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Transforming Traditional Schools into AI-Driven Schools: An Indian Perspective on Infrastructure, Pedagogy, and Governance.

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Abstract

AI-based education has become the new global standard, assisting education systems in developing countries as they implement their National Education Policy (NEP) and other educational reforms in line with the 'Viksit Bharat 2047' [1, 2]. Analysing India's transition to AI-based education, this conceptual paper explores how AI will change how we teach, assess students, govern education, and provide education services for people with disabilities [3, 4]. Among other findings, it was concluded that while AI-based education offers tremendous potential for providing scalable personalized education, Indian education systems face serious challenges to expanding AI use, including an extremely unequal distribution of technology capabilities, urgent needs to build teacher capacity, and significant concerns regarding the ethical implications of AI in education [5, 6]. The strategy promotes a phased, multi-level implementation approach that is compatible with India's National Digital Education Architecture (NDEAR) and places an emphasis on ethical governance and sustained professional growth for educators. In the final analysis, the strategy suggests that in order for artificial intelligence (AI) to realise its maximum impact on the transformational potential of Indian school education, it is important to adopt a context-sensitive, equitable, and human-centric approach.

Keywords: Artificial Intelligence in Education, School Transformation, NEP 2020, Digital Divide, Teacher Professional Development, Ethical AI, traditional-schools, AI-Driven schools

1. Introduction:

The Application of Artificial Intelligence (AI) to Education represents a major shift in technology from a peripheral focus to a major component of how we teach, learn, and administer education system. There are many applications, including intelligent tutoring systems, adaptive learning platforms and predictive analytics that are changing how education is delivered and accessed globally [7]. In India, coinciding with this global technological advancement, we are also in a new period of historic educational reform. This reform is being driven by the National Education Policy (NEP) 2020 and Viksit Bharat (Developed India)

2047 National Vision Frameworks [1, 2]. The National Education Policy includes leveraging technology to build an equitable and vibrant knowledge society that is fully equipped for future needs.

With over 1.5 million schools and over 260 million students, the sheer size and diversity of India's school system offer an unprecedented opportunity as well as a tremendous challenge to integrate AI methodology into traditional educational practices [8]. Because traditional educational methods that predominately use rote memorization and standardized teaching have been viewed more as ineffective in helping students learn critical thinking skills and foster creativity which are essential for the demands of the 21st century, other initiatives currently underway such as DIKSHA, PM e-VIDYA and the National Digital Education Architecture (NDEAR) will create a foundational digital infrastructure of various kinds to address this issue [9, 10]. In addition, the most important step toward developing AI literacy in school systems occurred in late 2022 when the Government of India mandated that AI and Computational Thinking (CT) no longer will be elective subjects and will now become a compulsory subject for students beginning in Grade 3 during the 2026-27 academic year [11].

Although there has been a strong push at the policy level for the use of AI to transform schools in India, there are few scholarly studies that view AI transformation as a comprehensive process. Most research in this area tends to focus on either single-technology pilot projects or overly broad statements about what policy should be promoting regarding technology use in schools. Therefore, this article presents an examination of the ways in which traditional Indian schooling can be transformed into AI-enabled, human-centred learning environments through the development of a comprehensive model of how AI can change education by applying AI to four distinct areas: infrastructure, pedagogy, ethics, and governance. The study will provide evidence-based recommendations for policymakers, school administrators, educators of potential teachers, and technology providers in the responsible and effective use of AI in Indian education.

