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The Education System and Artificial Intelligence - How It's Going to Change the World

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ABSTRACT

We posit two types of spontaneous symmetry breaking: one corresponding to the presence of a trivial vector bundle, the second corresponding to the presence of a nontrivial vector bundle. In their avatars, these resemble respectively the cases of type I and type II superconductivity. In the non-trivial case, the topology of the base space of the bundle enters fundamentally. Our applications will be to flavor symmetry breaking among the light quarks, so that the base space will be spacetime itself. In this case it is the SU(2)$_L$ and SU(3)$_L$ flavor symmetries themselves that are broken and the nature of such breaking is strongly restricted by the topology involved. Despite the negligible nature of any ambient gravitational intensities, we speculate that the topological change that must accompany the advent of mass could be the origin of this breaking and may give rise rise to both the Cabibbo angle and *CP* violation in the kaon system. We derive formulas for these parameters on the basis of this assumption.

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Introduction

The rapid evolution of artificial intelligence (AI) technologies has begun to transform fundamental aspects of human life, with education emerging as a critical domain of innovation. Globally, AI is being integrated into education systems to personalize learning, enhance administrative efficiency, support decision-making, and reduce inequalities in access to quality education. As countries strive to align with the demands of the Fourth Industrial Revolution, the deployment of AI in education is no longer a futuristic concept, but a practical imperative.

This doctoral thesis investigates the global and regional trends in the integration of AI in education, with a specific focus on two strategically significant and culturally distinct countries: **Russia and India**. These nations offer compelling comparative case studies due to their shared ambitions of becoming knowledge economies, their vast and diverse populations, and their proactive policy initiatives in both digital transformation and AI deployment. While Russia emphasizes centralized technological development and research-led innovation, India exhibits a more decentralized and grassroots-oriented approach to edtech, driven by both public and private sectors.

Globally, AI applications in education have shown promising developments in adaptive learning platforms, intelligent tutoring systems, predictive analytics, automated grading, and language processing tools. Countries such as the United States, China, and South Korea have already established frameworks and invested heavily in AI-driven educational ecosystems. In contrast, emerging economies are navigating the dual challenges of infrastructural limitations and the need for skilled human capital while attempting to leverage AI's transformative potential.

In this context, the regional dynamics of AI adoption in education in Russia and India deserve critical scholarly attention. Russia has launched strategic initiatives like the "Digital Economy Program" and "Artificial Intelligence 2030" that outline specific goals for AI implementation across sectors, including education. Meanwhile, India's "National Education Policy 2020" and programs like "AI for All" aim to democratize access to AI tools and build capacity among students and educators alike.

This thesis explores the **intersection of policy, technology, pedagogy, and socio-economic conditions** in shaping AI's role in the educational landscapes of Russia and India. Through a comparative lens, it aims to identify shared challenges, unique innovations, and prospective pathways for leveraging AI to improve learning outcomes, bridge digital divides, and prepare future-ready generations.

By examining the global context, national strategies, institutional frameworks, and on-the-ground implementation efforts, this research contributes to the growing discourse on **AI and educational transformation**, offering policy-relevant insights and theoretical frameworks for effective AI integration in education systems in both developed and developing contexts.

Artificial Intelligence is game changer and ten years from now every sector will be governed and controlled by AI. In a country like India 'Computer Revolution came in after 1985. At-least

that's what I thought but while watching an interview of legendary actress of India Rekha on BBC that was recorded in late 1970s in London I was amazed that She used the word "Computerized' that was an alien word back then in India.

Nowadays, artificial intelligence innovations affect more and more areas and not only technical ones. This is largely due to the development of computing facilities. Performance capabilities of modern gadgets and smartphones today are many times above the processing power of the giant supercomputers of the 80-90-s of the 20th century. Modern processors allow you to create artificial neuron networks, accumulate and process a large amount of data (Big Data), use the most complex mathematical and algorithmic methods and approaches. Today there are tremendous opportunities not only for theoretical research but also for the practical implementation of artificial intelligence systems in various spheres of human activity. Artificial intelligence technology entails a huge scope of activity, a vast field of knowledge. Since artificial intelligence is an interdisciplinary area of research, one needs knowledge in various fields, including new ones, to use it efficiently and more often as well as to participate in its development. Artificial intelligence (AI) refers to systems of technological and software solutions that, according to modern experts, are similar or superior to the result of human intellectual activity. As a result, some experimental problems are being solved - such as based on big data -when the researchers use speech recognition systems or voice synthesis, natural language processing, computer vision, and other technologies.

I came directly in touch of studies and Researches of AI when back in 2021-22 I was researching for my four volume books series 'Digital Security in Corporate World' that is available on Amazon.com. Companies like Facebook (Now Meta) are using the AI from as early as in 2005 for photo detection and identifying fake images or image location.Now what we see in advancement in field of AI is tail end of beginning phase of AI and it will still take 10-15 years for AI to fully occupy every sector.

In one of my Research Papers that I presented at Tomsk National Research University back in 2015-16 on 'Higher Education in India-The Glory of Past,The Challenges for Today and Road for Tomorrow',though, I advocated about traditional and ancient Education system of India but also supported technological advancements in field of Education in India. Russia too is a latecomer when it comes to Using AI in Education but soon it will be a front-runner like India. In this thesis the Scholar has discussd Global and Regional Trends in field of AI, the Studies and Researches in filed of AI and how it's taking shape in Russia and India and it's impact of Russian and Indian Education system.

