AI-Driven Personalised Learning Models Inspired by Indian Knowledge Systems in Modern Classrooms

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Abstract:
The rapid expansion of Artificial Intelligence (AI) in education has opened new possibilities for personalised learning, yet existing models often lack cultural contextualisation and holistic pedagogical grounding. This study explores the integration of AI-driven personalised learning with Indian Knowledge Systems (IKS) to create learner-centric, culturally rooted, and adaptive educational environments for modern classrooms. A significant research gap exists in connecting ancient Indian pedagogical traditions—such as the Gurukul model, Swadhyaya (self-directed learning), Tarka (logical inquiry), and Anukarana (learning through observation)—with contemporary AI methodologies. To address this, the study employs a secondary data methodology, drawing insights from scholarly literature, NEP 2020 policy documents, IKS frameworks, and digital research repositories. The analysis indicates that AI personalisation strategies naturally align with IKS practices: mentor-based adaptive feedback reflects the guru–shishya system, self-paced modules mirror Swadhyaya, reasoning-centred AI tutoring parallels Tarka, and multimodal learning technologies replicate Anukarana. These findings suggest that integrating IKS principles into AI-powered platforms can foster holistic learning, enhance cognitive engagement, and support value-based education. The implications extend to curriculum designers, policymakers, EdTech developers, and educators aiming to implement culturally meaningful AI systems. Overall, this study presents a conceptual foundation for building future-ready AI learning models inspired by India's rich educational heritage.

Keywords: Artificial Intelligence in Education (AIED), Indian Knowledge Systems (IKS), Personalised Learning Models, Gurukul and Swadhyaya Pedagogy, AI-Driven Adaptive Learning

1. Introduction

2.1 Background of the Study

Artificial Intelligence (AI) is reshaping the landscape of global education by enabling personalised, data-driven, and adaptive learning experiences. With the increasing use of intelligent tutoring systems, machine learning algorithms, and predictive analytics, AI allows educational platforms to tailor instruction according to individual learner needs, pace, and capabilities. This shift towards personalisation is aligned with global trends aiming to make education more inclusive, efficient, and outcome-oriented. However, technological advancement alone cannot fully address the need for holistic learning, emotional development, and value-based education.

Indian Knowledge Systems (IKS) present a long-standing tradition of learner-centric, experiential, and holistic pedagogy. Rooted in practices such as the *Gurukul* model of mentorship, *Swadhyaya* (self-learning), *Tarka* (logical inquiry), and *Anukarana* (learning through observation), IKS emphasises personalised attention, ethical development, and the nurturing of individual potential. These philosophies parallel many principles underlying modern AI-based personalised learning, offering a rich foundation for culturally grounded educational innovation.

In contemporary classrooms, there is an increasing need to merge advanced technologies with culturally relevant pedagogical models. Integrating AI with IKS can help develop adaptable, culturally meaningful, and holistic learning environments that cater to both cognitive and emotional development. Such a model can bridge the gap between traditional wisdom and digital-era learning, making education more contextually rich, inclusive, and future-ready.

2.2 Problem Statement

Although AI-driven personalised learning systems have gained significant attention, most existing models emphasise cognitive personalisation—such as content adaptation, learner profiling, and performance prediction—while overlooking cultural, ethical, and pedagogical contexts. The absence of culturally rooted frameworks limits their relevance and holistic impact, especially in diverse educational settings like India. Despite the vast potential of Indian Knowledge Systems, research integrating IKS principles into AI-driven personalised education remains scarce. This gap highlights the need for a comprehensive framework that aligns AI personalisation with time-tested indigenous pedagogies to create meaningful and effective learning experiences.

2.3 Research Questions

1. How can AI personalise learning in alignment with Indian traditional pedagogies?
2. Which IKS principles can be structured as algorithms for adaptive learning?
3. What are the challenges and opportunities for integrating AI + IKS in modern classrooms?

2.4 Objectives of the Study

- To review and analyse secondary literature connecting AI in education with IKS pedagogy.
- To design a conceptual AI-driven personalised learning framework inspired by IKS.
- To identify implementation pathways for schools and EdTech platforms.

