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Harnessing Artificial Intelligence through Indigenous Ways of Knowing in Education

Manas Khan[1], Dr. Laxmiram Gope[2]
[1]*Research Scholar, Department of Education, Sidho-Kanho-Birsha University, West Bengal, India*
[2]*Assistant Professor, Department of Education, Sidho-Kanho-Birsha University, West Bengal, India*

Abstract: ***Indigenous way of knowing represents holistic, relational, place-based knowledge and an ecologically sound knowledge system that has sustained indigenous communities from generation to generation. However, our modern education system is primarily shaped by Western epistemologies, which have historically marginalized these core knowledge traditions and customs, leading to epistemic injustice and cultural erosion. Nowadays, Artificial Intelligence (AI) has become very crucial and inevitable in the education process. With the rapid development of AI in Education, it has created many opportunities that compel us to reimagine and reconstruct our pedagogical framework in a culturally responsive, inclusive framework. Without technological knowledge, we are unable to adapt to this change, and without change, we lag, deprived and marginal in the technocrats' eyes. As we know, technology not only helps to develop our IT industry but is equally vital in the educational sector, mainly in the teaching-learning process. Therefore, it is now also a major challenge to implement Industry 4.0 and 5.0 in this educational setup. Technology not only helps us adapt to change but also enables us to develop our entire educational process with great effort and to address the changes and challenges in the educational paradigm. Through the utilisation of technology, education became more viable, affordable, and available in all contexts. In this context, AI is proven to be a game-changer, making it easier to implement ideas, facts, and knowledge in real-world contexts. This study explores the potential of Artificial Intelligence as a pedagogical tool for integrating, and harnessing, Indigenous ways of knowing into the formal education system, with special focus on the tribal context. This paper also contributes to the growing discourse on sustainability, creature-centric education, and environmental justice education in the digital age.***

Keywords: Artificial Intelligence, Indigenous Ways of Knowing, Indigenous Pedagogy, Tribal Education, Sustainable Education.

I. INTRODUCTION

The modern educational landscape is undergoing a reflective transformation due to the rapid advancement of digital technologies and Artificial Intelligence. Artificial Intelligence and digital technologies are profoundly reshaping the modern education system by enabling personalized learning, AI-based tutoring, automated assessment and evaluation, etc. (Bit et al., 2024). Digital technologies, especially AI, are revolutionizing education by shifting from a teacher-centric to a learner-centric approach, improving learning outcomes, feedback, and engagement. AI acts as a guide or mentor, providing support and feedback that ensures students learn at their own pace (Haleem et al., 2022). Indigenous Ways of Knowing (IWOK) are rich, holistic, and culturally based pedagogies rooted in daily life experience, oral traditions, community wisdom, and human-nature relationships, which have been marginalized within formal education systems. In India, tribal and Indigenous communities hold rich and diverse knowledge systems related to agriculture, medicine, ecology, ethics, and art. However, these knowledge traditions remain largely absent in our curricula (Jaiswal, 2025). The National Education Policy (NEP) 2020 marks a significant change and emphasizes the integration of indigenous knowledge and cultural traditions into curricula at all levels. However, the government has launched several initiatives to achieve those goals, yet implementing them at the grassroots level remains a significant challenge (Farooqi et al., 2025). This paper argues that Artificial Intelligence can serve as a powerful tool for bridging Indigenous Ways of Knowing and formal education systems. The primary aim of this paper is to critically explore and analyze how AI can be used to integrate Indigenous Ways of Knowing into the formal curriculum, with particular reference to Indian contexts.

