sensory sense.

Immersion should be distinguished from interactivity and presence. Interactivity is the capacity of a system to respond to user input. Presence is the subjective feeling of being in an experienced environment. Immersion can also describe the objective capacity of a system to present an environment that surrounds the user. In design practice, these concepts are related but not identical. A touch screen can be highly interactive but weakly immersive. Conversely, a 360-degree projection with enveloping audio can be immersive even when interaction is limited. Designers need to establish an appropriate balance. Reflective education does not always require dense interaction, whereas collaborative play may require it.

In interior design, immersion is embodied. The floor shapes stability and direction of movement. Projection distance determines visual scale. Ceiling height influences sound reflection and perceived spaciousness. Light affects the ability to read faces, signs, and screens. The presence of other people changes the sense of privacy and sociability. Technology does not replace interior design. Instead, it makes interior qualities, including proportion, acoustics, surfaces, circulation, thresholds, and places to pause, more decisive because they all affect how digital media are received.

Kalantari and Neo emphasize that immersive VR can be a powerful tool for interior-design research because it allows the control of spatial variables and observation of user responses [7]. However, virtual representation is not automatically equivalent to the experience of a real building. Materiality, smell, temperature, touch, social dynamics, and safety consequences are often not fully simulated. Evaluation through VR should therefore be treated as supporting evidence and should be triangulated with models, technical simulations, observation, or post-occupancy evaluation.

2. Technology spectrum

Tabel 1. Type of Technology, Characteristic, Implication and Use

Technology	Experience characteristics	Interior implications	Public-use examples
VR	Three-dimensional digital environment through a headset; high degree of isolation	Requires a safe zone, device sanitation, supervision, and queue management	Historical simulation, learning, virtual tours, design testing
AR	Digital information layered over real space through a phone, tablet, or glasses	Requires markers, adequate lighting, safe movement routes, and contextual content	Collection interpretation, navigation, building information
MR	Digital objects appear anchored in and able to interact with the physical environment	Requires spatial mapping, calibration, interaction boundaries, and compatible devices	Object visualization, collaboration, spatial education
Interactive projection/video mapping	Walls, floors, ceilings, or objects become visual surfaces; sensors may enable response	Requires light control, projection surfaces, acoustics, electrical capacity, and evacuation routes	Museum narratives, festivals, exhibitions, performances
Digital installation	Combination of screens, sensors,	Requires furniture and cable integration, service access, public-use	Galleries, retail spaces, lobbies, education centres

	sound, light, physical objects, and software	durability, and accessibility

VR provides a digital environment that can remove many cues from real space. Its strength is the ability to simulate conditions that are difficult, expensive, distant, or not yet built. Its limitation is that users still have bodies in physical space. They need a clear obstacle-free area, assistance when mobility is limited, headset-cleaning procedures, and non-headset alternatives. AR works differently. It keeps users connected to the real environment while adding information or digital objects. Because it does not fully block the physical setting, AR can be more suitable for collection interpretation, orientation, and learning that still requires attention to the original building or artefact.

MR sits between VR and AR because its digital objects do not simply appear as overlays. They are perceived as occupying and responding to the geometry of physical space. In public interiors, MR can support demonstrations of objects that are too fragile, too large, or unavailable. Its usefulness, however, depends on stable spatial tracking and an interface that users can easily understand. Interactive projection and digital installations enable shared experiences without individual devices. These technologies can suit group visitors because they bring many bodies into the same narrative rhythm. They still require control of light, acoustics, density, and movement safety.

3. Benefits of immersive space

The most frequently cited benefit of immersive space is increased engagement. When information is presented through relationships among image, sound, movement, scale, and user action, visitors do not only receive facts linearly. They can build emotional and spatial connections with the material. In museums and galleries, this approach helps explain phenomena that cannot be touched directly, such as landscape change, time travel, geological processes, past conditions, or living cultural practices. Large-scale projections can turn data and archives into a shared environment, while AR can connect information layers directly to collections and places.

