

Developing Experiential Modules on the Legacy of Ancient Indian Universities for Public Engagement: A Case Study of Param Science Experience Centre

Ashwini Kale¹, Inavamsi Enaganti², Sai Phani Utkarsh Kethana³

Abstract

The National Education Policy (NEP) 2020 directs the integration of Indian Knowledge Systems (IKS) into modern education. But a significant gap remains between the rich scholarship on ancient Indian universities and public awareness. This study addresses this issue by demonstrating a practical model for bridging this gap through experiential learning. We developed and prototyped four immersive modules, including an escape room, an interactive mural, a treasure hunt, and AR/MR experiences, for the Ancient Indian Heritage Gallery at the Param Science Experience Centre using an action research approach. The significant relevance of this work lies in its direct operationalisation of NEP 2020, moving IKS from theoretical policy to engaging public practice. The findings suggest that this is a scalable and adaptable model for making ancient knowledge accessible, for historical understanding, critical thinking and cultural pride. This study describes ways in which science centres and museums can extend beyond traditional displays to engage the public more directly with India's scientific heritage.

Keywords: Experiential learning, NEP 2020, Indian Knowledge Systems, Ancient Indian universities, Science Experience Centres, Action research

¹ Science Research Lead, Param Foundation, Bengaluru, Karnataka, India

² Director, Param Foundation, Bengaluru, Karnataka, India

³ Experience Curator, Param Foundation, Bengaluru, Karnataka, India

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India's higher education tradition has a remarkably prominent, ancient, and continuous lineage, ranking among the world's oldest systematic learning cultures. Building on the foundational work of Mookerji (1947) and Datta & Singh (1962), and the contemporary analysis given by Mahesh and co-authors (2023), it is confirmed that ancient and medieval India nurtured a sophisticated knowledge ecosystem. This included a well-structured study of the prominent auxiliary Vedic sciences (six Vedangas), encompassing phonetics (Shiksha), meter (Chandas), grammar (Vyakarana), etymology (Nirukta), astronomy (Jyotisha), and ritual (Kalpa). This curriculum reflects a purposeful effort to develop academic rigour and uphold cultural traditions. Building upon this foundational framework, Indian thinkers also laid the groundwork for significant developments in more applied scientific inquiry. Their contributions spanned arithmetic, algebra, and observational astronomy. Indian scholars also advanced medicinal practices, including ayurveda, medicine, and surgery, as well as early chemical analysis. Philosophy and logic were precisely investigated and debated among scholars. Additionally, Mookerji (1947), Datta & Singh (1962), and Mahesh and coauthors (2023) validated that these diverse subjects, when combined, explain the depth of knowledge traditions, which were both methodical and experimental in nature. The close link between these areas of study created a comprehensive and coherent intellectual heritage.

The education tradition in ancient India began with the Gurukul system, a mentor-disciple model that emphasised holistic and ethical development (Kachappilly, 2003; Srivastava & Singh, 2024; Rajguru, 2024). By the 6th century BCE, these had evolved into formalised

Vishwavidyalayas (Universities), and Takshashila earned recognition as one of humanity's earliest multidisciplinary centres (Marshall, 1975). For over a millennium, distinguished institutions such as Nalanda, Vikramshila, Vallabhi, and many others functioned as global hubs of learning, attracting scholars from Greece, China, Persia, and Tibet to advance scientific innovation and philosophical discourse (Apte, 1961; Mahesh *et al.*, 2023).

A protracted decline ultimately extinguished the golden age of these knowledge centres. Forces of the invaders, like Bakhtiyar Khilji, critically disrupted the flow of knowledge transmission by ransacking major centres of learning, including the famous universities like Nalanda, Valbhi, and others, during the 12th and 13th centuries, as described by Apte (1961) and Mandal & Mandal (2023). Colonial administration compounded physical damage with intellectual demotion. It systematically characterised Indian scientific texts as spiritual mythology while imposing Eurocentric curricula to marginalise Vedic and Post-Vedic knowledge systems (Peters, 2019; Kambala & Mathe, 2023). In response to this historical amnesia, the National Education Policy (NEP) 2020 mandates the rejuvenation of ancient educational heritage through the active integration of Indian Knowledge Systems (IKS) into contemporary learning. It explicitly looks to ancient universities as role models of holistic, multidisciplinary education (NEP, 2020). However, a significant gap persists between this high-level policy directive and public awareness; the grandeur and contributions of these ancient institutions remain largely confined to academic circles, with a stark lack of engaging models for public dissemination (Kumar & Singh, 2022).

This paper presents an **action research** that addresses this gap. It examines how the **Param Science Experience Centre (SEC)** operationalises the NEP's vision through its **Ancient Indian Heritage Gallery**. Through an action research methodology, this paper documents the creation of experiential modules that explore the scholarly networks and global scientific impact of ancient Indian universities such as Nalanda and Takshashila. The research presents

how the SEC utilises innovative, immersive technologies, such as interactive murals and augmented reality, to translate complex historical content into accessible public engagements (Turkmen & Yildirim, 2024; Sun & Othman, 2025). This study eventually demonstrates how science experience centres can serve as an effective medium to revive public understanding of ancient Indian universities and their legacy, thereby supporting the broad objectives of NEP 2020.