3. Literature Review

3.1 AI in Personalised Learning

Artificial Intelligence (AI) has significantly transformed personalised learning by enabling adaptive, data-driven instructional pathways. Adaptive learning systems analyse learner behaviour and adjust the complexity, sequence, and format of content in real time, thereby improving engagement and individual outcomes (Hariyanto, Kristianingsih, & Maharani, 2025). Reinforcement learning models further enhance personalisation by using trial-and-error optimisation to recommend the most suitable learning activities for each learner (Taşkın, 2024). Predictive analytics tools also play a crucial role by identifying students at risk of academic decline and suggesting targeted interventions to improve performance and retention (Gusnard & Wang, 2020).

Intelligent Tutoring Systems (ITS) replicate one-to-one tutoring by diagnosing learner misconceptions, offering customised hints, and providing feedback aligned with learner progress. Recent reviews (Liu, Latif, & Zhai, 2025) illustrate how ITS integrate machine learning and natural language processing to deliver context-sensitive support, often outperforming traditional instruction. However, most of these AI systems are developed using Western pedagogical perspectives and datasets, limiting their cultural relevance in Indian classrooms (Jha & Biswal, 2022). This highlights the need for AI models aligned with indigenous pedagogical philosophies such as Indian Knowledge Systems (IKS).

3.2 Foundations of Indian Knowledge Systems (IKS)

Indian Knowledge Systems (IKS) encompass a wide spectrum of educational, philosophical, and scientific traditions rooted in holistic development. The *Guru–Shishya parampara* emphasises personalised mentorship, moral development, and experiential learning—principles that closely align with AI-driven personalised learning (Chattopadhyay, 2019). Practices such as yoga and meditation support cognitive readiness, emotional regulation, and focus, making them relevant for AI models designed to enhance learner well-being and attention (Chakrabarti & Vidya, 2020).

Tarka Shastra, or Indian logic, promotes structured reasoning and analytical thinking, comparable to hierarchical learning taxonomies like Bloom's model. These reasoning frameworks can inform AI tutoring systems designed to develop critical thinking (Bhandari & Narayan, 2021). Similarly, *Swadhyaya* (self-directed learning) resonates strongly with adaptive, self-paced digital learning modules. *Anukarana*—learning through observation—aligns with modern AI-based simulation tools and AR-supported imitation learning. Additionally, Ayurvedic notions of learner constitution (*Prakriti* types) offer a culturally grounded framework

for profiling individual learning dispositions (National IKS Division, 2021). Collectively, IKS pedagogy provides a rich foundation for culturally contextualised AI models.

3.3 Gaps in Current Research

Despite progress in AI-based personalised learning, significant gaps persist. Existing AI systems rarely incorporate cultural or value-based pedagogies, resulting in learning experiences that may not resonate with Indian learners (Jha & Biswal, 2022). Few studies systematically integrate IKS methods—such as *Swadhyaya*, *Tarka*, or *Anukarana*—into algorithmic personalisation or adaptive learning frameworks. Most IKS literature remains descriptive and conceptual, lacking computational models that translate traditional pedagogies into AI-driven systems (Vasudevan, 2018).

Additionally, there is limited empirical research evaluating AI models designed explicitly around IKS principles. National policy documents, such as NEP 2020, encourage integrating IKS into curricula, yet few technological frameworks operationalise this vision (Bhandari & Narayan, 2021). Thus, there is a critical need for innovative AI architectures that merge indigenous epistemologies with personalised digital learning environments. This study addresses this gap by proposing an AI-driven personalised learning model inspired by IKS.

4. Theoretical Framework

This study employs a multidimensional theoretical framework that integrates contemporary educational theories with traditional Indian pedagogical principles to conceptualise an AI-driven personalised learning model. The framework draws upon constructivism, Indian Knowledge Systems (IKS), and AI personalisation theories, creating a cohesive lens through which modern technology and ancient wisdom converge to enhance classroom learning.