Engagement, however, is not the same as learning. Rapid visuals, excessive sound, or complex interaction demands can distract from the core message. Narratives therefore need a legible structure: introduction, focus, development, pause, and closure. The principle of one main objective per zone can help visitors understand what requires attention. In scheduled spaces, such as a 360-degree video-mapping presentation, managers can control collective rhythm. In free-exploration installations, core information should be available at several levels of depth: concise material for short visits and richer content for visitors who want to explore further.

Galeri Indonesia Kaya illustrates the value of a self-directed interactive model. Its digital programme includes animation, games, avatars, digital books, place exploration, and endemic flora and fauna. This structure allows visitors to enter cultural topics through varied activities [6]. Its design value lies not only in the screens but in the activity choices that translate cultural material into experience. In interior terms, each interaction point needs a waiting zone, suitable viewing distance, adequate body position, and circulation that does not disrupt other users.

During design development, VR and MR allow clients, end users, and stakeholders to experience spatial alternatives before construction. This potential matters when design decisions affect circulation, capacity, visibility, accessibility, or atmosphere. Literature on VR in interior design finds that the technology can strengthen spatial awareness, creativity, and virtual testing of design options while supporting communication with users [1]. By entering a one-to-one scale simulation, participants can more easily comment on whether a corridor feels narrow, whether a table is reachable, or whether a sign is visible from a decision point.

Lee et al. discuss the use of immersive VR in an interior-design studio as a tool for accessible design [10]. This contribution is important because accessibility evaluation should not stop at dimensional compliance. Simulation can test wheelchair travel, wayfinding by people with low vision, or spatial experience under crowding. Simulation should not replace the involvement of real users, especially people with disabilities who have diverse embodied experiences and navigation strategies. VR should function as a dialogue tool, not as the sole justification for design decisions.

Immersive space also provides curatorial flexibility because content can change without major physical renovation. A projection room can host different narratives if its visual, audio, and control infrastructure is well designed. This gives museums and galleries an advantage when they need to renew programmes, respond to educational opportunities, or present digital collections without moving fragile artefacts. Digital technology can also present reconstructions, archives, maps, sounds, or performance documentation as a complement to, rather than a replacement for, original objects.

A relevant example appears at the Sangiran Early Man Museum, Krikilan Cluster. Information from the Sangiran Heritage Site Preservation Office describes the use of touchscreen and video-mapping media in exhibition room 1 to explain the soil layers of the Sangiran site [3]. This application shows how a complex geological phenomenon can be translated into contextual audiovisual media. The interior challenge is to ensure that media do not obscure the value of artefacts and that the exhibition still supports calm reading and visitor orientation.

Unlike individual VR experiences, large projections and interactive installations can create social experiences. People can observe one another’s reactions, share attention toward the same visual environment, and discuss meaning after the experience. This social dimension matters in public space because a building is not only a container for media consumption. It is also a setting for encounter. When designed carefully, technology can strengthen place identity through local content, language, sound, motifs, oral stories, and community participation.

ImersifA demonstrates a collective-experience model. The National Museum of Indonesia states that the walls and floor become screens for a 360-degree video-mapping presentation that addresses Indonesian history through concepts of nature, society, history, and culture [12]. The arrangement allows visitors to experience a national narrative together. Cultural representation in immersive environments still requires sensitive curation. Diversity should not be reduced to visual decoration. It needs to acknowledge context, knowledge sources, and the communities connected to the cultural material.

4. Challenge and risks

Immersive space works directly with perception. Comfort problems are therefore not secondary concerns. In VR, cybersickness can include nausea, dizziness, disorientation, visual discomfort, and fatigue. Weech et al. identify a negative relationship between presence and cybersickness that is related to sensory integration processes [17]. Kim et al. find that camera movement, including rotation, translation, navigation speed, and acceleration, affects the level and severity of cybersickness [9]. The design implication is clear: avoid unnecessary camera movement, give users control over navigation, use predictable transitions, and provide options to sit or stop.

