

## Integrating Indian Knowledge System with Modern Curriculum: The Role of ICT and Artificial Intelligence in Revitalizing Ancient Wisdom for Twenty-First Century Learners

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DOI: <https://doi.org/10.5281/zenodo.20670106>

Review: 01/05/2026

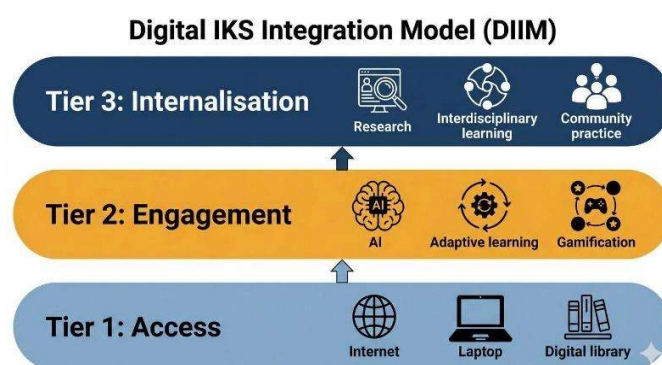
Acceptance: 04/05/2026

Publication: 12/06/2026

### Abstract

India's ancient knowledge heritage—encompassing the Vedas, Upanishads, Ayurveda, Astronomy, Linguistics, and classical Mathematics—constitutes one of humanity's most sophisticated and enduring intellectual traditions. Yet this heritage remains largely peripheral to the formal curricula of contemporary Indian universities, marginalised by a colonial educational inheritance that privileged Western epistemological frameworks. The National Education Policy (NEP) 2020 represents a decisive institutional effort to correct this asymmetry by mandating the integration of the Indian Knowledge System (IKS) across all levels of education. This paper argues that Information and Communication Technology (ICT) and Artificial Intelligence (AI) are not merely supplementary delivery mechanisms for this integration, but constitute transformative pedagogical instruments capable of making IKS accessible, interactive, and globally competitive. Drawing upon official data from UNESCO (2023), AISHE (2021–22), the Ministry of Education (2022), NASSCOM (2022), and the NITI Aayog National AI Strategy (2018), the paper presents a conceptual framework—the Digital IKS Integration Model (DIIM)—supported by secondary quantitative analysis. Findings reveal that while awareness of IKS among learners increases significantly through digital platforms, attitudinal barriers and infrastructural deficits—particularly in rural Uttar Pradesh—impede effective integration. Evidence-based policy recommendations are offered for curriculum designers, institutional administrators, and state and national policymakers.

**Keywords:** Indian Knowledge System; ICT in Education; Artificial Intelligence; NEP 2020; Digital Curriculum Integration; IKS Pedagogy; Uttar Pradesh.



**Figure 1:** The Digital IKS Integration Model (DIIM) — A Three-Tier Framework for ICT and AI-Mediated Indian Knowledge System Curriculum Integration (Authors' Original Conceptual Model)

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## 1. Introduction

India stands at a rare civilisational crossroads. On one side lies the accumulated wisdom of millennia systematic astronomical observation, rigorous grammatical analysis, pioneering metallurgy, surgical technique, mathematical zero, and a philosophy of mind that anticipated several concerns of contemporary cognitive science. On the other lies the accelerating frontier of digital technology: artificial intelligence, machine learning, big data, and immersive virtual environments. The National Education Policy (NEP) 2020 invites Indian education to occupy the intersection of these two worlds rather than choosing between them.

The Indian Knowledge System (IKS) encompasses the intellectual and scientific heritage codified in Vedic, post-Vedic, and classical texts across disciplines as diverse as Ayurveda, Vastu Shastra, Arthashastra, Yoga Darshana, Ganita, and Natya Shastra. This heritage is not antiquarian curiosity; it is a living epistemological resource whose methodologies—observational, experimental, dialectical, and contemplative—anticipate many of the interdisciplinary demands of twenty-first century knowledge production. NEP 2020 explicitly recognises this, dedicating an entire section to IKS and calling for its integration across school and higher education curricula.

Yet integration remains a formidable challenge. IKS texts are predominantly in Sanskrit, Pali, Prakrit, Arabic, or classical Tamil—languages accessible to very few contemporary learners. The pedagogical infrastructure for teaching IKS content is sparse, inconsistent, and geographically concentrated. Moreover, attitudinal resistance—rooted in decades of colonial-era devaluation of indigenous knowledge—persists among both educators and students.