A. Artificial Intelligence (AI) in Education

The integration of AI tools into education signifies one of the most important shifts in modern pedagogical practices. If Artificial Intelligence is to serve as a tool for epistemic inclusion rather than exclusion, its educational applications must be examined beyond instrumental efficiency and aligned with pluralistic and decolonial educational goals (Creely & Carabott, 2025). In the educational context, AI systems are primarily designed to analyse learner behavioural patterns, adapt instruction and content, and automate

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feedback and assessment (Kabudi et al., 2021). However, AI merely serves as a support system to improve learning outcomes. AI systems contribute to defining what counts as valid knowledge by arranging data-driven, assessable, and codified forms of learning (Al-Shammari & Al-Enezi, 2024). This poses a challenge for Indigenous knowledge systems, which are largely implicit, social, empirical, and embedded in local cultural contexts (Shrestha et al., 2025). Nowadays, in the context of Indigenous pedagogies or Indigenous Ways of Knowing, this critical approach becomes essential to ensure respect and empowered indigenous communities rather than perpetuate colonial biases (Alexandrowicz, 2024). Thus, AI must be understood not only as a technological innovation but also as an epistemological performer that shapes learning cultures and curricular priorities.

B. Indigenous Knowledge System (IKS)

Indigenous Knowledge (IK) represents a vast, holistic, and relational knowledge tradition developed by Indigenous people and local communities over time. Indigenous Knowledge refers to the ancient traditions and intimate knowledge of local environments, biodiversity, and social systems, deeply tied to cultural rituals, and daily life practices (Berkes, 2009; Ijatuyi et al., 2025). Unlike formal knowledge systems that emphasize abstraction and universality, the Indigenous Knowledge System is context-based, place-based, and experience-oriented (Das et al., 2025). Indigenous Knowledge isa comprehensive system that includes ecological wisdom, indigenous governance systems, pedagogical traditions, and moral and ethical values, mostly passed down through oral narratives, rituals and communal participation (Tharakan, 2015). This dynamic knowledge base is crucial for sustaining the cultural identity and practices of indigenous communities worldwide (Bawack et al.,2025). Indigenous Knowledge in India is indeed preserved and practiced by numerous tribal communities. These include prominent tribal communities such as the Santhals, Gonds, Munda, Bhils, Oraons, and others Indigenous groups of North-East India. These communities have a great understanding of biodiversity, sustainable agriculture, forest management, traditional medicine, and social harmony (Kumar, 2024). However, despite its richness and relevance, Indigenous Knowledge in India has largely remained marginalized within contemporary education systems, often reduced to folklore or extracurricular content rather than recognized as a valid epistemological framework (Puri, 2025).

C. Relationship Between Artificial Intelligence and Indigenous Knowledge:

The relationship between Artificial Intelligence (AI) and Indigenous Knowledge (IK) appears paradoxical due to their distinct foundations, yet it offers significant potential for synergy when grounded in ethical principles, mutual respect, and Indigenous data sovereignty. AI is often perceived as a symbol of technological modernity, automation, and data-driven rationality, whereas Indigenous Knowledge is rooted in tradition, oral transmission, lived experience, and spiritual relationships with ecology, biodiversity and cosmos (Lewis et al., 2024). However, a deeper analysis reveals that these two knowledge systems are not inherently oppositional; rather, their relationship is complex, dynamic, and filled with both transformative possibilities and ethical challenges (Srinivas, 2025).

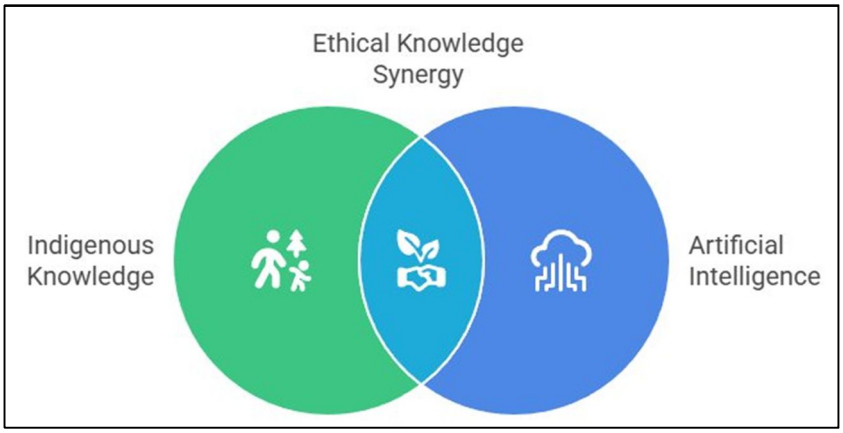


Figure -1: Bridging Indigenous Wisdom and Artificial Intelligence
(Source- https://www.gdrc.org/kmgmt/ik-ai.html)