In projection spaces, sensory concerns include flashing effects, extreme contrast, sound level, rapid visual patterns, dark environments, and crowd density. Visitors with migraine, photosensitive epilepsy, anxiety, vestibular conditions, autism, or sensory sensitivity may need lower-intensity options. Responsible design provides pre-visit information about duration, visual effects, sound, and exit options. It also provides quiet zones, legible evacuation routes, and staff training. Physical signs should not disappear simply because the room is dark or visually dominant.

Physical safety must also be integrated from the beginning. In standing VR experiences, the safe area should account for arm reach, unexpected movement, cables, and possible loss of orientation. In floor-projection settings, visual changes must not conceal level changes, steps, or obstacles. In installations that attract crowds, areas for watching, queuing, entering, exiting, and stopping need clear separation. The basic principle is simple: immersive effects must not prevent users from recognizing real risks in physical space.

Digital space can expand access, but it can also create new exclusion. Headsets may be uncomfortable for people wearing glasses, unsuitable for some users with vestibular conditions, or difficult for people with motor limitations. Audio content can be inaccessible to Deaf visitors without captions or sign language. Complex visuals can be inaccessible to people with low vision without audio description or alternative interfaces. Installations that depend on personal phones can exclude visitors who lack devices, data allowance, battery power, or digital literacy.

Universal design should be an essential strategy. The main experience should be reachable through more than one mode. Visual content can be accompanied by audio and text. Movement-based interaction can be supplemented with buttons or accessible controls. VR should have a flat-screen or video alternative. AR information should also be available on physical panels. Screen height, contrast, text size, reading duration, wheelchair turning space, seating, and transition lighting need to be planned as interior components. This approach does not reduce immersion. It expands the number of people who can experience the meaning of the space.

Exclusion also has social and cultural dimensions. Digital narratives available in only one language or based on narrow popular references can alienate some visitors. In multilingual and cross-generational Indonesian public spaces, content needs clear language levels, local-language options when relevant, and interaction design that does not assume familiarity with digital gestures. Testing with diverse user groups is essential before opening.

Immersive interaction often requires cameras, motion sensors, microphones, positional tracking, user accounts, or biometric devices. These systems can map visitor habits, expressions, voices, and movement patterns. Research on interactive media in public space notes that extraction and analysis of user information can create privacy and bias concerns [4]. In XR, privacy risks increase because usage data can reveal more detailed characteristics and behaviour [11].

Managers should apply data minimization. They should collect only data that are genuinely necessary, explain the purpose in concise and accessible language, limit retention periods, secure access, and provide an option to enjoy the experience without non-essential tracking. Cameras used only for real-time interaction should not automatically record unless clear consent is obtained. If visitor photos or videos appear on public screens, consent and moderation mechanisms should be explicit. Standards for children should be stricter.

Ethics also concern content. Digital reconstructions of history, culture, disaster, violence, or community identity have strong persuasive power because they can make visitors feel an event. Accuracy of sources, attribution, context, and stakeholder involvement must not be sacrificed for dramatization. Cultural content should avoid removing symbols from their meaning, reducing communities to stereotypes, or using assets without proper rights and consent.

Many immersive-space projects perform well at opening but decline after several months because they lack an operational plan. Projectors require calibration, cleaning, component replacement, and heat management. Sensors require retesting when lighting changes. Headsets need cleaning and updates. Software requires security patches and new compatibility checks. Content can lose appeal or relevance. These requirements must be treated as life-cycle costs, not only initial installation costs.

Indonesian public spaces also face practical variables such as network quality, electricity reliability, humidity, dust, temperature, staff capacity, and high visitor density during weekends and holiday seasons. Technical design needs a safe degradation mode. If a sensor fails, content should still run in non-interactive form. If the network fails, core functions should not stop. If one projector malfunctions, the room should not become unsafe or lose all orientation. Service space, equipment ventilation, cable routes, electrical points, and maintenance access must be designed from the initial floor plan rather than added after the interior is complete.

