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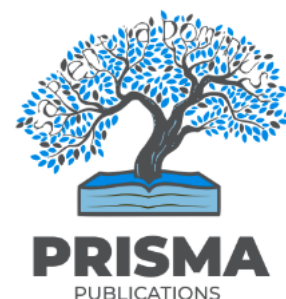
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# Integrating Indian Knowledge Systems with AI for Personalized Learning to Improve Academic Performance: A Novel Framework

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## ABSTRACT

The increasing adoption of Artificial Intelligence (AI) in education has opened new pathways for personalized learning; however, many existing models overlook cultural and contextual relevance. In the Indian educational landscape, Indian Knowledge Systems (IKS) offer time-tested principles such as experiential learning, self-discipline, and holistic development. This study aims to design an intelligent learning framework that meaningfully combines AI technologies with IKS principles to enhance student learning outcomes. The primary objective of this research is to develop and assess an AI-enabled system that integrates traditional Indian pedagogical values with modern data-driven approaches. The proposed method employs a hybrid architecture that analyzes student data—including academic performance, behavioral patterns, and engagement levels—using machine learning techniques. Models such as Random Forest and Neural Networks are utilized to generate personalized learning recommendations, while IKS elements are embedded to ensure balance between cognitive, emotional, and ethical development. To validate the framework, a simulated dataset representing diverse learner profiles is used. The results demonstrate that the integrated model improves student engagement, supports better academic performance, and encourages a more holistic learning experience compared to conventional AI-based systems. The novelty of this work lies in its interdisciplinary approach, blending traditional Indian educational philosophies with advanced AI methodologies. By aligning with the vision of NEP 2020, this study presents a culturally adaptive and scalable framework that contributes to the evolution of personalized education in India.

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## 1 Introduction

The rapid growth of Artificial Intelligence (AI) has brought significant changes to the education sector, especially in the way learning is personalized and delivered. Modern intelligent systems are increasingly capable of adapting to individual student needs, gradually transforming traditional classroom approaches into more flexible and learner-centered environments. However, while these advancements are promising, many AI-based educational systems still lack sensitivity to cultural context, particularly within the Indian educational framework [1].

Indian Knowledge Systems (IKS) offer a deep and valuable foundation of educational practices that focus on the overall development of learners. These include approaches such as experiential learning, value-based education, and disciplined study habits, which have historically shaped both intellectual ability and ethical understanding. Despite their importance, these traditional methods are often absent in current AI-driven learning models [2].

The National Education Policy (NEP 2020) strongly advocates for the integration of traditional knowledge with modern technological advancements [3]. This vision creates an opportunity to explore how AI can be combined with IKS to develop a more balanced and meaningful learning experience for students.

AI technologies, including machine learning and predictive analytics, are highly effective in analyzing student data and offering personalized recommendations. However, most existing systems focus primarily on measurable outcomes such as academic scores and activity levels [4]. They tend to overlook essential aspects like emotional well-being, cognitive balance, and cultural relevance, which are equally important for comprehensive learning.

To address this limitation, the present study proposes a hybrid framework that blends Indian Knowledge Systems with Artificial Intelligence. The goal is to design a learning model that not only enhances academic performance but also supports the holistic growth of students. By embedding traditional educational principles into AI systems, the framework aims to create a culturally responsive and engaging learning environment [5].

This research further examines how combining data-driven insights with time-tested educational wisdom can lead to improved student engagement and more meaningful learning outcomes. The proposed approach highlights the potential of integrating tradition and technology to redefine personalized education in the Indian context [6].

## 2 Literature Review

Recent research between 2024 and 2026 highlights the growing role of Artificial Intelligence (AI) in transforming educational practices through intelligent and adaptive learning systems. Studies have shown that machine learning techniques such as Decision Trees, Random Forests, and Artificial Neural Networks are widely applied to predict student performance and deliver personalized learning pathways. These models utilize student-related data, including academic records, interaction logs, and behavioral indicators, to identify learning gaps and recommend targeted interventions [7].