4.1 Constructivism + IKS Pedagogy

Constructivism posits that learners actively construct knowledge through personalised, meaningful experiences rather than passively receiving information. This learner-centred philosophy resonates strongly with Indian Knowledge Systems, where education historically emphasised *anubhava* (experiential learning), *adhyayan* (deep study), and individualised mentorship within the *Guru–Shishya* tradition. Both perspectives stress the importance of context, reflection, and self-directed inquiry. When applied together, constructivism and IKS pedagogy create a powerful foundation for personalised learning, highlighting the need for adaptive pathways that respond to each learner's cognitive, emotional, and cultural background. This combined foundation justifies the integration of AI technologies that can personalise content, pace, and support in ways that mirror IKS-inspired holistic practices.

4.2 AI Personalisation Frameworks

AI-driven personalisation draws upon several technical frameworks capable of tailoring educational experiences to individual learners. Machine Learning (ML) learner profiling enables the system to analyse behavioural patterns and academic performance to predict learning needs. Intelligent Tutoring Systems (ITS) simulate one-to-one mentorship by offering targeted feedback, hints, and explanations. Behavioural analytics monitor engagement levels, attentional patterns, and learning habits to refine the instructional strategy. Additionally, cognitive load management ensures that the learning experience remains optimally challenging by adjusting content complexity based on real-time learner performance. These AI frameworks provide the computational backbone necessary to operationalise personalised learning models that reflect IKS principles of responsiveness, adaptability, and holistic development.

4.3 Integration Model

The integration model aligns core IKS pedagogical methods with corresponding AI functions to construct a culturally responsive and technologically advanced learning environment. The Guru–Shishya model maps onto AI mentorship dashboards, enabling personalised guidance similar to traditional one-to-one learning. Swadhyaya, or self-learning, aligns with self-paced adaptive modules, allowing learners to progress autonomously as per their readiness. The logical inquiry tradition of Tarka connects with reasoning-based AI tutoring systems, which foster analytical thinking through structured questioning. Lastly, Anukarana, the practice of learning through observation, integrates naturally with computer vision and AR-based imitation learning technologies, enabling learners to mimic skills or behaviours demonstrated through digital simulations. Together, these alignments create a comprehensive framework for AI-IKS integration, ensuring both cultural relevance and pedagogical effectiveness.

5. Research Methodology

This study adopts a systematic, qualitative, and conceptual research methodology to explore how AI-driven personalised learning can be integrated with Indian Knowledge Systems (IKS) for modern classroom applications. The methodology incorporates a structured literature review, thematic analysis, and conceptual modelling based entirely on secondary data available before February 2025.

5.1 Research Design

The research follows a qualitative research design, emphasizing interpretive analysis rather than numerical generalisation. It includes:

1. **Systematic Review:**

A structured search and evaluation of existing research on AI in education, personalised learning frameworks, and traditional Indian pedagogical systems.

2. **Conceptual Modelling:**

Development of a theoretical AI–IKS integration model based on identified themes and patterns.

The qualitative approach is justified because the objective is to understand relationships between concepts—AI technologies and IKS pedagogies—rather than measuring their statistical impact.

Flowchart of Research Design (Text-Based Graph)

Literature Search → Screening → Thematic Coding → Interpretation → Conceptual Model

5.2 Secondary Data Sources

Secondary data forms the foundation of this study. Data were collected from academic databases, published policy documents, and institutional repositories.

Table 1: Overview of Secondary Data Sources

Category	Examples	Purpose
Academic Journals	Scopus, Web of Science, IEEE	Identify AI methodologies, adaptive learning technologies
Indian Journals	IKS-related publications	Understand Gurukul, Tarka, Swadhyaya, Anukarana pedagogies
Government Documents	NEP 2020, IKS Framework 2021–24, NCERT, NCF	Extract national educational priorities and cultural frameworks
Repositories	Google Scholar, Shodhganga, JSTOR, UNESCO	Collect diverse global and Indian perspectives
IKS Projects	AICTE, MoE–IKS Division	Access contemporary initiatives linking IKS and modern education

A. Academic Sources

Academic sources include high-impact journals and conference proceedings.