From a sustainability perspective, digital devices have energy and electronic-waste impacts. Procurement should consider energy efficiency, lifespan, repairability, availability of spare parts, and end-of-life management. More sustainable strategies include modular devices, content updates without replacing physical systems, scheduled power operation, energy-efficient lighting, and interior materials that do not produce excessive heat reflection or hinder maintenance.

5. Indonesian public-space examples

ImersifA is one of the clearest examples of a projection-based immersive interior in Indonesia. The National Museum of Indonesia states that this permanent installation is located in Building A, measures 12 × 21 metres, uses 360-degree video mapping including the floor, and presents

a programme lasting about 30 minutes [12]. Walls and floors operate as screens, placing visitors inside a visual environment rather than in front of a single display. Its content addresses Indonesian history through the concepts of nature, society, history, and culture.



Figure 1. ImersifA at Museum Nasional Indonesia
Source: newjakarta.co.id

From an interior-design perspective, the project shows how spatial boundaries can become narrative media. This decision requires different technical conditions from a conventional exhibition room: projection surfaces, lighting control, projector placement, sound design, visitor capacity, entry-exit routes, and time management. Museum operational information notes a capacity of up to 30 people per session [13]. A limited capacity can support experience quality and safety, but it creates the need for queue management and alternative experiences for visitors who do not obtain a session.

The main lesson from ImersifA is the importance of alignment between content and institutional mission. The 360-degree projection functions not only as visual entertainment but also as a medium for narrating Indonesian heritage. Such a space still requires periodic evaluation of visitor understanding, sensory comfort, accessibility, and the relationship between the digital experience and the museum's physical collections. Success should not be measured only by dwell time or social-media posts. It should also assess whether visitors connect the digital experience with broader knowledge, collections, and reflection.

Galeri Indonesia Kaya offers a different model. It is a cultural edutainment space that presents information about musical instruments, toys, traditional clothing, cuisine, tourism, traditions, and arts through digital and interactive technology [5]. Its location in Grand Indonesia West Mall, Jakarta, shows that immersive and interactive spaces can be situated in commercial centres while retaining public-educational functions and free access.

The Jelajah Indonesia Kaya programme illustrates a more dispersed and participatory installation model than a single projection room. Seven digital activities let visitors interact with a digital village animation, traditional dance, culinary themes, avatars, folklore, virtual travel,

and endemic flora and fauna [6]. From an interior perspective, this model requires clear zoning. Each point must be recognizable, avoid queue conflicts, provide appropriate interaction height and distance, and maintain circulation between stations. Its strength is that visitors can control their exploration rhythm. Its risk is fragmentation when there is no strong narrative thread and orientation system.



Figure 2. Imersif Facility of Galeri Indonesia Kaya
Source: skycitytrans.com

The Sangiran Early Man Museum shows the application of digital media for scientific interpretation. The Sangiran Heritage Site Preservation Office records the use of touchscreen and video mapping in exhibition room 1 at the Krikilan Cluster to explain layers of soil at the Sangiran site [3]. This approach is relevant because stratigraphy and prehistoric environmental change are difficult to understand when shown only through separate texts or objects.