1) AI as a Tool for Preservation of Indigenous Knowledge: One of the most constructive relationships between AI and Indigenous Knowledge lies in the preservation of knowledge (Lewis et al., 2024). Many Indigenous languages, oral traditions, and ecological practices are at risk of extinction due to globalization, urbanization, and formal education systems that privilege dominant languages (Khan & Gope, 2025). AI technologies such as speech recognition, natural language processing, and multimedia archiving can support documentation and preservation of oral histories, folklore, songs and Indigenous languages (Tella et al., 2025).
2) Ecological and Sustainability Relationship: Indigenous Knowledge is deeply connected to ecology, emphasizing balance, reciprocity, and coexistence with all living and non-living beings (Gope et al., 2017). Artificial Intelligence is increasingly applied in environmental monitoring, climate modeling, and sustainability planning. The integration of Traditional Ecological Knowledge (TEK) with AI-driven analytics can improve climate resilience strategies, support sustainable agriculture and resource management, enhance biodiversity conservation and promote creature-centric well-being (Afzal et al., 2024; Das & Mishra, 2025).
3) Towards a Symbiotic Relationship: The ideal relationship between Artificial Intelligence and Indigenous Knowledge systems is interdependent and mutual support rather than extractive. AI should function as a listener, supporter and facilitator. AI technologies can serve cultural continuity, educational equity, and ecological sustainability (Sethy, 2025). The relationship between Artificial Intelligence and Indigenous Knowledge is not predetermined; it is socially, culturally, and ethically constructed. AI can either deepen epistemic injustice or become a powerful ally in preserving, revitalizing, and integrating Indigenous Ways of Knowing. A respectful, ethical, and community-centered approach is essential to ensure that AI contributes to a future where technological advancement coexists with cultural wisdom, ecological balance, and epistemic plurality (Khurana, 2025).

D. Dimensions of Indigenous Knowledge for Preservation, Promotion, and Protection (3P) Through AI

1) Preservation of Indigenous Knowledge Through AI: AI-based technologies such as speech recognition, audio-visual documentation, and knowledge mapping are powerful tools for preserving Indigenous knowledge. With the help of AI, they can digitize and organise oral traditions, traditional ecological knowledge, and cultural practices in their native languages. These tools safeguard those knowledges from loss and enable intergenerational learning (Tella et al., 2025; Kamal, 2025).
2) Promotion of Indigenous Knowledge Through AI: AI-powered educational platforms can promote Indigenous Knowledge into formal curricula through various methods such as simulations, interactive modules and content-cum-context based learning resources. By embedding Indigenous wisdom into subjects such as environmental studies, science, and social science (Nokulunga et al., 2025; Sutrisno et al., 2025).
3) Protection of Indigenous Knowledge Through AI: AI can support the protection of Indigenous Knowledge by incorporating ethical safeguards such as controlled access, community consent mechanisms, and Indigenous data sovereignty frameworks. Properly designed AI systems can prevent unauthorized extraction, commercialization, and misrepresentation of Indigenous knowledge traditions (Tella et al., 2025).