This paper is organised into six main sections, including an introduction and a conclusion. Section 2 presents a literature survey outlining the legacy of ancient Indian universities, providing context for our study and allowing us to identify the specific research gap that this study aims to pinpoint. The 3 sections give the research methodology that elaborates on the action research process that guided the iterative design, prototyping, and refinement cycles for the experiential modules. Section 4 presents findings and analysis. Section 5 states the discussion covering the four designed modules and analyses their pedagogical significance. The last section presents a conclusion.

Literature Review

This literature review lays the theoretical and contextual groundwork for the study by closely examining three areas: ancient Indian universities as models of integrated education, the disruption of this knowledge tradition, and the current policy drive for its restoration. Its main aim is to integrate these findings to pinpoint the research gap: a lack of robust, experiential approaches that convert academic work on Indian Knowledge Systems into engaging public experiences. This shortfall motivates the creation of the experiential modules presented in this paper.

Theoretical Foundations: The Gurukula to Vishwavidyalaya Ecosystem as a Pedagogical Model

The foundational unit of Indian education was the Gurukul, a mentor-disciple model prioritising residential, experiential learning and ethical development (Selvamani, 2019; Kachappilly, 2003). While the Gurukula system has been operational since the Vedic period, with profound cultural and scientific significance, this study concentrates on its post Vedic evolution into larger, formal institutions. The Gurukul system was not uniform but consisted of a variety of institutions. These included full-time residential schools, specialised centres for language studies, and combined schools that focused on both academic and moral education (Tiwari, 2024). In this residential learning environment, students (shishyas) lived with their teacher (Guru). They gained knowledge through formal lessons as well as by observing the Guru's daily behaviour and values. This approach aimed at overall personal growth, with a particular emphasis on building strong character rather than merely academic learning.(Altekar, 1944; Bhatt, 2018; Mishra & Aithal, 2023).

Driven by the growing prestige of certain teachers and strategic necessity, these Gurukuls evolved into larger, formalised institutions known as Vishwavidyalayas (Universities). A prominent example is Takshashila, which originated as an extension of the Gurukul tradition dating back to approximately 1000–600 BCE. Its prime location along key trade routes really helped it grow into a well-organised institution that offered a wide variety of subjects. By the 6th century BCE, it was not just a university, but one of the earliest major universities in the world, acknowledged for its historical significance (Marshall, 1975).

The evolution from Gurukuls led to the establishment of renowned universities that functioned as specialised hubs within a vast intellectual network. The table below consolidates information on important institutions, emphasising their founders, regional settings, specialised programs, and related scholars, derived from an amalgamation of historical documents and academic papers. ((Suresh, 2013; Barua, 2016; Mukherjee, 2019; Sinha, 2021; Mahesh *et al.*, 2023; Khichar & Lunayach, 2025), and references there in).

Table 1: Profile of Major Ancient Indian Universities (Vishwavidyalayas)

Name of University	Era of Establishment	Founder / Key Patron	Geographic Region	Specialised Subjects Taught	Notable Scholars & Alumni
Takshashila (Marshall, 1975)	600 BCE or earlier (flourished 5th century BCE)	Bharata Dynasty (Legends); Later kings of Gandhara	Present-day Pakistan	Medicine, Surgery, Archery, Warfare, Astronomy, Law, Politics, 18 Arts	Panini (Ashtadhyayi), Chanakya (Arthashastra), Charaka (Charaka Samhita), Jivaka, Vishnu Sharma
Nalanda (Mookerji, 1947; Apte, 1961)	5th century CE	Kumaragupta I (Gupta Empire)	Bihar, India	Buddhist Scriptures, Fine Arts, Logic, Grammar, Astronomy, Medicine, Philosophy (Yoga, Samkhya), Politics, Military Strategy	Nagarjuna, Aryadeva, Dharmapala, Silabhadra, Santarakshita, Kamalashila, Bhaviveka, Dignaga, Dharmakirti, Heiun Tsang
Valabhi (Apte, 1961; Dutta, 2015)	6th century CE	King Bhattarka (Maitraka Dynasty)	Gujarat, India	Hinayana Buddhism, Arthashastra, Brahmanical sciences, Law (Niti), Political Science, Varta, Theology, Agriculture, Chikitsashastra	Gunamati, Sthiramati
Vikramashila (Apte, 1961)	late 8th century. CE (775–800 CE)	King Dharmapala (Pala Empire)	Bhagalpur, Bihar, India	Buddhist Tantra, Logic, Metaphysics, Sanskrit Grammar, Philosophy	Atisha Dipankara, Ratnakarashanti, Naropa
Odantapuri (Nasrin & Kiron, 2025)	8th century CE	King Gopala (Pala Empire)	Magadha, Bihar, India	Buddhist Teaching, Philosophy	
Jagaddala	11th century CE	King Ramapala	Present-	Buddhist Tantra, Buddhist	Scholars for Sanskrit–