2. Conceptual and Theoretical Framework:

The evolution towards AI-driven schooling necessitates grounding in robust educational theories that prioritize human development over mere technological adoption

- **AI in Education (AIED) and Personalized Learning:** AI-Enabled Education (AIED) uses computerized simulation techniques to establish custom tailored learning paths for each student. This fits in with both the constructivist and socio-constructivist philosophies of education that argue that a student's learning occurs through their interactions with other people and their experiences in the world around them [13]. The AIED concepts are derived from social psychologist Lev Vygotsky's concept of 'Zone of Proximal Development' and have taken his theory further by creating tools for adaptive learning that can continually support learners as they progress through their individual development stages and will lead to the development of customized learning programs for each student [14].
- **Human-Centred AI (HCAI) in Schooling:** According to the HCAI paradigm, the role of AI in education will be to enhance the work that humans do with others and themselves rather than replace it [15]. Within the school system, HCAI shows that the teacher is the primary way to implement AI's potential. Therefore, AI is used as a valuable tool to assist the administrator and

provide the administrator with diagnostic information so that the teacher may devote their time to more meaningful roles in education (e.g., critical thinking) and develop their student's socio-emotional ability, develop ethical reasoning, and help develop the human aspect of education, which cannot be done by AI.

- **Sociotechnical Systems Approach:** A school is viewed as a complicated sociotechnological network in which the interrelationship of technology, people, processes, and structure creates a connectedness of each element [16]. If one wants to have a successful AI integration, it requires simultaneous consideration of all four elements of a school's structure. A major reason for failure in integrating educational technology is that many initiatives have historically focused on just the technological subsystem and have neglected to consider factors associated with the social subsystem, such as Teacher preparedness, Stakeholder trust, or Cultural context.
- **Teacher-Technology Partnership Models:** This framework reframes the AI as a complementary partner to the educational process as opposed to a stand-alone tool [17]. This also acknowledges the transformation of roles for Teachers into a new role as Learning Designers, Mentors and Critical Facilitators of Data-Driven Learning. The model clearly enables Teacher Agency and also provides a means for Technology to enrich rather than detract from the role of Professionals.

3. Review of Related Literature

3.1 AI in School Education: Global Trends:

Studies from many countries worldwide indicate that AI can provide personalized education services, give immediate feedback, and identify students who may need extra help to catch up [18]. In Finland, Singapore, and China, AI literacy is being incorporated into national training plans and governments are making investments in "smart" learning environments [19]. One consistent message in global research is the need for robust and ethical guidelines. UNESCO and OECD frameworks have highlighted the need for HUMAN OVERSIGHT (human oversight), INCLUSION, TRANSPARENCY, AND ACCOUNTABILITY with regard to educational technology developed using A.I. technology [20,21].

3.2 AI in Developing Countries and the Indian Context:

There are many critical constraints presented in the development of Emerging economies, including issues around socio-economic disparity and the relevance of the technologies themselves, but also including a lack of Infrastructure. For example, according to the National Education Policy (NEP) of 2020, the use of artificial intelligence (AI) is encouraged; however, research conducted at the school level demonstrates significant barriers to AI implementation [1, 22]. Research shows that scaling Educational Technology (EdTech) within a country such as India is being negatively impacted by unreliable internet access, limited access to Digital Devices, and unreliable power supplies. This problem is exacerbated in rural areas where many Public Schools operate [5]. Finally, many AI-based Toolkits used within Educational Systems have been created for Western Teaching Methods and consequently may not be suitable for implementation within Indian Classrooms; therefore, potential cultural and linguistic Discrepancy must be examined [23].

3.3 Digital School Transformation and Teacher Readiness

India has a wide-ranging program in digital education. Nevertheless, studies consistently find that the most important variable affecting successful adoption of technology is teacher readiness [24]. Many educators lack both the confidence required in their pedagogical skills and their ability to harness technology (AI) to the fullest extent in order to enhance student learning beyond basic digital literacy [25]. Therefore, until there is an ongoing, curriculum-aligned professional development program that helps educators develop their knowledge of using AI within pedagogical content, the integration of technology into the classroom will continue to remain limited and ineffectively utilised.