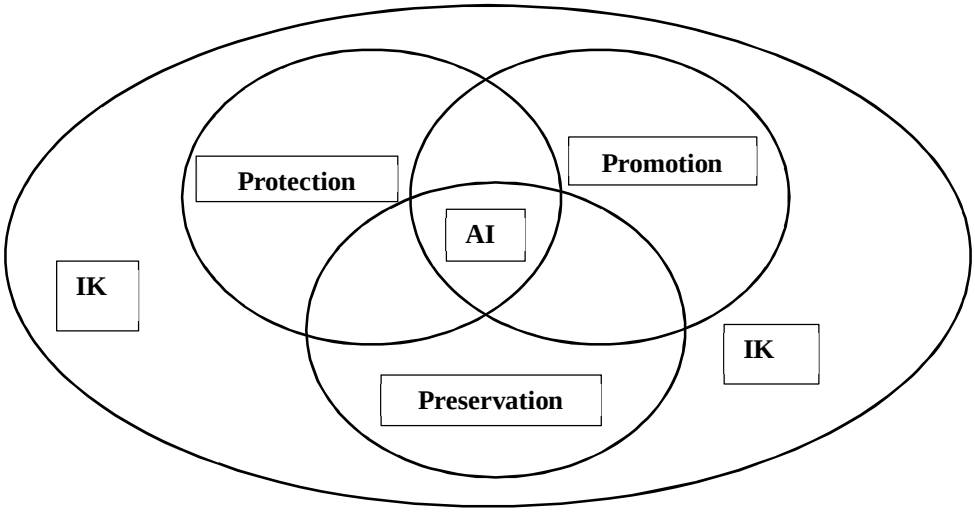


Figure-2: Dimensions of Indigenous Knowledge for Preservation, Promotion, and Protection (3P) Through AI

II. LITERATURE REVIEW

Recent Indian studies emphasize the role of Indigenous Knowledge in sustainable development, environmental education, and cultural preservation. Fausto et al. (2024) investigate the application of AI tools and technologies in an education course to emphasize cultural appreciation and the development of digital competencies of indigenous teachers. Through integrating AI tools in image creation by indigenous teachers, carried out in the continuing education course in computing, technologies and educational robotics, demonstrated extremely positive outcomes. Teachers explored the creative possibilities and opportunities of AI for developing essential skills to apply in their classroom pedagogical practices. Deckker and Sumanasekara (2025) explore the potential and challenges of AI learning tools for language revitalization and culture-based technological development through empirical research.

Hamilton (2024) integrates Indigenous ways of knowing with applications of artificial intelligence in education and concludes that AI is necessary to promote equitable and barrier-free learning opportunities for learners. Ofosu-Asare (2025) presents a holistic methodology for integrating indigenous knowledge systems into AI development to counter cognitive imperialism and foster inclusivity in the knowledge domain. This paper makes a significant contribution to the ethics of Artificial Intelligence and social justice, providing a roadmap for equitable, culturally respectful AI. Nokulunga et al. (2025) investigates viability of integrating indigenous knowledge systems with science education using artificial intelligence technologies.

The study addresses the limited recognition of indigenous knowledge in science curricula and explores AI's potential for culturally sensitive incorporation. This study concludes that Artificial Intelligence could develop an inclusive educational system honouring cultural heritage while preparing students for future challenges. Chirima (2025) Harnessing digital technologies presents both opportunities and challenges for the preservation and promotion of Indigenous Knowledge Systems (IKS) in Africa. This study highlighted that digital technologies for Indigenous Knowledge Systems (IKS) in Africa offer significant transformative potential for preservation, dissemination, and integration of indigenous heritage.

Pradhan and Dey (2025) explore technology initiatives using artificial intelligence (AI) to advance minoritized languages in India. The use of technology in language education in India is embedded within the complex history of policy on minority or Indigenous languages. By exploring how language initiatives utilise technology to promote language learning, this paper provides insights into the challenges and opportunities in the emerging field of AI and language learning. Williams and Shipley (2021) discussed that Artificial wisdom would greatly benefit from incorporating elements of non-Western worldviews, particularly the metaphysically inclusive Indigenous worldview.

This study revealed that Indigenous concepts could be paradigm-shifting additions to artificial wisdom, greatly enhancing the usefulness and overall benefits of artificial intelligence applications.

Recent literature review highlights the Indigenous Knowledge System as holistic, culturally driven, place-based, and ecologically grounded, while AI in education emphasizes personalization and data-driven learning. Indian and Western studies note risks of cultural appropriation and bias, yet suggest ethically designed AI can preserve, promote, and protect Indigenous knowledge within formal curricula globally, sustainably and inclusively. Emerging literature on AI ethics emphasizes cultural responsiveness, participatory design, and epistemic justice. However, empirical and conceptual integration of AI with Indigenous Knowledge remains underexplored and revealing a significant research gap.