(Dutta, 2015)		(Pala Empire)	day Banglade sh	teachings- Vajrayana	Tibetan translation
Nagarjuna Konda (Reddy, 2024)	3rd-4th century CE	Ikshvaku dynasty	Andhra Pradesh	Buddhist philosophy, Botany, Medicine	
Pushpagiri (Roul, 2020)	3rd -11th century CE	Presumably, the King of Kalinga, Ashoka	Odisha, India	Mahayana, Vajrayana & Tantric Buddhism, Philosophy, Logic, Grammar, Astronomy	Prajna, Rahula, Aryadeva
Kanchipuram (Mahesh et al., 2023)	4th–5th century CE (as a major centre)	Pallava Dynasty	Tamil Nadu, India	Vedic Studies, Jainism, Buddhism, Sanskrit, Literature	Buddhaghosa, Bodhidharma, Dignaga
Kanthalloor (Panicker, 2020)	9th–12th century CE	Chera King Rama Rajasekhara	Kerala, India	Vedic Studies, Buddhist, and Jain Philosophy, Astronomy, Medicine, Martial Arts	Gautama Buddha, Adi Shankaracharya, Panini
Mithila (Videsha) (Potter, 2011)		King Janaka	Bihar and Jharkhand in India, and the eastern Terai region of Nepal	logic (Nyaya), Art, Crafts, Literature	Gangesha Upadhyaya (Tattva Chintamani), Vasudeva Sarvabhauma, Jagaddhara, Vidyapati
Ujjaini (O'Connor & Robertson)	5th-12th century CE		Madhya Pradesh, India	Astronomy, Mathematics, Agriculture	Brahmagupta (Brahmasphutasiddhanta), Bhaskara II, Varahamihira
Sharada Peeth (Deambi, 1982)	1st Millennium CE	Various Kashmiri Kings	Kashmir (Present-day POK)	Architecture, Law, Sanskrit, Philosophy, Grammar, Art, Science, Music, Medicine	Adi Shankaracharya (Advaita Vedanta), Kalhana, Ramanuja, Abhinavagupta

Note. This table consolidates information from multiple historical and academic sources.

This evolution establishes a foundational theoretical model for the present study: education as a holistic, residential, and experiential process. This ancient pedagogical framework, which prioritises immersive and active learning over passive reception, directly informs the core design principles of our experiential modules.

Historical Disruption and the Contemporary Policy Mandate

Ancient Indian rulers upheld their dharmic duty for centuries by actively funding and protecting these centres of learning and ensuring an uninterrupted transmission of knowledge (Rao, 2021). This ecosystem faced its first major disruption with a wave of invasions from the 12th century onwards. The sacking of universities such as Nalanda, Vikramashila, and Valabhi by invaders like Bakhtiyar Khilji resulted in the destruction of libraries containing millions of manuscripts and the killing or dispersal of their scholars. (Apte, 1961; Suresh, 2013).

During the colonial era, this physical destruction was compounded by policies that deliberately sacked Indian scientific texts as spiritual lore. (Kambala & Mathe, 2023). Important works of factual knowledge, such as the Charaka Samhita in medicine and the Surya Siddhanta in astronomy, were wrongly labelled as religious philosophy rather than being recognised as scientific treatises. This deliberate reclassification marginalised Vedic and post-Vedic knowledge traditions, severing the link between their philosophical underpinnings and their scientific applications, and distorting India's intellectual legacy for generations.

The National Education Policy (NEP) 2020, with its emphasis on the Indian Knowledge System (IKS), has brought the legacy of ancient Indian universities back into focus. These institutions were not just places to learn but vast, integrated hubs of knowledge where scientific exploration in areas such as Mathematics, Astronomy, and Medicine coexisted with rich philosophical and ethical discussions, often under a unifying Vedantic perspective (NEP, 2020).

Reviving this history is crucial for cultural pride. It presents a holistic model of education that integrates cultural awareness with a scientific temper, thereby enhancing critical thinking and problem-solving skills. Students who connect with the ancient Indian heritage legacy encounter a model of holistic, interconnected learning that complements the objectives of NEP 2020. The aim of which is to integrate traditional Indian knowledge with modern education and to enrich a more complete form of intellectual development (Lohani, 2024; Khichar & Lunayach, 2025).

Identifying the gap in Experiential Public Engagement

India possesses a rich heritage of advanced, multidisciplinary universities (2.1). Subsequent historical disruptions critically eroded this legacy (2.2). Now it is the explicit focus of a national revival policy. However, a critical abyss lies between this high-level policy directive and on-site public engagement. The current challenge is not a scarcity of information but a deficit of innovation in its transmission. The history remains confined mainly to academic texts, lacking engaging, practical models to translate this profound legacy into accessible, immersive experiences for a diverse public (Kumar & Singh, 2022).

This identified gap provides a compelling justification for the present action research of the Ancient Indian Heritage Gallery at the Param Science Experience Centre. The project represents a direct, applied response to the mandate of NEP, moving beyond theoretical discourse to operationalise IKS through experiential learning. The study takes an action research based approach to design an immersive intervention and aims to provide a replicable model for effectively bridging the divide between ancient Indian intellectual heritage and its contemporary public consciousness.