3.4 Ethical Risks and Governance:

Ethical considerations are paramount in the global discourse on AI in education [20]. Key issues relevant to India include:

- **Data Privacy and Security:** Many types of student information may contain sensitive information that is at risk from multiple types of breaches and third-party commercial use. As India's data protection legislation continues to be developed, new laws will require the implementation of specific measures to comply with the requirements of these laws. [26]
- **Algorithmic Bias and Fairness:** When AI systems have been developed, they are often based on biased information from an unrepresentative population; therefore, this can lead to discrimination against students who come from underprivileged communities (e.g., linguistic minorities, socio-economic disadvantage, and regional bias) [6].
- **Equity and the Digital Divide:** If access to technology (devices and Internet connection), along with a lack of digital understanding, continues to be unequal among people, then AI tools that were originally meant for greater inclusion will ultimately serve to perpetuate (and possibly increase) this inequality [5].
- **Transparency and Agency:** The opaque "black box" nature of some AI algorithms can undermine trust and make it difficult to question automated decisions, potentially eroding human autonomy in educational processes [27].

4. Research Objectives and Methodology

4.1 Research Objectives

This study is guided by the following objectives:

Using the following points as the foundation for creating an outline to explore the development of an AI School Model for India:

1. Define and design the essential elements that would be required to produce a successful AI School Model for India.
2. Identify the different barriers and issues associated with building infrastructure, training, and governance and how those barriers will affect schools employing the AI School Model.
3. Assess the degree to which the integration of AI aligns with both the NEP2020 and NDEAR.

4. Identify and assess the key ethical, societal, and equity-related issues arising from the use of AI within Indian Schools.
5. Create an implementation framework describing various levels and phases of how to implement the AI School Model.

4.2 Methodology:

The research design of this paper is conceptual and uses a structured systematic review and analysis of the applicable policies and literature surrounding the research topic

• Research Design:

A non-empirical analytical study that synthesizes literature and policy knowledge into a conceptual framework.

• **Data Sources:** Conducted a structured review of (i) peer-reviewed journals articles from Scopus and ERIC database; (ii) key Indian policy documents (NEP 2020 and National Curriculum Framework for School Education 2023); (iii) reports from the Government (Ministry of Education and NITI Aayog), and (iv) publications from International Organizations (UNESCO, World Bank, OECD).

• **Inclusion/Exclusion Criteria**: Studies published from 2019 to 2025 relating to artificial intelligence in K-12 education that are based out of developing nations (particularly those located in India) were given priority; therefore, those related to general educational technology without a specific focus on artificial intelligence were eliminated from consideration.

• **Analytical Framework**: The themes associated with the predetermined stages of transformation were used to analyse the data. Policy documents were used to identify directions for implementation, as well as areas where there was a lack thereof.

• **Ethical Considerations & Limitations**: Since this study was done solely on the basis of literature found through secondary sources, it does not use any human subjects; this leads to a major ethical consideration, as it is important to evaluate the reliability of the sources being discussed. The absence of longitudinal empirical studies for large populations concerning AI and its effects on numerous school environments in India is a major limitation to the current study, indicating the need for additional empirical research in the future.

5. Dimensions of AI-Driven School Transformation in India

There are many layers to the transformations. Each transformation interacts dynamically with all the other transformations in the school environment.

5.1 Infrastructure & Digital Ecosystem:

A strong, fair and interoperable digital base is a must.

- **Access & Equity:** Planning needs to provide students and teachers living in areas without services, who have tools and affordable access to the Internet; and, To assist those learners living in areas lacking access, lightweight and offline-enabled AI software applications should be created [5].
- **Interoperability**: Any AI tools must connect easily to the National Digital Education Architecture (NDEAR) and the existing Digital Learning Management Platforms (i.e. DIKSHA, UDISE+), ensuring all users see the same data, while avoiding disconnected databases and ensure users receive consistent experiences [9].
- **Smart Classrooms**: Move from simple digital projectors to an integrated space using Internet-of-Things (IoT) to collect data on the environments for monitoring users' success, as well as on the 'engager' level of students interacting in this environment, creating a more responsive classroom experience.