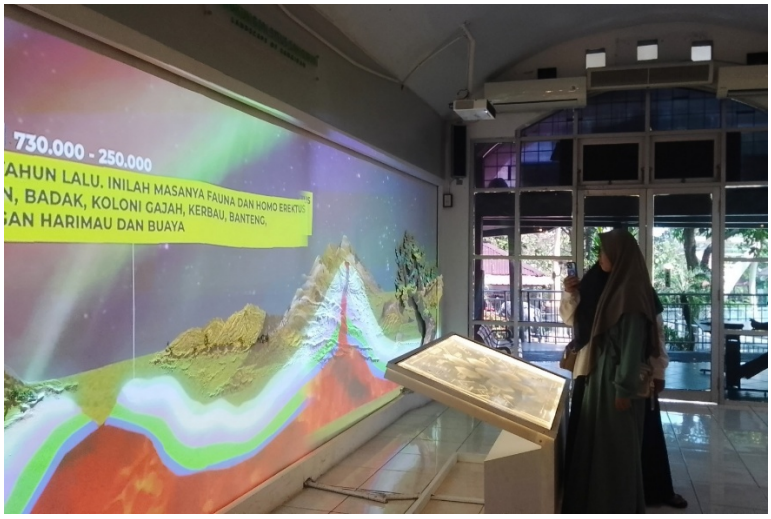


Figure 3. Touchscreen and Video Mapping in Exhibition Room

Source: solobalapan.jawapos.com

In this case, digital media translate invisible processes and long time scales. Design success does not depend on screen size or the number of visual effects. It depends on the extent to which visualization helps visitors connect soil layers, fossil discoveries, time periods, and the site's significance. The room layout should structure an interpretive sequence from introduction, to media reading, to object observation, and finally reflection. Touchscreens also need simple interaction for different age groups and alternative explanations for visitors who cannot or do not wish to use a screen.

Tabel 2. Comparation of Digital Implementation

Case	Dominant technology	Main value	Design note
ImersifA, National Museum of Indonesia	360-degree video mapping and sound design	Collective historical-cultural narrative and transformation of interior surfaces	Session capacity, sensory control, evacuation routes, and alternative experience
Galeri Indonesia Kaya	Interactive digital panels and games	Independent and participatory cultural exploration	Zoning, queue management, orientation, and meaning beyond gamification
Sangiran Museum, Krikilan Cluster	Touchscreen and video mapping	Explanation of complex geological and prehistoric processes	Interpretive sequence, legibility, and non-screen alternatives

The three cases show that digital implementation has no single formula. The National Museum uses environmental immersion to build a shared experience. Galeri Indonesia Kaya uses a network of interaction points for independent exploration. Sangiran uses digital visualization as a scientific-interpretation tool. These differences confirm that technology selection must follow the purpose of the space, the character of the material, visitor profiles, and management capacity. A strong public space is not the one with the most devices. It is the one that provides the clearest reason for each device within the visitor experience.

Discussion

1. Experience, Place, and Governance Framework

Based on the literature synthesis and Indonesian examples, this article proposes an implementation framework centred on experience, place, and governance. The experience dimension addresses purpose, users, narrative, and sensory conditions. The place dimension addresses relationships between technology and interior architecture, circulation, acoustics, lighting, materials, and safety. The governance dimension addresses data, staff, content updates, budgets, maintenance, and evaluation. These dimensions should be developed together. Failure in any one of them can reduce the value of the technology.

First, managers should establish public objectives in specific terms. The initial question is not whether a space needs VR or projection mapping. The question is what change is expected after visitors enter the space. Objectives may include understanding a process, building empathy, improving orientation, expanding access to collections, inviting discussion, or supporting design

decisions. Specific objectives make indicators easier to define. If the purpose is understanding, assess whether visitors can explain the core information. If the purpose is orientation, assess whether visitors can find their destination without help. If the purpose is cultural experience, assess the quality of connection and appreciation rather than interaction duration alone.

Second, designers should map users and the visit journey. This map includes who visits, whom they visit with, what devices they have, accessibility needs, digital literacy, available time, and possible crowd conditions. The journey should cover arrival, pre-visit information, queuing, introduction, use, pauses, assistance, exit, and feedback. A strong immersive experience often begins before the visitor enters the room through appropriate expectations. It also continues after exit through a decompression area or follow-up material.

Third, designers should build a multimodal narrative. Core content should be accessible through more than one channel, such as visuals supported by concise text, audio narration, subtitles, audio description, and physical objects. Information should not be piled into one moment. It needs a hierarchy: core message, supporting information, and further exploration. In dark spaces, transitions can use orientation lighting or sound cues. In AR, digital content should reinforce real objects rather than force users to keep staring at a screen and ignore the space around them.