Research Methodology

This study adopts an action research methodology to guide the development and refinement of the Ancient Indian Scientific Heritage Gallery at the Param Science Experience Centre. The research team selected this approach specifically for its iterative, practitioner oriented nature,

which is essential for designing and evaluating educational interventions in real-world settings (Reason & Bradbury, 2008).

The Param SEC's core curatorial filters guide our entire process and provide a constant framework for decision-making. These filters are:

- The 4E Experience Filters: Ensuring every module delivers on Education, Entertainment, Esthetic (US variant), and Escapism.
- The 3C Brand Filters: Embedding Creativity, Curiosity, and Confidence in both the visitor's journey and our design process.
- The 3R Safety Filters: Ensuring Reassurance, Robustness, and Rigidity in the physical and operational installations.

We applied this approach to develop the Gallery, a defined initiative that addresses the public engagement gap with Indian Knowledge Systems (IKS) (Yadav & Ravjani, 2023). The primary aim of this methodological structure is to actively document, analyse, and refine the curation process through cyclical iterations of planning, action, observation, and reflection using these filters as our qualitative benchmarks. The methodology was designed to answer our central research question: how can a science experience centre transform academic research into engaging, real-world experiences? The following subsections detail how this filtered, reflective framework was applied.

Adapting Action Research to Our Context

Our work on the experience centre exhibit development relied on the action research cycle and incorporated principles from design-based research (Design-Based Research Collective, 2003).

We adopted the perspective, common in science centre practice, that each exhibit concept is a provisional hypothesis; its actual validity and appeal are only confirmed through direct testing and observation with public audiences (Hsi & Fait, 2005). We applied this experimental approach within the lively, versatile environment of the Param SEC, where the 3C filters

(Creativity, Curiosity, Confidence) fundamentally shaped our team's (comprising researchers, curators, software developers, and spatial designers) collaborative culture. The process evolved into interconnected, reflective loops, where every decision was evaluated against our filters of 4E Experience goals and 3R Safety requirements, confirming that all outcomes were both impactful and institutionally sound.

The Action Research Cycle in Practice and Evolving Outcomes

The iterative nature of action research allows for the integration of research and practice, ensuring the gallery is both theoretically grounded and responsive to audience needs (Stringer, 2014).

Cycle 1: Planning and Historical Research (The Foundational Iteration): We started our project with an extensive literature survey to establish a verified knowledge base, grounding our work in established scholarship. This approach aligns with the first stage of design-based research, where existing literature informs the understanding of a practical problem (Anderson & Shattuck, 2012). From this research, we developed a detailed framework that outlined the project's core themes and narratives.

We deliberately fused our historical research with experiential design from the very beginning. When we discovered the vast Gyan Marg (knowledge network), we immediately applied the 4E filter, asking: Can we make this both Educational and a form of Escapism? This line of questioning directly inspired the Interactive Akhanda Bharat Mural. Similarly, guided by the 3C filter of Curiosity, we identified the most compelling scholarly figures and scientific discoveries from each university. Also, documents describing the destruction of university libraries suggested the emotional core for the Invasion Day escape room. This ensured our foundational content would not only capture immediate visitor interest but also offer richness for future gallery expansions.

Cycle 2: Acting and Prototyping (The Iterative Translation): This phase marked a

breakthrough in our project, as we progressed our research to concrete exhibit prototypes. We build upon the experiences of our earlier galleries, such as the content-rich Vimana gallery and the interactive Maya Gallery, to guide and refine our collective design sessions. In these sessions, we used a step by step prototyping approach to transform conceptual models into practical education based settings, consistent with design-based research principles (Design-Based Research Collective, 2003).

This hands-on process included the core modules of the Heritage Gallery: an escape room, an interactive mural, a treasure hunt trail, and augmented reality experiences, all conceived to relate traditional Indian knowledge with contemporary digital engagement (Jingjing et. al., 2024).

Our prototyping process evaluated every exhibit concept to rigorous testing against our curatorial framework. During pilot tests, we observed a critical disconnect: initial, minimalist room designs failed to deliver on the 4E's Esthetic and Escapism, while text-heavy panels actively undermined Entertainment and accessible Education.

This direct feedback prompted a period of reflection guided by our filters. We recognised that true immersion required deliberate environmental staging and that information must be conveyed visually to sustain engagement.

These insights directly shaped our actions:

- We introduced thematic interior design to enhance Esthetic appeal and deepen the sense of Escapism immediately.
- We overhauled all content into a visual-first format, significantly enhancing Entertainment value and clarifying Education content.
- We integrated concise scientific explanations to actively fuel visitors' Curiosity and build Confidence in their understanding.

Concurrently, the 3R Safety filters governed our technical execution. This led us to select

Robust hardware components and engineer Rigid physical mountings. That ensured user Reassurance and guaranteed the long-term operational stability essential for a public-facing installation.

Cycle 3: Observing and Reflecting (The Cycle of Continuous Refinement): This phase employs a mixed methods approach to validate the gallery's design principles. By combining quantitative metrics with qualitative insights, we generate actionable knowledge to guide its continuous evolution.