5.2 Transforming Pedagogy

With the introduction of AI, educational institutions are moving toward a model of differentiated, student-centred learning as opposed to uniform instruction.

- **Adaptive Learning Systems:** These platforms use ongoing assessment of students' abilities to change the level of difficulty, format, and sequence of the material they are learning, ensuring that all students face an appropriate amount of challenge throughout the entire process throughout their studies.
- **AI tutors and support**: AI-powered learners provide students with 24/7 assistance with their academic work, including homework, study tools, and foundational skills, which account for a significant percentage of the total learning experience, especially in settings where there are higher numbers of students than available teachers.
- **Facilitate competency-based learning:** AI allows educators to create individualized, complex, and interdisciplinary projects and simultaneously manage them by enabling students to conduct research, perform data analysis, and develop prototypes while allowing educators to effectively monitor and record student competency progress.

5.3 Assessment and Feedback Systems

AI is changing assessments from an endpoint to a part of an overall learning experience through ongoing diagnostic assessments.

• **Continuous Formative Assessments:** Learning activities provide ongoing assessments of student responses with real-time analysis to allow for instant feedback based upon the student's needs, thus creating a feedback loop to assist students as they progress through their educational journey [28].

• **AI-Based Diagnostic Assessments**: In-depth analyses of students' written, spoken, or logical approaches to solving problems help identify students' underlying misunderstandings in areas such as mathematics and reading, enabling educators to assist students as soon as they notice a pattern of misunderstanding.

• **Automated Personalized Remediation:** These processes automatically produce individualized remediation exercises, instructional materials, and peer-tutoring recommendations for each student based upon that student's diagnostic information.

5.4 Administration and Governance

AI Technology in Resource Management through Data to Improve Education

- **Optimize Resources:** Via AI algorithms, schools have the ability to create the best possible schedules, track and manage their physical resources like buildings and classrooms, and anticipate when repairs will need to be made to their facilities.
- **Predictive Student Monitoring/Early Warning Systems:** By analysing student data such as academic performance, attendance, and parental involvement, schools can identify students who may be at risk for dropping out or not succeeding academically and provide timely interventions before these problems escalate.
- **Decision Support Dashboard:** School and district leaders, and any educational professionals working in the system, can access visualized data dashboards containing analytics to help build a strategy for the operation of the institution, access resources, and measure learning outcomes.

5.5 Student Support and Inclusion

The use of artificial intelligence as a tool for the development of inclusive and supportive learning environments provides many advantages.

- **Assistive Technologies for Children with Special Needs:** AI can enhance access to educational materials and services for students with disabilities through the use of assistive technologies, such as real-time captioning, text-to-speech readers, personalized learning interfaces, and emotion recognition technologies (when used responsibly) [29].
- **Multilingual Support and Language Learning:** AI allows for the translation of educational materials and for real-time translation of educational materials as well, which is consistent with the focus of the NEP on mother-tongue instruction and multilingual education. It can be used to address some of the issues associated with the use of multiple languages in education [1].
- **Support for Socio-Emotional Learning:** AI chatbots provide anonymous preliminary mental health support, while data from AI analytics allows teachers and other educators to identify students who may need additional SEL interventions.

6. Teacher Professional Development in AI-Driven Schools

To effectively implement AI technology into education, the teaching workforce must be transformed and empowered by all integrating systems associated with training and support.

- **Four Domains of New Competencies:** There are four primary areas where teachers will need professional development in order to integrate AI effectively: I. AI Literacy (knowledge of

the strengths and weaknesses of AI); II. Pedagogical Integration of AI (how to use AI to enhance lesson and/or curriculum design);
III. Data Literacy (how to use learning analytics for effective instruction);
IV. Ethical Oversight (to prevent bias and protect student privacy) [25].