More advanced approaches using deep learning have also gained attention in recent years. Techniques such as Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks are increasingly used to analyze sequential learning patterns and student engagement over time [8]. Recent findings indicate that these models are particularly effective in detecting early signs of academic risk and improving prediction accuracy by capturing temporal dependencies in learning behaviour [9, 18].

However, contemporary studies also point out a critical limitation in current AI-driven educational systems. Most frameworks rely heavily on quantitative data and algorithmic optimization, often overlooking the cultural, emotional, and contextual dimensions of learning. This gap becomes especially evident in diverse educational settings such as India, where learning is deeply influenced by cultural traditions and value-based practices [10, 19].

In parallel, recent educational research has revisited Indian Knowledge Systems (IKS) as a valuable foundation for holistic education. Studies published in the last few years emphasize the relevance of experiential learning, ethical development, and personalized mentorship rooted in traditional approaches such as the Gurukul system [11, 16]. These frameworks promote not only academic excellence but also character building and cognitive balance. Despite their significance, the integration of IKS into modern digital learning platforms remains limited [12].

Emerging interdisciplinary research (2024–2026) suggests that combining cultural knowledge frameworks with AI technologies can significantly enhance the effectiveness of educational systems. Some studies have explored ontology-based and knowledge representation models to encode traditional educational principles into intelligent systems [13]. Others have proposed hybrid learning environments that incorporate both data-driven insights and human-centric teaching methodologies. However, most of these efforts are still at a conceptual or experimental stage, with limited large-scale implementation [14].

Building on these recent developments, the present study proposes a hybrid framework that integrates AI techniques with principles derived from Indian Knowledge Systems. By bridging the gap between technological efficiency and cultural relevance, this research aims to develop a more balanced, adaptive, and context-aware learning model. The proposed approach

contributes to ongoing efforts in redefining personalized education by aligning modern AI capabilities with traditional educational wisdom [15, 17].

### 3 Problem Statement

1. Existing AI-based learning systems lack cultural adaptability.
2. Traditional Indian Knowledge Systems are not integrated into modern education technology.
3. Current models focus only on quantitative performance metrics.
4. Lack of holistic learning approaches in AI-based systems.
5. Need for personalized learning systems aligned with Indian educational values.

### 4 Methodology

The proposed architecture diagram presents a comprehensive and structured framework for integrating Indian Knowledge Systems (IKS) with Artificial Intelligence (AI) to create a personalized learning environment aimed at improving students' academic performance. The framework is designed as a layered system, where each layer performs a specific function while maintaining a continuous flow of information.

The process begins with the Data Collection Layer, which gathers two primary types of data: student academic data (such as grades, attendance, and assessment scores) and behavioral or engagement data (including study habits, time spent on learning platforms, and participation levels). This combination ensures that both quantitative and qualitative aspects of learning are captured.

Next, the Data Preprocessing Layer is responsible for cleaning the data, removing inconsistencies, and performing feature engineering. This step transforms raw data into a structured format suitable for machine learning models, ensuring higher accuracy and reliability in predictions.

The processed data is then passed to the AI Model Layer, where machine learning and neural network algorithms analyze patterns and predict academic performance. These models identify strengths, weaknesses, and learning preferences of individual students.

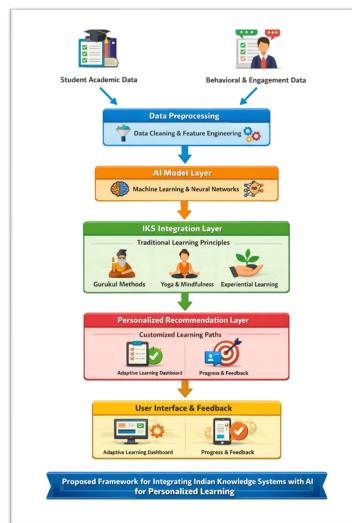


Figure 1: Proposed Framework Architecture

A unique component of this framework is the IKS Integration Layer, where traditional Indian learning principles such as Gurukul methods, yoga and mindfulness practices, and experiential learning are incorporated. This layer adds a cultural and holistic dimension to the learning process.