- Scopus and Web of Science provided empirical studies on AI-based personalised learning and machine learning applications in classrooms.
- IEEE Xplore offered insights into intelligent tutoring systems, cognitive modelling, and adaptive learning algorithms.
- Indian journals focusing on education and IKS were reviewed to extract traditional teaching methods such as *Gurukul*, *Tarka*, *Anukarana*, and *Swadhyaya*.
- Reports from AICTE and IKS Division–MoE helped connect ancient pedagogies with current educational innovations.

B. Government & Policy Documents

Key policy documents such as NEP 2020, IKS Framework (2021–2024), and NCERT/NCF position papers served as essential references to understand national strategies supporting personalised learning and integration of IKS into curricular reforms. These documents highlight the Indian government's increasing emphasis on technology-enabled, culturally grounded learning models.

C. Repositories & Databases

The literature search included diverse global and national repositories:

- Google Scholar for broad academic coverage

- Shodhganga for Indian theses and dissertations
- JSTOR for historical and philosophical perspectives on IKS
- UNESCO AI in Education reports for international AI ethics and implementation guidelines
- IKS Digital Repository for authentic translations and documentation of traditional knowledge systems

Simple Bar Graph Representing Data Source Usage Frequency (Illustrative)

5.3 Data Collection Procedure

The data collection procedure for this study followed a systematic and structured approach to ensure the reliability, relevance, and comprehensiveness of the secondary sources used. Since the research is conceptual and qualitative in nature, the emphasis was placed on identifying high-quality academic literature, policy documents, and institutional reports published before February 2025. The procedure involved four major stages: defining keywords for literature search, applying inclusion and exclusion criteria, conducting iterative screening, and organising the final dataset for thematic analysis.

1. Defining Keywords

The first step involved generating a list of relevant keywords and search strings that would guide the literature search across academic databases and digital repositories. These keywords were selected based on the study's focus on AI-driven personalised learning and Indian Knowledge Systems (IKS). Examples include:

- "AI personalised learning,"
- "Indian Knowledge Systems education,"
- "Gurukul pedagogy and AI,"
- "Adaptive learning models,"
- "Swadhyaya AI,"
- "AI ethics education India,"
- Additional combinations such as "Tarka logic AI," "Anukarana imitation learning," "IKS digital pedagogy," and "AI mentoring frameworks."

Keywords were used with Boolean operators (AND, OR) to widen or narrow search results depending on the database.

2. Applying Inclusion Criteria

After initial keyword searches, inclusion criteria were applied to filter sources that align with the scope and purpose of the study. The inclusion criteria were:

1. Publication Timeline:

Only documents published between 2015 and February 2025 were considered to ensure relevance to recent AI advancements and contemporary IKS reforms.

2. Topical Relevance:

Studies focusing on AI in education, personalised learning frameworks, or Indian Knowledge Systems pedagogy were included.

3. Institutional Authenticity:

Reports from reputable institutions such as AICTE, Ministry of Education (IKS Division), NCERT, UNESCO, IEEE, and high-impact peer-reviewed journals were prioritised.

This ensured that the dataset comprised reliable, credible, and academically useful materials.

3. Applying Exclusion Criteria

To refine the dataset further, exclusion criteria were applied to remove sources that lacked academic depth or meaningful relevance. Excluded materials included:

- Non-academic articles, blog posts, news features, or opinion pieces lacking scholarly rigour.
- Studies that did not address the integration of AI with pedagogy, or lacked direct relevance to IKS, even if they discussed AI generally.
- Publications that were outdated, duplicated, or lacked methodological transparency.

This filtering strengthened the dataset by ensuring conceptual precision and thematic consistency.

4. Organising the Data

After screening, the remaining documents were systematically organised to support thematic and conceptual analysis. This process involved:

1. **Summarising Key Arguments:**

Each selected source was reviewed to extract major insights on AI methods, personalised learning strategies, and IKS pedagogical principles.

2. **Categorising AI Methods & IKS Pedagogy:**

Data were organised into clusters—such as machine learning profiling, intelligent tutoring, Gurukul mentorship, Tarka reasoning, Swadhyaya self-learning, and Anukarana observation-based learning.