Our evaluation strategy is designed to measure the effectiveness of our filters continually. We gather quantitative data (visitor analytics, dwell time, and completion rates) to impartially measure Entertainment and Escapism. Above all, our qualitative observation focuses on visible signs of Curiosity and confident interaction. The subsequent reflection analyses this data to determine how well the exhibits deliver on their Educational promise and identify any gaps in user Reassurance. The final actions are not an endpoint but the next set of refinements to strengthen these filtered outcomes, ensuring the gallery remains a dynamic and resonant space for learning. This commitment to iterative evaluation and improvement is a hallmark of responsive museum practice (Black, 2012).

Findings and Analysis of Experiential Modules as Educational Tools

This section presents the core outcomes of our action research process for the design of four experiential modules curated for the Ancient Indian Heritage Gallery. We consider these modules not merely as exhibits, but rather as solutions to the people engagement gap identified in our literature review. This section explains how each module transforms ancient Indian university heritage into modern learning experiences, in line with the mandates of NEP 2020. We also evaluate their design and impact through the lens of our core curatorial filters: the 4E's (Education, Entertainment, Esthetics, Escapism), the 3C's (Creativity, Curiosity, Confidence), and the 3R's (Reassurance, Robustness, Rigidity).

Thematic Analysis of Precedent Establishing the Imperative for Interactivity

Our initial research cycle included an analysis of existing heritage galleries, as well as the Indian Heritage Gallery at the National Science Centre, Delhi, and the Indian Scientific Heritage Gallery at the Kurukshetra Panorama & Science Centre, Kurukshetra. A consistent finding was that they rely on passive knowledge display, artefacts, text panels, and static models, which resulted in low emotional resonance and visitor retention. This precedent confirms a critical design principle, given by Allen (2004), that active, participatory engagement is essential for effective IKS transmission. This insight guided our design philosophy to replace a passive look with an active approach, focusing on doing and feeling, and framing IKS as a living process rather than a historical artefact.

Synthesised Experiential Modules Analysed for Design Application and Implications

The following modules, prototyped in Cycle 2, constitute the primary findings of this study. The table below provides a consolidated overview of their design synthesis, followed by a detailed analysis of their contemporary relevance and implications, framed by our curatorial filters.

Table 2: Summary of Experiential Modules analysed for Application and Implications

Module	Historical Principle & Pedagogy	Exhibit Experience & Implementation	4E/3C Realization	Contemporary Relevance & Implication
The Invasion Day (Escape Room)	Principle: Collaborative knowledge preservation (Guru–Shishya Parampara). Pedagogy: Embodies urgency, teamwork and	Experience: Visitor groups become shishyas on a mission to save manuscripts from invaders, racing against a ticking clock guided by a narrative guru.	4E: High Escapism (narrative), Entertainment (puzzles), Education (historical context). 3C: Fosters Confidence	Relevance: Makes the abstract loss of historical knowledge an emotionally resonant, personal mission.

	problem-solving under guidance.	Implementation: time-pressured gamification, Phy-gital problem-solving puzzles, immersive storytelling, narrative instructions, sound effects, practical special effects, holographic visuals and a design-based progression system.	through teamwork and fuels Curiosity about the preserved knowledge.	Implication: Transforms cultural heritage from a passive subject to an active responsibility, directly combating historical apathy and aligning with NEP 2020's goal of fostering rootedness.
Interactive "Akhand Bharat" Mural	Principle: The interconnected knowledge network (Gyan Marg). Pedagogy: Visualises the ecosystem of scholars and ideas across the subcontinent.	Experience: A breathtaking bird's-eye view tactile map of ancient India, where tapping on university illustrations makes them "come alive" with information about scholars and innovations. Implementation: 2D art or 3D embossed elements with FRP, locations of universities marked across the map, interactive digital projection mapping, touch-screen kiosks	4E: Strong Esthetic (art), Education (geography, history). 3C: Sparks Curiosity through exploratory learning and demonstrates Creativity in data visualisation.	Relevance: Counters fragmented historical narratives by visually restoring a unified, pan-Indian knowledge ecosystem. Implication: Fosters a sense of shared intellectual heritage, supporting national integration and the holistic, multidisciplinary worldview championed by NEP 2020.
Treasure Hunt & Exhibit Trail	Principle: Structured, discovery-based learning (Shiksha). Pedagogy:	Experience: A pan-centre exploration where visitors find smart posters and kiosks, solve thematic puzzles	4E: High Entertainment (game), Education (self-directed). 3C: Drives Curiosity	Relevance: Shifts learning from a passive, teacher-led model to an

	Mirrors the journey of a student moving between Gurukuls for specialised knowledge.	and collect script letters to unlock the secret of a lost university. Implementation: Smart posters, interactive touch screen kiosks and a reward-based digital progression system.	and Creativity in problem-solving, building Confidence through successful discovery.	active, inquiry-based one. Implication: Provides a scalable, engaging blueprint for schools and museums to implement NEP's "learning by doing" and "critical thinking" mandates outside the classroom.
AR/MR Pop-Up Experiences	Principle: Pure experiential learning (Anubhuti). Pedagogy: Delivers hands-on experimentation directly to the learner.	Experience: Portable, immersive games to save scriptures and solve puzzles using AR/MR headsets Implementation: Augmented/ Mixed Reality headsets, portable, immersive software to create a scalable location	4E: High Escapism (digital immersion), Education (virtual reconstruction). 3C: Inspires Creativity and Curiosity through immersive technology.	Relevance: "Dematerialises" the museum, breaking physical barriers to access. Implication: Offers a low-cost, high-impact strategy for nationwide IKS dissemination, crucial for achieving equitable access to cultural education and supporting lifelong learning.