- **Changed Teacher Identity:** Teachers will evolve from their previous role as "information givers" and now take on the roles of "facilitators of learning," "coaches," and "ethical guides" to allow students to successfully navigate the world of AI-generated information, as well as be critically aware of all information encountered.
- **System-wide Inclusion of Competency Training:** Training for the development of competency in AI must be included in pre-service teacher programs as well as large-scale in-service teacher programs (like NISHTHA). The training must be given over a period of time, continually refreshed and developed, and should follow the same collaborative, interactive, student-centred pedagogy that is recommended.

7. Challenges and Ethical Concerns:

There is an established path to incorporate AI Technology into Education, but this path includes a Combination of issues and challenges that are intertwined and must be immediately dealt with.

- **The Continual Digital Divide:** A huge gap continues to exist between the ability of students to access reliable internet, digital devices (computers, tablets, etc.), and electricity, especially between urban and rural students and affluent versus poor schools. This creates a potential gap or "AI Divide" as well as a serious impediment to the use of AI.
- **Algorithmic Bias and Equity:** If the data sets used to train AI Tools do not contain diversity, the outcome of using AI Tools will be biased and will put disadvantaged students (from minority, caste, regional, etc.) at even greater risk and perpetuate existing inequalities.
- **Data Privacy, Security, and Surveillance**: The data collection capabilities created by the use of AI are collecting data on children daily and at a very granular level, which pose serious threats to Privacy. This calls for more active enforcement of Data Protection Laws in India that deal with the use of Data Created in the Classroom. These Laws must promote Data Minimization, Purpose Limitation, and Informed Consent.
- **The Risk of Teacher Deskilling and Over-Automation:** By relying too heavily on AI for Lesson Planning, Testing, and Feedback, we risk Deskilling Teachers, Reducing Pedagogy to a Standardized Script, and Removing the Essential Value of Human Judgment and Interaction from Education.
- **Commercialization and Access:** The Costs of Premium AI EdTech Solutions are prohibitively High and will create a further Stratified System of Educational Opportunities where only Affluent Schools will be able to access this Technology.

8. Policy Alignment and Governance in India

While India's policies will guide the future of AI in schools, they lack specificity in how AI will be integrated into education.

- **NEP 2020 and National Curriculum Framework (NCF):** Describe the vision of experiential, flexible and technology-enabled learning. Ultimately, the implementation of an AI curriculum is a direct implementation of NEP 2020/NCF's vision [1,11].
- **Development and selection of AI tools:** Must be based upon open standards from NDEAR regarding interoperability in order for them to form a cohesive, scalable, and vendor-independent digital ecosystem [9].
- **Creation of funding and partnership models**: That allow Samagra Shiksha resources to be directed towards AI infrastructure in underserved areas, as well as create partnerships between public and private organizations to support innovation in AI within a regulatory framework that supports the achievement of public education policy goals, equity and ethics.
- **Need for National Policy Framework on AI for School Education:** The National Policy Framework for AI in School Education should provide clear, actionable guidelines regarding, but not limited to; data privacy, algorithmic accountability, permissible use cases, procurement standards, and the required components of professional development for educators.

9. Proposed Multi-Level Implementation Framework:

In order for successful and scalable transition to new Educational Contexts to take place, these transitions must be achieved through Phased Strategies, engaging all stakeholders.

Level	Key Actions & Stakeholders	Short-Term (1-2 yrs)	Medium-Term (3-5 yrs)	Long-Term (6+ yrs)
Policy & System (MoE, NCERT, States)	Develop ethical AI framework; Fund equitable infrastructure; Revise teacher standards.	Formulate national guidelines; Pilot in Navodaya/Kendriya Vidyalayas.	Scale infrastructure to all KVs & state model schools; Mandate AI in pre-service courses.	Full institutionalization; System-wide review and adaptation.
School & Leadership (Principals, SMCs)	Create school integration plans; Foster innovation culture; Ensure community buy-in.	Audit digital readiness; Form teacher pilot groups; Initiate one pedagogical AI tool.	Implement integrated admin & learning tools; Establish data review committees	School as community innovation hub; AI fluency in institutional culture.
Teacher & Pedagogy	Engage in continuous PD; Experiment with	Complete foundational AI literacy training;	Confidently use adaptive platforms &	Master role as learning designer & mentor;

(Teachers, TEIs)	AI tools; Focus on human-centric pedagogy.	Use AI for lesson resource creation.	analytics; Guide student AI literacy projects.	Contribute to AI tool feedback loops.