3. **Identifying Gaps:**

Comparative analysis allowed identification of gaps in existing literature—particularly the lack of integrated AI-IKS frameworks, limited cultural contextualisation in AI models, and minimal research linking ancient Indian pedagogy to contemporary digital technologies.

Through this structured procedure, the study ensured that the secondary data collected were relevant, credible, and aligned with the research objectives, enabling the development of a robust conceptual model for AI-driven personalised learning inspired by Indian Knowledge Systems.

5.4 Data Analysis Technique

The study employs a multi-layered qualitative analysis approach to interpret secondary data and construct an integrated framework combining AI-driven personalised learning with Indian Knowledge Systems (IKS). Three primary analytical strategies were used: Qualitative Content Analysis, Thematic Analysis, and Comparative Analysis.

Qualitative Content Analysis

Qualitative content analysis was conducted to categorise and interpret concepts from the collected literature. This involved coding both AI-related features and IKS pedagogical principles to identify areas of alignment and divergence. AI features such as adaptivity, assessment mechanisms, and learner profiling were coded to understand how existing systems personalise learning. Similarly, IKS principles including self-learning (Swadhyaya), observation-based learning (Anukarana), logical reasoning (Tarka), and personal mentorship (Guru–Shishya) were coded to reveal traditional approaches to personalised learning. Once coded, recurring patterns and intersections were identified to understand how technological elements correspond to indigenous pedagogical frameworks. This coding process allowed for the systematic integration of historical and contemporary educational insights.

Thematic Analysis

Thematic analysis was used to group findings into broader conceptual categories. Themes emerging from the literature included personalisation logic, which explores how AI adjusts learning pathways; cognitive development alignment, which examines how both AI and IKS emphasise intellectual growth; cultural pedagogy integration, reflecting how IKS principles enrich AI models; and implementation challenges, including infrastructural, ethical, and pedagogical constraints. These themes provided a structured understanding of the potential synergy between AI systems and IKS-based holistic learning approaches.

Comparative Analysis

Comparative analysis enabled the evaluation of Western AI-driven personalised learning models versus IKS-aligned approaches. Western models often prioritise efficiency, cognitive performance metrics, and data-driven adaptivity, whereas IKS-informed models emphasise mentorship, moral development, experiential learning, and contextual relevance. By comparing these paradigms, the study highlights how integrating IKS principles can enrich AI systems, making them more culturally grounded and holistic.

This combined analytical approach ensures rigorous interpretation and supports the development of a robust conceptual model for AI–IKS integration.

6. Proposed AI-Driven Personalised Learning Model Inspired by IKS

The proposed model integrates Artificial Intelligence (AI) with Indian Knowledge Systems (IKS) to create a personalised and culturally grounded learning ecosystem. By aligning ancient pedagogical principles with modern adaptive technologies, this model aims to offer holistic learning experiences that address cognitive, emotional, and ethical dimensions.

6.1 Model Components

Learner Profiling Based on IKS Psychological Concepts

Traditional IKS frameworks emphasise understanding each learner's constitution, aptitude, temperament, and learning style. Drawing inspiration from concepts such as *Prakriti* (individual constitution) and *Gunas* (qualities), the AI system profiles learners across cognitive skills, behavioural tendencies, and emotional patterns. The profiling becomes the foundation upon which personalised pathways are created. Unlike generic AI profiling, this approach embeds cultural and psychological depth.

AI-Based Guru (Mentor) Dashboard

In the *Guru–Shishya* tradition, mentorship is personalised, continuous, and holistic. The AI-based mentor dashboard simulates this by offering real-time insights into student progress, learning challenges, emotional engagement, and readiness levels. Teachers or parents receive AI-generated suggestions for interventions, thereby enhancing personalised human support. The dashboard acts as a digital extension of the traditional guru, offering wisdom-driven guidance rather than generic performance data.

Swadhyaya Self-Paced Learning System

Swadhyaya, or self-study, is central to autonomous learning in IKS. The AI-powered self-paced system allows learners to engage with resources suited to their level, move through modules at their own speed, and explore enrichment content when ready. Adaptive algorithms adjust content difficulty, suggest reflective practices, and promote metacognitive skills—mirroring the self-discipline encouraged in IKS.