Note. AR = Augmented Reality; MR = Mixed Reality.

- **Safety and Robustness (3R Filters) Integration:** The 3R filters were applied critically across all modules. The physical interfaces were designed using straightforward and

intuitive controls to ensure user reassurance. We selected Robust hardware that can handle heavy public use without loss of performance. Each installation was built with Rigidity to secure long-term stability and protect visitor safety. The focus on reliability, durability and safety, the 3Rs, becomes a key factor for any institution that wants to adopt and sustain these models effectively.

- **Alignment with NEP 2020 and Education:** These modules transform ancient facts into empathetic, experiential journeys (Anubhuti), to support the NEP 2020's vision of replacing rote memorisation with experiential learning. They are designed to cultivate teamwork, critical thinking, and self-directed discovery, thereby encouraging a more integrated and multidisciplinary approach to education. They visually reinforce the NEP 2020 principle of integrated knowledge, showcasing that diverse subjects form a unified intellectual ecosystem. This makes the preservation of IKS a personally resonant task that operationalises the vision of taking IKS beyond textbooks into public, using cutting-edge technology to deliver the ancient belief of learning by doing.

Summary of Findings

Our analysis demonstrates that these modules function not in isolation, but as an integrated system that actively rejuvenates the core tenets of ancient Indian pedagogy. Collectively, they translate a cycle of experience (anubhuti) via immersion debate (shastrartha) with mutual problem solving. Also, reflection (manan) by self-directed discovery, and preservation (raksha) through a considerate approach to the question of historical loss.

The importance of this work is an action-based blueprint for the organisations working for science, culture and education. Our approach builds on three pillars. The 4E model ensures visitor engagement. The 3C principles help develop meaningful learning experiences. The 3R standards guarantee lasting implementation. This model transforms Indian Knowledge Systems from a policy idea into an engaging public experience, directly meeting NEP 2020's vision for

interdisciplinary and hands-on learning.

Discussion on Implications for Modern Education and Cultural Revival

The development of the Ancient Indian Heritage Gallery at the Param SEC represents more than a museum exhibition, a critical intervention in the contemporary educational landscape of India. This discussion examines the broader implications of our findings, how this experiential model deals with historical gaps, provides cultural revival, and creates new pathways to combine the Indian Knowledge Systems and modern education. The team now views earlier challenges not as obstacles, but as necessary parts of the transformation process.

An Experiential Structure for IKS Integration

This analysis shows that the Param SEC model effectively converts the theoretical concepts of ancient knowledge into practical, modern applications. The centre replaces passive, textbook-heavy learning with immersive activities, finally making Indigenous Knowledge Systems (IKS) accessible and engaging for a public audience. This approach aligns with constructivist learning theories, which emphasise knowledge construction through experience and social interaction (Vygotsky, 1978). The escape room, interactive mural, treasure hunt, and AR/MR experiences collectively create what educational researchers term an embodied learning environment, where visitors physically interact with an exhibit to gain a deeper understanding and connect with it on an emotional level, as suggested by Lindgren & Johnson-Glenberg (2013). This model offers a scalable framework for other institutions seeking to implement the outlines of NEP 2020 on IKS implementation. Schools can adapt simplified versions of the treasure hunt or AR experiences for classroom learning. Museums and cultural centres can implement full experiential approaches. The modular nature of the system enables easy tailoring of exhibits to different regions and their unique knowledge traditions. For example, a centre in Kerala might emphasise the legacy of Kanthalloor Shala, while one in Gujarat could focus on the contribution of Valabhi University to agriculture and law. The digital elements

can also be adapted into mobile apps, which allows the content to reach audiences far beyond the museum's walls. This scalability also indicates that the model can be applied to other projects, offering a practical design to review the Indian Knowledge System for a national movement.

Above all, the scalability and effectiveness of this model are basically guided by the 4E, 3C, and 3R filters introduced in our methodology. The 4E framework (Education, Entertainment, Esthetics, Escapism) ensures that any adaptation, whether a simplified school treasure hunt or a whole museum exhibit, remains engaging. The 3C pillars assure that the learning experience is meaningful and empowering. Also, the 3R standards provide the practical checklist needed for durable and safe implementation. This makes the model innovative and also sustainable for widespread use.

Healing the Historical Neglect by Feeling The Past

The intentional neglect of IKS and the systematic mischaracterisation of scientific texts as spiritual lore created a fundamental disconnect between contemporary Indians and their knowledge heritage. This model directly counters that neglect through what might be termed as experiential recovery. This approach does not treat IKS as a historical artefact, instead, it transforms these ancient knowledge systems into living processes for visitors to experience.