III. OBJECTIVES OF THE STUDY

i. To find out the Indigenous way of knowing in the context of indigenous pedagogy and epistemological foundation

ii. To explore the potential of Artificial Intelligence as a pedagogical tool for integrating Indigenous ways of knowing into the formal education system

IV. METHODOLOGY OF THE STUDY

This study is basically qualitative in nature. Here, the researchers used qualitative and secondary data, including ethnographic and anthropological research papers, peer-reviewed journals, government reports on indigenous studies and policy documents, especially NEP 2020. Researchers adopt document analysis, content analysis, triangular analysis and the bricolage approach to integrate multiple theoretical dimensions and perspectives and build a holistic understanding of the integration of Artificial Intelligence and Indigenous pedagogy.

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V. FINDINGS OF THE STUDY

Data were analysed and findings were derived based on the formulated objectives.

A. Objective – I: To find out the Indigenous way of knowing in the context of indigenous pedagogy and epistemological foundation

1) Indigenous Ways of Knowing: Philosophical, Ontological, and Pedagogical Foundations

Indigenous Ways of Knowing (IWK) are diverse, holistic and living knowledge systems that have evolved through interaction between Indigenous communities and their specific environments. These knowledge systems are not static but dynamic and evolving through changing circumstances (Berkes, 2009; Bharath, 2024). Unlike dominant Western epistemologies that often prioritize objectivity and abstraction, Indigenous knowledge systems are deeply contextual, relational, and value-based. Understanding these foundations is important before analysing how AI can engage with or support such knowledge traditions within formal education curricula (Lewis et al., 2024; Khurana, 2025).

a) Epistemological Foundations of Indigenous Ways of Knowing

Epistemology concerns the nature of knowledge, its sources, the medium of knowledge, and how knowledge is created, validated, and transmitted. Indigenous epistemologies challenge the universalist claims of Western knowledge by asserting that knowledge is situated, plural, and embedded in lived experience (Gelinas & Bouchard, 2014). In Indigenous contexts, knowledge is not produced through detached observation but through participatory engagement with the world. Knowing emerges from doing, observing, feeling, and relating. For instance, tribal knowledge about agriculture or forest ecosystems is generated through generations of sustained interaction with land, seasons, and non-human life forms rather than through controlled experimentation alone (Sonwane & Pradhan, 2025). Furthermore, Indigenous epistemologies emphasize collective ownership of knowledge. Knowledge is seen as a communal asset rather than an individual intellectual property. Elders, community leaders, healers, and artisans serve as custodians of knowledge, and learning occurs through apprenticeship, storytelling, and communal participation. This stands in contrast to the individualistic and competitive knowledge culture prevalent in formal schooling (Buning et al., 2023).

b) Ontological Dimensions: Relational Worldviews and Being-in-the-World

Ontology refers to beliefs about reality and existence. Indigenous ontologies are fundamentally relational, viewing humans as inseparable from nature, ancestors, and spiritual forces. Reality is not divided into binary categories such as human/non-human, nature/culture, or material/spiritual (Romm, 2024). For many Indian tribal communities, forests, rivers, animals, and mountains are not resources but living entities with moral and spiritual significance (DePuy et al., 2021). Among the Santhals, the forest is regarded as a life-sustaining relative rather than a commodity. Similarly, Gond cosmology portrays animals, trees, and celestial bodies as active participants in the moral universe. This relational ontology profoundly shapes Indigenous education. Learning is not aimed at mastery or control over nature but at cultivating harmony, responsibility, and ethical coexistence (Findlay, 2023). Knowledge is evaluated not solely by its predictive power but also by its capacity to sustain balance within the ecological and social order (Taringa & Taringa, 2024).