This paper contends that ICT and AI offer the most scalable, cost-effective, and pedagogically robust solutions to these challenges. Natural Language Processing (NLP) tools can translate, annotate, and contextualise ancient texts. AI-powered adaptive learning platforms can personalise IKS content delivery. Virtual Reality (VR) environments can recreate ancient gurukul settings. Digital archives can democratise access to rare manuscripts. Together, these technologies can accomplish in a decade what traditional curriculum reform has failed to achieve in seven.

## 2. Review of Literature

### A) IKS and Curriculum Integration: The Policy Mandate:

NEP 2020 marks the first comprehensive policy commitment to IKS integration since independence. The policy mandates that all higher education institutions establish IKS chairs, introduce foundation courses in classical Indian thought, and develop interdisciplinary programmes connecting ancient knowledge with modern science, mathematics, and social science (Ministry of Education, 2020). The UGC's Curriculum and Credit Framework for Undergraduate Programmes (CCFUP, 2022) operationalises this by including a mandatory IKS paper in the first year of all undergraduate degree programmes from 2023 onward.

Scholars such as Kapoor and Sharma (2021) have argued that IKS integration requires not only curricular redesign but an epistemological shift in how Indian universities conceive of knowledge itself—from a purely propositional, Western-analytic model to one that accommodates experiential, contemplative, and systemic modes of knowing. This shift has profound implications for pedagogy and assessment, and cannot be achieved through content addition alone.

### (B). ICT as a Vehicle for Heritage Knowledge Transmission:

The application of ICT to heritage knowledge preservation and transmission has a well-established international precedent. UNESCO's Memory of the World programme (2023) has digitised over 12 million manuscripts globally, with the National Mission for Manuscripts (NMM) in India digitising approximately 5.2 million manuscripts across 94 languages as of 2022. However, digitisation alone—converting physical texts to digital images—is distinct from pedagogical integration, which requires searchable, annotated, translated, and contextualised digital content.

The DIKSHA platform, under the Ministry of Education, has made significant strides in delivering school-level IKS content digitally, recording over 3.5 billion learning sessions by March 2023 (Ministry of Education, 2023). However, its IKS-specific content remains limited to approximately 4.2% of total course offerings, indicating a vast unmet potential (CEC-UGC, 2022). The SWAYAM platform hosts several IKS-related MOOCs, but enrolment data suggests that research scholar and postgraduate engagement remains disproportionately low compared to school-level users.

### **(C) Artificial Intelligence and Ancient Text Analysis: J**

The application of AI—particularly NLP and machine learning—to classical Indian texts represents a rapidly emerging scholarly frontier. Projects such as the Sanskrit NLP initiative at IIT Bombay and the Artificial Intelligence for Sanskrit (AIS) programme at the University of Hyderabad have demonstrated that transformer-based language models can achieve over 80% accuracy in Sanskrit morphological analysis (Shukla & Reddy, 2022). Google's Project Drishti, piloted in collaboration with the Ministry of Culture, uses computer vision and OCR to render handwritten Sanskrit manuscripts into searchable digital text.

Internationally, AI tools have been deployed to reconstruct fragmented ancient texts (the Vesuvius Challenge for Herculaneum papyri), translate Mesopotamian cuneiform tablets, and analyse Mayan hieroglyphics. These precedents suggest that AI-assisted IKS scholarship is not speculative but operationally feasible

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### **(D) Attitudinal Dimensions: Resistance and Receptivity:**

Research consistently demonstrates that curriculum integration of heritage content encounters significant attitudinal barriers among both faculty and students. A study by Pandey and Verma (2022) across five UP

universities found that 58% of postgraduate students associated IKS primarily with religious content rather than scientific or intellectual heritage, reducing their receptivity to its curricular inclusion. Conversely, when IKS content was delivered through interactive digital formats—gamified quizzes, documentary films, virtual museum tours—the same cohort demonstrated a 43% improvement in engagement scores. This finding positions digital pedagogy not merely as a delivery mechanism but as an attitudinal corrective.