Fourth, designers should prototype and test with real users. Before building a full system, they can test the flow with sketches, mock-ups, simple video, or one interactive module. Tests should involve children, older adults, people with disabilities, frontline staff, curators, and general visitors. Evaluation should ask more than whether users like the experience. It should assess whether they understand how to begin, whether routes are safe, whether content is legible, where confusion occurs, how long queues are, and whether discomfort appears. Iterative testing costs less than correcting an installation after opening.

Fifth, governance needs to be prepared at procurement stage. Procurement documents should specify asset ownership, content licences, file formats, modification rights, manuals, component lists, maintenance schedules, staff training, repair-response targets, and replacement plans. These provisions reduce dependence on a single provider. Data governance must also be embedded. It should list sensors, collected data, processing purposes, retention periods, access rights, security measures, and deletion procedures.

2. Operational Design Principles

Principle 1: Technology should be proportional to the objective. If the aim is to communicate short information that is easy to read, a well-designed panel may be more effective and economical than VR. VR is appropriate when bodily perspective, scale, risk simulation, or experience of a distant location provides clear added value. Spatial projection is appropriate when collective narrative and environmental envelopment strengthen the message. Technology choice must demonstrate value that cannot be achieved more simply.

Principle 2: Design options rather than a single path. Visitors should be able to choose experience intensity: a full version, a short version, a headset-free version, or companion material. This principle supports accessibility, reduces sensory load, and improves capacity during busy

periods. Choice does not mean every visitor must have an identical experience. It means that everyone should have equitable access to the main meaning.

Principle 3: Treat the interior as media infrastructure. Service space, ventilation, acoustic treatment, blackout systems, hanging structures, electrical outlets, networks, cable routes, and technician access must be solved architecturally. Adding devices after the space is finished often produces visible cables, excess heat, poor reflections, or narrow routes. Early planning produces a cleaner, safer, and more maintainable space.

Principle 4: Measure impact across several layers. Indicators should cover experience, including satisfaction, presence, and comfort; outcomes, including understanding, memory, and attitude change; access, including who can participate; operations, including queue time, failure rate, and staff workload; and sustainability, including energy use, updates, and device waste. Evaluation should also record complaints such as dizziness or difficulty of use. In VR, comfort and cybersickness should be measured explicitly because many immersive studies still do not assess these constructs adequately [8].

Principle 5: Maintain authenticity and context. When immersive space presents culture, history, or heritage, content needs traceable sources. Curators, researchers, communities, and archive sources should be acknowledged when appropriate. Visitors should be able to distinguish reconstruction, artistic interpretation, and documented fact. This transparency is important because the emotional power of immersive media should not become an exaggerated claim.

Conclusion

Digital immersive spaces expand the possibilities of interior design by turning space into a medium for experience, narrative, and interaction. VR, AR, MR, interactive projection, and digital installations can help users understand complex information, experience scale and atmosphere, participate in learning, and develop stronger connections with cultural content and place. In Indonesian public spaces, these benefits appear in different models: 360-degree video mapping at ImersifA in the National Museum, self-directed cultural interaction at Galeri Indonesia Kaya, and geological visualization at the Sangiran Museum.

Technology does not guarantee experience quality. The value of immersive space depends on clear objectives, narrative quality, integration with physical interiors, sensory comfort, universal design, safety, data governance, staff capacity, and maintenance strategies. Risks of cybersickness, digital exclusion, privacy violations, shallow cultural narratives, and operational failure must be treated as design issues from the start rather than as afterthoughts after an installation opens.

For designers and managers, the most appropriate strategy is to position technology as a medium that serves public experience. The experience, place, and governance framework offers a way to unite user needs, interior quality, and operational sustainability. Future research can test this framework through post-occupancy studies of immersive spaces in Indonesia, compare visitor responses across age and ability groups, and develop evaluation indicators that combine learning, emotional experience, accessibility, and environmental impact. With a critical and

participatory approach, immersive space can become an important tool for creating more communicative, inclusive, and meaningful public interiors.

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