c) Orality, Memory, and Story-Based Knowledge Transmission

Orality is a central pedagogical mode within Indigenous knowledge systems. Knowledge is transmitted through stories, myths, songs, rituals, and communal practices rather than solely through written texts. These oral traditions serve not only as repositories of information but also as ethical and emotional guides for living. In Indian tribal communities, ecological knowledge is often encoded within folk songs and sung during seasonal festivals (Gope et al., 2017). These narratives convey complex understandings of climate patterns, biodiversity, and social responsibility in accessible, memorable ways. Oral traditions also allow for flexibility and adaptation. Stories evolve with changing contexts while retaining core cultural values. This dynamic nature of Indigenous knowledge challenges the static, textbook-based representations common in formal education (Ali & Punia, 2021).

d) Experiential and Place-Based Learning

Indigenous pedagogy is inherently experiential. Learning occurs through direct engagement with land, community, and daily life rather than through abstract instruction (Kumari & Rao, 2022). Children learn by observing elders, participating in communal tasks, and gradually assuming responsibilities. This mode of learning aligns with the principle of learning to be rather than learning to know (Jaiswal, 2025). Knowledge is adopted through practice, repetition, and reflection within real-life situations. Such experiential learning fosters deep ecological consciousness, emotional intelligence, and ethical sensibility. In contrast, formal schooling often privileges decontextualized learning and standardized assessment (Lees & Bang, 2023).

e) Indigenous Ethics, Values, and Knowledge

Indigenous Ways of Knowing are inseparable from ethical frameworks. Knowledge carries responsibility. Knowing how to use medicinal plants, for instance, involves moral obligations regarding conservation, sharing, and respect for life (Alum, 2024; Kibonde, 2020). Indigenous ethics emphasize care for all living beings, Intergenerational responsibility, moderation and sustainability and respect for ancestral wisdom. These ethical orientations are particularly relevant in the context of contemporary ecological crises. Indigenous knowledge systems offer alternative visions of development grounded in coexistence rather than exploitation (Lushombo, 2025).

B. Objective – II: To explore the potential of Artificial Intelligence as a pedagogical tool for integrating Indigenous ways of knowing into the formal education system

1) Conceptual Alignment Between Artificial Intelligence and Indigenous Pedagogies

At first glance, Artificial Intelligence and Indigenous Ways of Knowing appear to emerge from fundamentally different epistemological worlds. AI is often associated with data-driven logic, automation, and computational efficiency, whereas Indigenous pedagogies are rooted in oral traditions, relational ethics, spirituality, and lived experience. However, a deeper examination reveals significant conceptual convergences that allow AI to function as a supportive medium rather than a disruptive force in the integration of Indigenous knowledge into formal curricula. This section discusses these alignments in a broader and more nuanced manner (Costa et al., 2025).

a) Orality, Memory and AI as a Living Archive

Orality is a foundational pillar of Indigenous knowledge transmission. Stories, songs, myths, proverbs, and ritual narratives serve not only as educational tools but also as repositories of historical memory, ecological ethics, and community values. Unlike written texts, oral knowledge is dynamic, performative, and context-based (Mukherjee & Rakesh, 2025). Artificial Intelligence, particularly through speech recognition, audio-visual processing, and machine learning-based archiving, offers powerful mechanisms for preserving oral traditions without converting them into static or decontextualized texts (Gupta et al., 2024). AI-enabled systems can store voice recordings, gestures, music, and narrative variations across generations, allowing Indigenous knowledge to remain fluid and living. For instance, AI-based voice databases can document seasonal songs, healing chants, and folktales in Indigenous languages, maintaining pronunciation, rhythm, and emotion elements often lost in textual transcription (Choudhary et al., 2025). In the Indian context, Santhal oral narratives related to forest ethics and agricultural cycles can be preserved as multimedia learning resources accessible to students within and beyond the community (Chattopadhyay & Mandal, 2025). Importantly, AI should not be placed as a replacement for elders or community storytelling. Rather, it functions as a memory companion, supporting intergenerational transmission while respecting Indigenous authority over the interpretation of knowledge.