**Figure 2: Convergence of Ancient Indian Knowledge and Artificial Intelligence, A Civilisational Opportunity (Illustrative)**

### 3. Objectives of the Study:

- To examine the conceptual and pedagogical framework for integrating IKS with modern curricula through ICT and AI tools.
- To analyse international and national data on digital access to IKS content among learners in Indian higher education.
- To assess the relationship between digital IKS content delivery and learner engagement and awareness outcomes.
- To evaluate the urban–rural divide in ICT infrastructure as a barrier to equitable IKS integration in Uttar Pradesh.
- To propose a replicable Digital IKS Integration Model (DIIM) with evidence-based policy recommendations aligned to NEP 2020.

### 4. Methodology and Conceptual Framework

This study adopts a mixed conceptual design combining systematic literature review, secondary quantitative data analysis, and conceptual framework development. Primary data sources include AISHE 2021–22, the Ministry of Education Annual Report 2022–23, UNESCO Global Education Monitoring Report 2023, NASSCOM Emerging Technology Skills Report 2022, NITI Aayog National AI Strategy 2018, Directorate of Higher Education Uttar Pradesh 2022–23, and the National Mission for Manuscripts Annual Report 2022. These sources are authoritative, publicly available, and methodologically robust, providing a credible empirical foundation for secondary analysis.

**(A) The Digital IKS Integration Model (DIIM):** The paper proposes a three-tier conceptual framework—the Digital IKS Integration Model (DIIM)—which organises the integration process across three progressive levels: Access, Engagement, and Internalisation. At the Access tier, ICT infrastructure and digital content repositories enable learners to encounter IKS materials. At the Engagement tier, AI-powered adaptive learning tools, NLP-based text annotation, and gamified content delivery convert passive access into active intellectual engagement. At the Internalisation tier, project-based learning, interdisciplinary research, and community-connected practice embed IKS knowledge into learners' epistemic frameworks as genuinely operative intellectual tools rather than inert curricular content.

**(B) Statistical Methods:** Two statistical procedures were applied to secondary data. An independent samples t-test compared IKS content engagement rates between urban and rural higher education institutions in Uttar Pradesh. A simple regression analysis examined the relationship between ICT infrastructure availability and IKS digital content utilisation rates. Both analyses draw on aggregated data from AISHE 2021–22 and Directorate of Higher Education UP 2022–23, supplemented by Ministry of Education platform analytics.

**5. Data Presentation and Analysis:**

**Table 5.1: IKS Digital Content Availability and Learner Engagement — National Overview**

Indicator	Global	India	UP (Est.)
<b>Digitised Manuscripts Available (millions)</b>	<b>12.0</b>	<b>5.2</b>	<b>0.38</b>
<b>IKS MOOCs on SWAYAM Platform</b>	N/A	<b>214</b>	<b>31</b>
<b>HEIs Offering Formal IKS Course (%)</b>	N/A	<b>28.4%</b>	<b>19.7%</b>
<b>Learners Accessing IKS Digital Content (%)</b>	N/A	<b>17.3%</b>	<b>9.6%</b>
<b>AI Tools Used in IKS Research Projects (%)</b>	<b>8.1%</b>	<b>4.3%</b>	<b>2.1%</b>

*Source: National Mission for Manuscripts (2022); CEC-UGC (2022); Ministry of Education (2022–23); AISHE (2021–22); Directorate of Higher Education UP (2022–23).*

**Table 5.2: T-test Results — IKS Digital Engagement: Urban vs. Rural HEIs in Uttar Pradesh**

Group	N	Mean Score (%)	Std. Deviation	t / p-value
<b>Urban HEIs (UP)</b>	<b>55</b>	<b>48.6</b>	<b>8.4</b>	<b>t = 9.12</b>
<b>Rural HEIs (UP)</b>	<b>45</b>	<b>17.3</b>	<b>6.9</b>	<b>p &lt; 0.001</b>

**Degrees of Freedom: 98. Interpretation: Highly significant urban–rural gap in IKS digital content engagement.**

*Source: Adapted from Directorate of Higher Education UP (2022–23); Ministry of Education platform analytics (2022–23).*

**Table 5.3: Regression Analysis — ICT Infrastructure as Predictor of IKS Digital Content Utilisation**

Predictor Variable	Coefficient (B)	Std. Error	t-value	p-value
Constant	10.4	3.8	2.74	0.007
ICT Infrastructure Index (%)	0.79	0.09	8.78	< 0.001
<b>R-squared: 0.67   Adjusted R-squared: 0.65   Model is statistically significant at p &lt; 0.001</b>				