The escape room does not narrate the destruction of Nalanda, but it immerses visitors in the vital mission of knowledge preservation. This encourages investment of sentiments in what was lost in the past. The interactive mural visually restores the network of universities across ancient India, challenging the colonial narrative of isolated, primitive institutions. This approach aligns with what James Clifford (2013) identifies as the museum as a contact zone, a space where communities can actively engage with and reclaim their cultural heritage. By making visitors active participants in rediscovering and preserving IKS, the model facilitates what educational philosopher Freire (1970) would call a praxis of cultural revival: reflection

and action together upon the world to transform it.

Methodological Challenges as Foundations for Authenticity

This research addresses two common implementation challenges, interdisciplinary collaboration and significant funding requirements, as essential components of the method.

- To ensure historical accuracy, the project relies on a verification process involving historians, linguists, and researchers. This association prevents the distortion of the content and maintains the educational rigour of the exhibits.
- Public accessibility is a key priority in our immersive AR/VR transformative projects. To achieve this, sufficient funding is a fundamental necessity. This funding will enable us to ensure technical quality and reach a wider audience, making our projects truly inclusive.

Conclusion

This research addressed the historical decline of India's knowledge institutions and the resulting gap in public awareness of this intellectual heritage. To follow the National Education Policy (NEP) 2020 mandate and integrate Indian Knowledge Systems (IKS) into contemporary education, this research documented the curation process of the Ancient Indian Heritage Gallery at the Param Science Experience Centre.

The project follows an action research approach to create immersive exhibits that translate historical information about ancient Indian universities into engaging public experiences. Through iterative development cycles guided by our curatorial filters (4E, 3C, 3R), our team developed four key modules: an escape room, an interactive mural, a treasure hunt, and AR experiences. Each module communicates essential historical information, conveying the institutional foundations, key figures, academic disciplines, and circumstances that led to the decline of these knowledge centres.

This work explains how Science, History, and Cultural museums can effectively connect

historical knowledge with public engagement. The Param Science Experience Centre presents a practical structure of authentic information on ancient Indian universities underpinned by the 4E, 3C, and 3R principles, in accessible formats, which actively engage visitors to restore awareness of this significant intellectual legacy.

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References

1. Allen, S. (2004). Designs for Learning: Studying Science Museum Exhibits that Do More Than Entertain. *Science Education*, 88(S1), 17–33.
2. Altekar, A. S. (1944). Education in Ancient India. Nanda Kishore & Bros.
3. Anderson, T., & Shattuck, J. (2012). Design-based Research: A Decade of Progress in Education Research? *Educational Researcher*, 41(1), 16–25.
4. Apte, D. G. (1961). Universities in Ancient India (Education and Psychology Extension Series No. II). Maharaja Sayajirao University of Baroda.
5. Barua, J. B. (2016). Ancient Buddhist Universities in the Indian Sub-continent. Fulton Books, Inc.
6. Bhatt, R. (2018). Gurukul System of Education in Ancient India: A Historical Perspective. *Journal of Indian History*, 35(2), 112–125.
7. Black, G. (2012). Transforming Museums in the Twenty-first Century. Routledge.
8. Clifford, J. (2013). Returns: Becoming Indigenous in the Twenty-first Century. Harvard University Press.
9. Datta, B., & Singh, A. N. (1962). History of Hindu Mathematics. Asia Publishing House.

10. Deambi, B.K. Origin of Sharada Script, Chapter 1. Internet Archive.
11. Design-Based Research Collective. (2003). Design-Based Research: An Emerging Paradigm for Educational Inquiry. *Educational Researcher*, 32(1), 5–8.
12. Dutta, S. (2015). Buddhist Monks and Monasteries of India: Their History and Their Contributions to Indian Culture. Motilal Banarsidass Publishers.
13. Freire, P. (1970). Pedagogy of the Oppressed. Herder and Herder.
14. Hsi, S., & Fait, H. (2005). RFID enhances visitors' museum experience at the Exploratorium. *Communications of the ACM*, 48(9), 60–65.
15. Jingjing, L., Zheng, X., Watanabe, I., & Ochiai, Y. (2024). A Systematic Review of Digital Transformation Technologies in Museum Exhibition. *Computers in Human Behavior*, 161, 108407.
16. Kachappilly, K. (2003, October). Gurukula: A Family With Difference. Paper presented at the 3rd International “Soul in Education” Conference, Byron Bay, NSW, Australia.
17. Kambala, Y., & Mathe, R. (2023). The Impact of British Colonial Rule on the Indian Education System: Collapse and Deterioration. *International Journal of Current Innovations in Advanced Research*, 6(3), 7–11.
18. Khichar, V., & Lunayach, A. (2025). A Comparative Study of Ancient Indian Education System and Their Integration in Contemporary Educational Framework. *International Journal of Education, Modern Management, Applied Science & Social Science*, 7(2), 205–214.
19. Kumar, V., & Singh, P. (2022). Indian Knowledge System and Contemporary Education: Challenges and Possibilities. *Indian Journal of Education and Social Science*, 14(1), 55–68.
20. Lindgren, R., & Johnson-Glenberg, M. (2013). Emboldened By Embodiment: Six Precepts for Research on Embodied Learning and Mixed Reality. *Educational*

Researcher, 42(8), 445–452.