b) Experiential Learning and AI-Supported Situated Knowledge

Indigenous pedagogies emphasize learning through direct engagement with land, community, and daily life. Knowledge is acquired by observing elders, participating in rituals, cultivating crops, and responding to environmental changes. This experiential approach contrasts with the abstract, classroom-bound learning that is dominant in formal education. AI-based experiential learning tools, such as simulations, virtual environments, and interactive storytelling platforms, can complement Indigenous pedagogies by creating immersive learning experiences rooted in real-world contexts (Roschella, 1995). When thoughtfully designed, AI simulations can model Indigenous ecological practices, seasonal cycles, and decision-making processes. For example, AI-driven ecological simulations can demonstrate traditional water conservation techniques, forest regeneration practices, or sustainable agriculture methods practiced by tribal communities (Wu & Zhong, 2025). Students can engage with these simulations to understand cause–and–effect relationships, ethical choices, and long-term environmental consequences, aligning with Indigenous principles of responsibility and balance. Such AI-supported experiential learning does not abstract Indigenous knowledge but extends its pedagogical reach, particularly for learners who may be physically disconnected from their ancestral lands due to migration or urbanization (Elshall & Badir, 2025; Mustofa et al., 2025).

c) Personalized, Context-based, and Place-Based Learning

Place-based knowledge is central to Indigenous education. Learning is shaped by local ecology, climate, culture, and history. However, standardized curricula often disregard these contextual dimensions, resulting in alienation among Indigenous learners. AI-driven adaptive learning systems can personalize educational content based on learners' geographical, cultural, and linguistic contexts (Li & Shein, 2022).

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Instead of delivering uniform content, AI can adapt lessons to include local examples, Indigenous practices, and community narratives. For instance, a science lesson on plant life can integrate local tribal medicinal knowledge, while mathematics problems can be framed using community-based activities such as farming, weaving, or market exchange. This contextualization enhances relevance and meaning, fostering deeper engagement and cultural affirmation. By supporting place-based learning, AI contributes to culturally responsive pedagogy and counters the homogenizing tendencies of formal education (Alum, 2024).

d) Multimodality and Indigenous Ways of Expression

Indigenous knowledge is communicated through multiple modes such as dance, art, music, symbols, rituals, and communal practices. Text-centric education systems often fail to accommodate these diverse forms of expression. AI supports multimodal learning by integrating text, audio, video, images, and interactive elements within a single platform (Sianturi et al., 2025). Image recognition, gesture analysis, and visual storytelling tools can help represent Indigenous art forms such as Gond paintings, Warli art, or ritual performances as legitimate curricular knowledge. For example, AI-assisted visual analysis of Gond art can help learners explore ecological symbolism, cosmology, and ethical values embedded in artistic representations. This multimodal engagement validates Indigenous expressive traditions and broadens the definition of academic knowledge (Suryawanshi & Shah, 2025).

Table-1: Relationship Between the Function of AI and Indigenous Principles

Indigenous Principle	AI Function	Curriculum Outcome
Orality	Speech recognition	Preservation of oral traditions
Experiential learning	Simulations	Ecological understanding
Relationality	Contextual personalization	Place-based curriculum
Multilingualism	NLP tools	Linguistic inclusion

CONCLUSION

Artificial Intelligence, often viewed as a symbol of technological dominance, also serves as a tool for epistemic inclusion when guided by Indigenous values and ethical frameworks. This paper has argued that Artificial Intelligence can help integrate Indigenous Ways of Knowing into formal education by preserving and promoting oral traditions to foster place-based learning and develop creature-centric wellbeing. Artificial Intelligence does not replace Indigenous pedagogies but strengthens them when communities remain at the centre of knowledge production. Tribal teaching is an essential component of the knowledge framework and it's essential for the inclusive development of the nation. The tribal community in Purulia district, West Bengal, has its own knowledge framework. Now it's time to codify and document to preserve, protect, and promote through Artificial Intelligence. Suppose that codifying the Tribal community's indigenous cultural practices and documenting them using Artificial Intelligence (AI) will help build a digital database for future reference and protect them from erosion and the loss of indigenous knowledge. Documentation of this endeavour, indigenous knowledge, helps give recognition to indigenous people and their knowledge systems. Indigenous knowledge has many aspects that give alternative ways of living and lifestyle, and also help in adapting to new knowledge creation through human learning.