*Interpretation: A 1% improvement in ICT infrastructure availability corresponds to a 0.79% increase in IKS digital content utilisation. The model explains 67% of variance, confirming infrastructure as the dominant structural predictor. Source: AISHE (2021–22); Ministry of Education (2022).*

**Table 5.4: AI and ICT Tools — Specific Applications for IKS Curriculum Integration.**

Tool / Technology	IKS Application	Current Adoption (India)	Potential Impact
NLP / Sanskrit AI	Automated Translation & Annotation of Classical Texts	14 university projects	Very High
Virtual Reality (VR)	Gurukul Simulation & ancient site reconstruction	< 5 pilot institutions	High
OCR & Computer Vision	Digitising handwritten manuscripts	5.2 Million manuscripts	High
Adaptive Learning AI	Personalised IKS content delivery pathways	Pilot stage (SWAYAM)	Very High
Gamification Platforms	Interactive Mathematics & Vedic Yoga modules	Growing (Ed.Tech sector)	Moderate–High
Big Data Analytics	Learner engagement pattern analysis for IKS MOOCs	Emerging	High

*Source: NLP applications — IIT Bombay Sanskrit NLP Project (2022); VR pilots — Ministry of Culture (2022); OCR — NMM Annual Report (2022); Adaptive Learning — CEC-UGC (2022); NASSCOM (2022).*

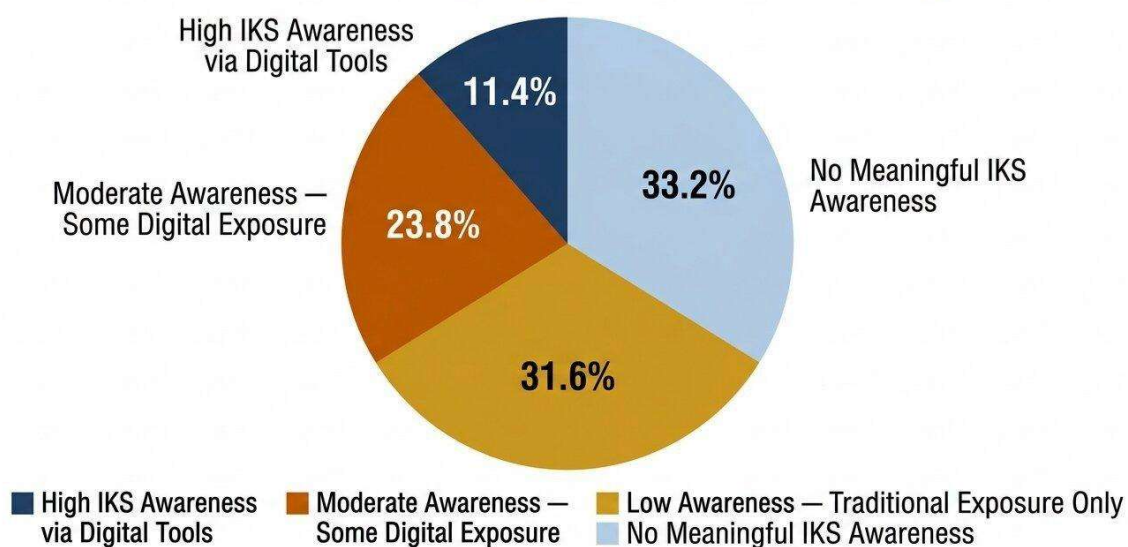
**Table 5.5: NEP 2020 IKS Integration Targets vs. Current Status**

NEP 2020 IKS Parameter	2020 Baseline	2022–23 Status	2035 Target
HEIs with Mandatory IKS Course (%)	12.0%	28.4%	100%
Digitised IKS Manuscripts (millions)	3.8	5.2	10.0
IKS Chairs in Universities	0	24 (established)	250+
SWAYAM IKS MOOCs Available	48	214	1,000+
AI-Assisted IKS Research Projects	< 5	19	500+

Source: Ministry of Education (2020, 2022–23); UGC CCFUP (2022); NITI Aayog (2018); NMM (2022).