Tarka-Based Reasoning Tutor

Tarka, the art of reasoning and debate, is foundational to Indian logic. The reasoning tutor uses natural language processing (NLP) and structured prompts to encourage argumentation, critical thinking, and inquiry-based learning. Students engage in dialogue-like interactions with the AI tutor, fostering analytical reasoning and moral reflection. This ensures that learning goes beyond rote knowledge towards intellectual maturity.

AI-Assisted Observational / Imitation Modules

Anukarana, or learning through observation, is deeply embedded in Indian traditions. Using computer vision and augmented reality (AR), students observe demonstrations of skills—such as scientific experiments, artistic techniques, or yogic postures—and imitate them under AI guidance. The system analyses performance and offers corrective feedback, supporting skill-based and experiential learning.

6.2 Architecture Overview

The architecture of the AI–IKS model follows a continuous learning feedback loop:

Input: Learner Data

Data includes learner profiles, behavioural patterns, performance metrics, emotional indicators, and cultural learning preferences.

Processing: Adaptive Algorithms and ML Models

Machine Learning models analyse learner input, detect patterns, and predict learning needs. Cognitive load management ensures optimal pacing. Cultural alignment algorithms match pedagogical approaches with learner profiles.

Output: Personalised Learning Paths

Each student receives adaptive content, challenges, guided reasoning sessions, observational modules, and reflective tasks. The pathways evolve dynamically as learner behaviour changes.

Feedback: Reflective Analytics + Yogic Learning Readiness Practices

The system incorporates yogic principles such as mindfulness, focus enhancement, and emotional balance. Reflective analytics promote self-awareness, enabling learners to track progress and engage in self-regulated learning.

7. Discussion & Implications

7.1 For Schools

Curriculum Redesign

Schools need to integrate AI-supported personalised learning frameworks with IKS-based themes and values. This requires designing flexible curricula that allow varied learning speeds, interdisciplinary exploration, and reflective practices.

Teacher–AI Collaboration

AI must serve as an assistant, not a replacement. Teachers act as facilitators, mentors, and cultural anchors. The AI provides analytics, personalised pathways, and content suggestions, while teachers interpret data through human judgment and empathy.

7.2 For EdTech Companies

Cultural Localisation of AI Models

EdTech platforms must embed Indian cultural narratives, traditional logic structures, and regional languages into AI systems. This enhances relevance and learner engagement.

Development of IKS-Inspired Tutoring Agents

AI tutors can embody IKS principles such as mentorship, inquiry, discipline, and reflection. This creates meaningful, value-driven learning interactions.

7.3 For Policymakers

Ethical Usage of AI

Policymakers must ensure data privacy, transparency, and fairness in AI models. Ethical guidelines inspired by both global norms and Indian philosophical values are crucial.

Inclusion of IKS in NEP-Compliant Platforms

NEP 2020 encourages integration of cultural knowledge systems. Policymakers should promote AI solutions that incorporate IKS pedagogy at scale.

8. Limitations of the Study

The study relies solely on secondary data, limiting its empirical validation. Historical interpretations of IKS concepts may introduce bias, as IKS is documented inconsistently across texts and regions. Furthermore, the conceptual model has not been tested in real classroom scenarios, restricting practical generalisability.

9. Future Scope

Future research may involve developing AI-driven Gurukul simulation environments, allowing immersive interactions with virtual mentors. Neuro-cognitive studies could measure the impact of IKS-inspired AI learning on attention, memory, and emotional development. Pilot studies in real classrooms will be essential to evaluate the feasibility, scalability, and effectiveness of the proposed model.

10. Conclusion

Integrating AI with Indian Knowledge Systems offers a transformative approach to personalised learning. By combining advanced adaptive algorithms with culturally rooted pedagogies such as *Gurukul*, *Swadhyaya*, *Tarka*, and *Anukarana*, education can become more holistic, inclusive, and meaningful. The proposed model bridges ancient wisdom and modern technology, supporting learners' cognitive, emotional, and ethical growth. Such AI–IKS alignment has the potential to reshape India's educational landscape, enabling future-ready learning grounded in cultural identity.

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