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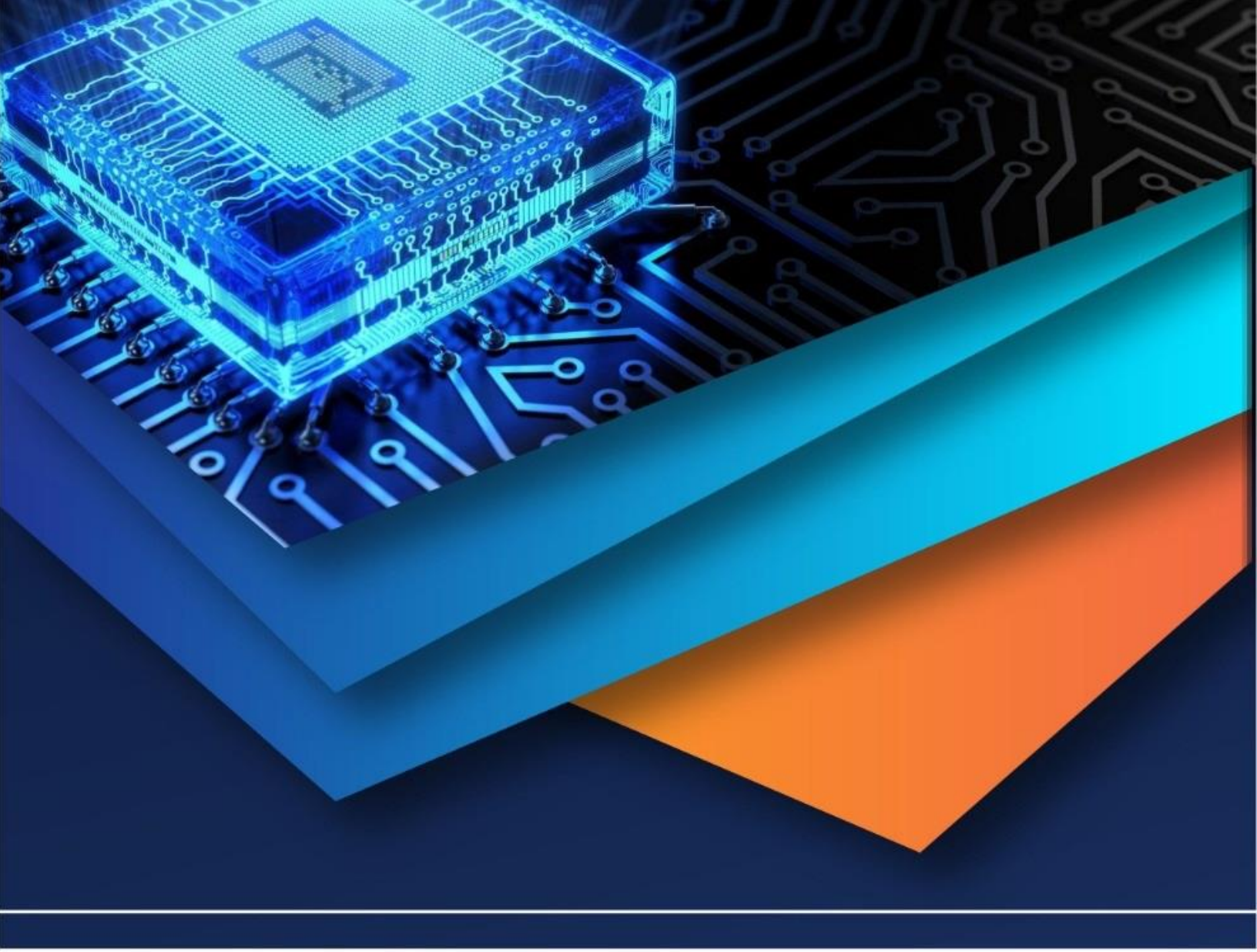
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