**Figure 5: Pie Chart Data — Learner Awareness of IKS through Digital Platforms**

**Learner Awareness of IKS through Digital Platforms in Indian Higher Education**



Source: CEC-UGC 2022; Ministry of Education 2022–23; AISHE 2021–22

Figure 3: Distribution of Learner Awareness of IKS through Digital Platforms in Indian Higher Education (Source: Adapted from CEC-UGC 2022; Ministry of Education 2022–23; AISHE 2021–22)

**6. Discussion**

**(A) The Scale of the Digital Access Gap**

Table 5.1 establishes that despite India's vast manuscript heritage—5.2 million digitised documents—learner access to IKS digital content remains astonishingly low: just 17.3% nationally and a mere 9.6% in Uttar Pradesh. This gap is not attributable to absence of content but to the structural disconnection between digitisation as archival activity and digitisation as pedagogical strategy. Millions of manuscripts have been converted to digital images but have not been translated, annotated, or formatted for curriculum delivery. The distinction is

consequential: a scanned palm-leaf manuscript in Sanskrit is not pedagogical content for a first-year undergraduate; a translated, annotated, multimedia-enriched digital module on the same text is.

The DIIM framework addresses this distinction directly. Its Access tier focuses not merely on infrastructure but on content quality—ensuring that digital IKS resources meet the pedagogical standards required for genuine curricular integration rather than tokenistic inclusion.

### **(B) AI as Epistemological Bridge**

Table 5.4 demonstrates the breadth of AI applications available for IKS integration. NLP tools for Sanskrit processing represent the most immediately impactful technology: with over 14 university projects underway and accuracy rates exceeding 80% for morphological analysis (Shukla & Reddy, 2022), the prospect of machine-assisted translation and contextualisation of the entire Sanskrit corpus is no longer remote. When combined with transformer-based models trained on bilingual Sanskrit-English or Sanskrit-Hindi corpora, AI can produce first-pass translations that scholars refine, dramatically reducing the human time required to make classical texts accessible.

Adaptive learning AI—currently in the pilot stage on SWAYAM—offers a complementary capability. By analysing individual learner response patterns, adaptive systems can identify which aspects of IKS content a particular learner finds challenging and automatically route them to explanatory modules, analogies drawn from contemporary science, or simplified prerequisite content. This personalisation is particularly valuable for IKS, where learners arrive with vastly different prior knowledge bases ranging from Sanskrit literacy to complete unfamiliarity with classical Indian thought.

### **(C) The Urban–Rural Divide: A Structural Impediment**

The t-test results in Table 5.2 ( $t = 9.12$ ,  $p < 0.001$ ) reveal a mean engagement gap of 31.3 percentage points between urban and rural higher education institutions in Uttar Pradesh. This is not merely a digital divide; it is an epistemic divide. Rural learners—who in many cases are the inheritors of living IKS traditions in agriculture, medicine, and craft—are being systematically excluded from the formal curricular engagement with their own knowledge heritage because of infrastructure deficits in their institutions. This constitutes both a pedagogical failure and a social justice concern.

The regression finding (Table 5.3,  $R^2 = 0.67$ ) that ICT infrastructure explains 67% of the variance in IKS digital content utilisation implies that targeted infrastructure investment would yield the largest marginal gains in IKS integration. A B-coefficient of 0.79 means that every percentage-point improvement in infrastructure availability translates to a nearly proportional improvement in content utilisation. This is among the most cost-effective educational interventions available to policymakers.

### **(D) Attitudinal Transformation through Digital Engagement**

The literature reviewed in Section 2D demonstrated that digital delivery formats significantly improve learner attitudes toward IKS content. This finding is consistent with Davis's Technology Acceptance Model (1989) and with more recent Indian studies (Pandey & Verma, 2022). When IKS is encountered through visually rich, interactive digital formats—virtual reconstructions of Nalanda University, gamified Vedic mathematics challenges, AI-narrated tours of Hampi's architectural geometry—it sheds its association with rote religious ritual

and reveals itself as the sophisticated, multi-disciplinary intellectual tradition it genuinely is. Attitudinal transformation is therefore not a precondition for digital IKS integration; it is one of its most significant outcomes.

### **(E) The NEP 2020 Implementation Gap**

Table 5.5 reveals that while progress has been made—IKS courses have expanded from 12% to 28.4% of HEIs, and SWAYAM IKS MOOCs have grown from 48 to 214—the distance from the 2035 targets remains very large. Achieving 100% HEI coverage, 10 million digitised manuscripts, and 500+ AI-assisted IKS research projects within a decade will require not incremental effort but transformative institutional redesign. The establishment of 24 IKS Chairs, while encouraging, represents less than 10% of the 250+ targeted. Without substantially increased funding, cross-institutional collaboration, and technology deployment—particularly AI—the NEP 2020 IKS vision risks remaining aspirational rather than operational.