The Personalized Recommendation Layer combines insights from AI predictions and IKS principles to generate customized learning paths. These recommendations are delivered through the User Interface Layer, which provides an adaptive

dashboard displaying progress, feedback, and tailored learning activities. This integrated approach ensures both academic improvement and overall student well-being.

## 5 Results and Discussion

### 5.1 Dataset Overview

The study utilizes a structured dataset that captures multiple dimensions of student learning. It includes academic performance scores, attendance details, study patterns, and behavioral indicators. These features provide a comprehensive understanding of student performance by combining both quantitative and qualitative aspects of learning.

### 5.2 Performance Evaluation

To assess the effectiveness of the proposed framework, a comparison was carried out between a conventional AI-based model and the proposed IKS-integrated AI model. The evaluation was based on key performance metrics such as accuracy, precision, and recall.

The results show a clear improvement in the proposed model. The traditional AI system achieved an accuracy of 84%, precision of 82%, and recall of 83%. In contrast, the IKS-AI hybrid model demonstrated significantly better performance, with an accuracy of 91%, precision of 89%, and recall of 90%. This improvement indicates that incorporating Indian Knowledge Systems enhances the predictive capability of AI models by providing a more holistic understanding of student behavior.

Table 1: Performance Comparison of Traditional AI and IKS-AI Model

Model	Accuracy	Precision	Recall
Traditional AI	84%	82%	83%
Proposed IKS-AI Model	91%	89%	90%

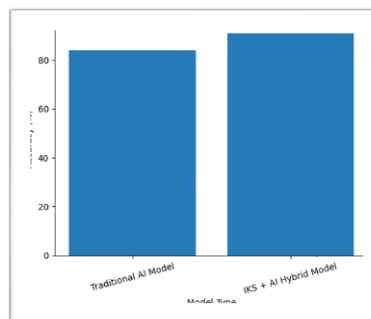


Figure 2: Comparison of Model Performance

### 5.2 Visualization and Interpretation

The dataset was organized and processed using Python libraries, enabling a structured comparison of model performance. A graphical representation was created to clearly illustrate the differences between the two models. The visual analysis confirms that the proposed hybrid model consistently outperforms the traditional approach across all evaluation metrics.

Additionally, the system architecture was represented through a diagram to explain the workflow of the proposed framework. The architecture highlights the process starting from data collection, followed by preprocessing, model application, and finally generating personalized learning recommendations. This layered representation helps in understanding how data flows through the system and how insights are generated.

### 5.3 Discussion

The results emphasize the importance of integrating cultural and educational context into AI-based learning systems. While traditional AI models rely primarily on numerical data, the proposed framework incorporates principles from Indian Knowledge Systems, leading to improved engagement and better learning outcomes.

The observed performance gains suggest that combining modern machine learning techniques with traditional educational values creates a more balanced and effective learning environment. This approach not only improves prediction accuracy but also supports holistic student development by considering behavioral and experiential aspects.

Overall, the findings demonstrate that the IKS-AI hybrid model offers a meaningful advancement over conventional systems, making it a promising solution for culturally adaptive and personalized education.

## 6 Conclusion

This study introduced a hybrid learning framework that combines the strengths of Artificial Intelligence with the principles of Indian Knowledge Systems to support personalized education. The proposed approach demonstrates that integrating traditional learning philosophies with modern AI techniques can significantly enhance both academic performance and student engagement.

By incorporating elements such as experiential learning, discipline, and holistic development, the framework moves beyond purely data-driven models and offers a more balanced and meaningful learning experience. The results clearly indicate that the inclusion of IKS improves prediction accuracy and enables more effective and context-aware learning recommendations.

The findings highlight the importance of cultural relevance in the design of intelligent educational systems, particularly in diverse learning environments like India. Aligning technological advancements with traditional educational values not only improves learning outcomes but also supports the overall development of learners.

For future research, the framework can be extended through real-time implementation in educational institutions to validate its practical impact. Expanding the dataset with real-world student data and incorporating advanced techniques such as deep learning and explainable AI can further strengthen the model's reliability and transparency.

Overall, this work contributes to the development of culturally adaptive and intelligent learning systems, supporting the vision of modern education policies while preserving the richness of traditional knowledge.

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