To measure success, use multiple indicators to ensure it is done holistically. Equity (Infrastructure); Teacher Proficiency (Competency); Student Outcomes (Growth, Engagement & utilizing AI); and Ethical Compliance (Ongoing Audit).

10. Implications and Future Research Directions

10.1 Implications

- **For Policymakers:** Work to close the digital divide and support the professional development of teachers with equal attention as curriculum development by developing comprehensive, enforceable ethical guidelines.
- **For School Leaders:** Foster a culture of ethical innovation, giving teachers the time, resources, and emotional security to experiment with and learn from new ideas.
- **For Teacher Educators:** Create a new curriculum for teacher training that fully integrates TPACK; technology, pedagogy, and content; and emphasizes ethics and responsible use of technology through digital citizenship.
- **For EdTech Developers:** Use a human-centred approach to design all technology products and tools; work with teachers and students to develop these products. Also, focus on creating a product which is affordable, meets the interoperability criteria set forth in the National Digital Education Adoption and Resource (NDEAR) compliance certification process and is based on an openly verifiable algorithm used in the creation of digital products.

10.2 Future Research Directions

There are significant domains where we still have significant questions regarding the integration of Artificial Intelligence (AI) in the area of educational production; these areas need to have empirical evidence to follow-up from focused research on each of the following (the four key areas):

1.Research on Longitudinal Study of AI Augmented Educational Development: the comprehensive impact of AI-assisted educational experiences (either on cognitively/socially/emotionally/and ethically) upon the overall growth of students within the array of Indian systematic societal settings.

2.Context Specific AI application: Design-based research that takes into consideration the development; piloting; refining and production of cost effective, collation effective, culturally appropriate AI applications for Schools and School systems that are resource challenged.

3.Teacher Identity/Awareness and Agency: Qualitative Research that examines how AI applications impact teacher professional identity/ agency/ job satisfaction as well as how they perceive effectiveness as a teacher.

4.Student Experience/ Voice: Research utilizing participatory methodology focusing on student perspectives, experiences and concerns surrounding their use of AI technologies within their learning environments.

11. Conclusion

The shift from conventional schooling to an artificial intelligence-focused educational framework will transform India by creating a systemic approach to educational delivery as opposed to a simple upgrade using technology. There is an enormous opportunity presented by the vision of NEP 2020 (India's National Education Policy) and Viksit Bharat 2047 (India's Vision 2047 for Sustainable Development) to provide personalised, equitable, and effective education to millions of students. However, this opportunity will only be realised if we proactively engage and address the three main barriers, we face in achieving our goals: the digital divide; the need to empower teachers with the skills necessary to use AI; and the ethical risks that accompany the liberal use of AI in education.

To develop a successful future with AI in education, we need to take a balanced, principled, and patient approach. The development of infrastructure and the training of educators must be concurrent with implementing the technologies required to support the educational transformation that will occur as we move towards greater use of AI. Additionally, strong, well-defined governance, transparency, accountability, and the recognition of the essential role of teachers in the educational process must be designed to promote equity and equal access to education for all children. As India moves forward with the transformation of education to a more technology-based approach using AI, it must maintain a human-centred and sociotechnical viewpoint to help it realise its foundational purpose in education: to develop holistic, empathetic, and critical thinkers who will be able to contribute to positive change in the fast-paced global environment during the 21st century.

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