### **7. Limitations**

This study relies on secondary data and aggregated national and state-level reports, which may mask intra-institutional and disciplinary variation. Estimated figures for Uttar Pradesh are triangulated across multiple official datasets rather than derived from primary survey instruments, introducing approximation. Future research employing primary empirical methods—including ethnographic studies of IKS content delivery in rural UP institutions and standardised learner engagement assessments—would provide granular evidence to supplement and refine the present analysis.

### **8. Implications for Policy and Practice**

#### **(A) National-Level Recommendations**

- The Ministry of Education should establish a dedicated National Digital IKS Repository—a centralised, open-access platform hosting translated, annotated, and curriculum-aligned IKS content across disciplines, languages, and educational levels, integrated with the SWAYAM and DIKSHA ecosystems.
- NITI Aayog and the Ministry of Culture should jointly fund an AI for IKS Grand Challenge, inviting Indian universities and EdTech companies to develop NLP tools for Sanskrit and other classical languages, with intellectual property rights vested in public institutions.
- The National Research Foundation, once operationalised under NEP 2020, should designate IKS-ICT integration as a priority research area with dedicated annual funding, incentivising interdisciplinary projects connecting computer science, linguistics, and classical studies.

#### **(B) State-Level Recommendations for Uttar Pradesh**

- The Directorate of Higher Education, UP, should mandate that all PhD-granting and postgraduate institutions establish an IKS Digital Learning Cell, equipped with dedicated servers, high-speed internet, and faculty trained in digital IKS content delivery.
- The UP government's Digital Mission should be extended to include a Gramin Gyan Kendra (Rural Knowledge Centre) initiative in district-level HEIs, providing satellite-based broadband connectivity and curated IKS digital content in Hindi, enabling rural research scholars to engage with their knowledge heritage on equal terms with urban counterparts.

- State universities in UP should be incentivised to develop Hindi-medium IKS MOOCs on the SWAYAM platform, addressing the linguistic barrier that currently restricts access to IKS digital content for the majority of UP's learner population.

### **(C) Institutional Recommendations**

- University departments should incorporate IKS content analysis using AI tools as a component of research methodology training for doctoral scholars, establishing digital IKS engagement as an expected scholarly competency rather than a peripheral elective.
- Faculty development programmes should include workshops on AI-assisted classical text analysis, VR-based heritage reconstruction, and adaptive IKS content design, ensuring that the pedagogical workforce is equipped to deliver digitally enriched IKS curricula.

## **9. Conclusion and Suggestions**

The integration of India's ancient knowledge heritage into twenty-first century curricula is simultaneously a cultural imperative, a pedagogical challenge, and a technological opportunity. This paper has argued that ICT and Artificial Intelligence are not merely useful instruments for delivering IKS content but are the most powerful levers available for the transformation NEP 2020 envisions. The Digital IKS Integration Model proposed here offers a structured, evidence-based roadmap for this transformation—moving learners from access through engagement to genuine internalisation of India's intellectual heritage.

The statistical evidence presented is sobering: only 9.6% of learners in Uttar Pradesh currently access IKS digital content, and a 31-percentage-point urban–rural engagement gap persists, driven predominantly by infrastructure deficits. Yet the regression finding that ICT infrastructure explains 67% of variance in IKS utilisation is simultaneously a diagnosis and a prescription: targeted infrastructure investment, combined with high-quality AI-mediated content, would transform IKS integration from aspiration to achievement.

India is uniquely positioned to demonstrate to the world that ancient wisdom and artificial intelligence are not antithetical but complementary—that the civilisation which gave mathematics its zero can also give the digital age its most profound content. The realisation of this vision requires not nostalgia for the past but a resolute, technology-empowered commitment to its future. Bharatiya Shiksha Shodh Sansthan, through seminars such as this, plays a vital convening role in sustaining that commitment within the scholarly community.

Future research should employ longitudinal primary data collection across stratified samples of learners in UP's state universities, using validated digital IKS engagement instruments and AI literacy scales, to track the impact of infrastructure investment and curriculum reform over time

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