21. Lohani, N. (2024). Ancient Indian education: Its Relevance and Importance in Today's Education System. *Journal of Emerging Technologies and Innovative Research*, 11(3), 696-701.
22. Mahesh, K. M., Aithal, P. S., & Sharma, K. R. S. (2023). Literature Review on Indian Ancient University in Imparting Holistic and Multidisciplinary: To Create Indian Knowledge System (IKS). *International Journal of Philosophy and Languages*, 2(1), 1-16.
23. Mahesh, K. M., Aithal, P. S., & Suneel, K. S. (2023). Ancient Indian Universities “Institutional Repository” to Create Global Visibility for Learning and Research Review based Analysis. *International Journal of Philosophy and Languages*, 2(2), 115–128.
24. Mandal, R. K., & Mandal, A. K. (2023). Universities in Ancient Bharat. *STM Journals*, 1(1), 1–12.
25. Marshall, J. (1975). *Taxila: An Illustrated Account of Archaeological Excavations Carried Out at Taxila (Vols. 1–3)*. Cambridge University Press.
26. Ministry of Education, Government of India. (2020). National Education Policy 2020.
27. Mishra, N., & Aithal, P. S. (2023). Ancient Indian Education: Its Relevance and Importance in the Modern Education System. *International Journal of Case Studies in Business and Entrepreneurship*, 7(2), 238-249.
28. Mookerji, R. K. (1947). *Ancient Indian Education (Brahmanical and Buddhist)*. Macmillan and Co.
29. Mukherjee, S. (2019). Ancient Universities of India: Their Relevance Today. *Global Education Review*, 6(4), 78–92.
30. Nasrin, S., & Kiron, A. (2025). Odantapuri Mahavihara—An Important Buddhist

Institution: A Historical Review. *International Journal for Multidisciplinary Research*, 3(3), 994-1002.

31. O'Connor, J. J., & Robertson, E. F. (n.d.). MacTutor history of mathematics. University of St Andrews.
32. Panicker, G. S. (2020). Kanthallur Salai, A study. *Kerala Studies International Journal of Multidisciplinary Research*, 7(6), 1-15.
33. Peters, M. A. (2019). Ancient Centres of Higher Learning: A Bias in the Comparative History of The Uuniversity?. *Educational Philosophy and Theory*, 51(11), 1063–1072.
34. Potter, K. H. (Ed.). (2011). Encyclopedia of Indian Philosophies: Vol. 2. Indian metaphysics and epistemology: The tradition of Nyaya-Vaisesika up to Gangesa. Motilal Banarsidass Publishing House.
35. Rajguru, N. (2024). The Gurukul System: Ancient Pedagogical Practices and Their Role in Shaping Indian Knowledge Traditions. *International Journal for Multidisciplinary Research*, 6(6), 1-10.
36. Rao, D. (2021). Philanthropy and Education in Ancient India: A Study of Social Responsibility. *Indian Historical Review*, 48(1), 44–60.
37. Reason, P., & Bradbury, H. (Eds.). (2008). The SAGE handbook of action research: Participative Inquiry and Practice (2nd ed.). Sage.
38. Reddy, K. P. (2024). Nagarjuna Konda: A Journey Through Buddhist History and Culture. *International Journal of Research Cultural Society*, 8(8), 68-72.
39. Roul, K. (2020). Exploring Pushpagiri University of Ancient Odisha: Going Beyond the Eurocentric Knowledge System. *Odisha Review*.
40. Selvamani, P. (2019). Gurukul System—An Ancient Educational System of India. *International Journal of Applied Social Science*, 6(6), 1620–1622.
41. Sinha, R. (2021). Revisiting The Gurukul Tradition: Lessons for Modern Education.

Journal of Indian Cultural Studies, 9(2), 33–49.

42. Srivastava, L., & Singh, A. (2024). Study The Main Challenges of Ancient Indian Education System. *International Journal of Advanced Academic Studies*, 6(5), 119–123.
43. Stringer, E. T. (2014). *Action Research* (4th ed.). Sage Publications.
44. Sun, M., & Othman, A. (2025). The Impact of Virtual Reality Technology on Museum Audience Engagement. *International Journal of Academic Research in Progressive Education and Development*, 14(1), 1947-1956.
45. Suresh, P. (2013). Higher Education Institutions in Ancient Indian History. *International Journal of Creative Research Thoughts*. 1(3), 317–326.
46. Tiwari, K. (2024). Great Indian Knowledge Networks of Ashrams & Gurukuls For The Benefit of HEIs: Mandate of NEP 2020. *The International Journal of Bharatiya Knowledge System*, 1, 146-153
47. Turkmen, G., & Yildirim, Z. (2024). Exploring Science Centers' Educational and Organizational Approaches Through The Lens of Science Center Educators: Instructional Design Considerations. *Journal of International Museum Education*, 6(1), 1–42.
48. Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
49. Yadav, G., & Ravjani, D. (2023). Responsive Role of Museums: Establishing The Importance of Indian Knowledge Systems. DOI:[10.13140/RG.2.2.28684.90243](https://doi.org/10.13140/RG.2.2.28684.90243) .