AI in education is driving changes like personalized teaching, multi-lingual and differential learning, and real-time assessments. By taking up administrative tasks, Indian edtech companies are using AI to help teachers focus more on high-value activities such as lesson planning, personalized curriculum and reading material suggestions.
Edtech players continue to bridge learning gaps with the help of AI teaching tools such as regional languages and differences in the learning capability spectrum.

The government of India is committed to building the future of education by harnessing the capabilities of AI at the school, college and university levels.

The government of India's education vision for Viksit Bharat 2047 is to create an inclusive, high-quality education system for skill development and life abilities. India has 1.5 million schools, more than 8.5 million primary and secondary teachers and more than 260 million enrolments into the school system every year. In the higher education space, more than 40 million students enrol in more than 1000 universities and 42000 colleges annually. However, the Indian education system is characterized by fixed curriculums, archaic education delivery models and static testing concepts. This has caused a gaping chasm between education and contemporary work skills. The advent of AI, however, has changed things. It is helping the system move away from standardized to personalized, making it relevant and effective for the present.

AI has taken seriously long strides to alter every aspect of the system– from curriculum to test delivery. In the race for skilling for Viksit Bharat 2047, these step changes are causing a paradigm shift and helping Indian education come at par with global systems. We look at some of the biggest shifts.

Even if AI development becomes Russia's highest priority, Moscow has no chance of catching up with Washington and Beijing in this field. Under favorable conditions, however, Russia is quite capable of becoming a serious player and even a local leader in certain areas.

Russia's leaders have been paying close attention to artificial intelligence (AI) technologies for several years now. President Vladimir Putin has said on numerous occasions that the leader in the field of AI would become "the master of the world." Until recently, however, Russia remained virtually the only large country without its own AI development strategy.

That changed in October 2019, when the country adopted a long-discussed National Strategy for the Development of Artificial Intelligence Through 2030. One of the driving forces behind the strategy was Sberbank president German Gref. The state-owned bank has also developed a road map for developing AI in Russia and coordinated the creation of Russia's AI development strategy, which is largely corporate, involving the internet giants Yandex and Mail.ru Group, along with Gazprom Neft energy company.

Hypothesis
"The integration of Artificial Intelligence in the education systems of Russia and India reflects both global convergence in digital learning strategies and regional divergence due to sociopolitical, infrastructural, and cultural factors. While global trends push both countries toward adaptive learning, automated assessment, and personalized education, regional implementation and effectiveness are significantly influenced by national policies, technological infrastructure, and educational priorities."

Breakdown of Hypothesis Components
Global Convergence
Worldwide AI trends in education (e.g., intelligent tutoring systems, AI-driven learning analytics, personalized learning paths).

Influence of global tech companies and shared innovations in EdTech.

Regional Divergence
Russia: centralized governance, emphasis on state-controlled education, focus on STEM and national security.
India: decentralized education policies, large linguistic and socio-economic diversity, growing private EdTech sector.

Influencing Factors
Technological Infrastructure: Digital divide, internet penetration, AI research capabilities.
Policy Frameworks: NEP 2020 in India vs. Russia's "Digital Economy" program.
Cultural and Educational Traditions: Teaching methodologies, teacher roles, exam-centric culture.

Prospects and Predictions
Comparative forecast of AI adoption in both nations.
How regional approaches may impact global competitiveness and educational equity

Objective
The primary objective of this research is to explore, analyze, and compare global and regional trends in the adoption and application of Artificial Intelligence (AI) in the education systems of Russia and India. The study aims to:

Identify and analyze the key global trends in AI integration within educational frameworks.

Examine regional developments specific to Russia and India, highlighting government initiatives, technological advancements, policy frameworks, and institutional adoption.

Evaluate the impact of AI technologies on teaching, learning, and educational administration in both countries.

Assess the challenges and opportunities associated with AI implementation in diverse educational contexts.

Forecast future prospects for AI in education in Russia and India, based on current trajectories and global benchmarks.

Propose strategic recommendations for policymakers, educators, and technology developers to optimize AI use in education tailored to the socio-economic and cultural contexts of Russia and India.

The Objective for This Study Can be Divided in Major Parts as Under
1. Studying Global trends in filed of AI
2. Studying Regional Trends in field of AI
3. Studying about AI (Origin,History,Growth,Changes and Evolution) in Field of AI
4. Impact of AI on Russian Education System
5. Impact of AI on Indian Education System
6. Advancements of New Technologies in Era of AI
7. The detailed Results and Conclusion of entire Study.

Research Problem
The integration of Artificial Intelligence (AI) into educational systems has emerged as a transformative global trend, reshaping pedagogical methods, administrative processes, and learning outcomes. However, while high-income countries have made significant strides in embedding AI technologies within education, there remains a stark contrast in how developing economies such as Russia and India approach this transformation.

Thus, the central problem this study addresses is:
"**How are global trends in the use of AI in education being adopted, adapted, and challenged within the specific regional contexts of Russia and India, and what are the prospects for their effective implementation in the near future**?"

The importance of artificial intelligence for the future of humanity is becoming more and more evident, which is reflected in the measures taken by the governments of leading countries to ensure their leadership in this direction. Making exactly this point, viz the importance of AI for the future of the US economy and national security, on February 11, 2019, the President of the United States issued Executive Order (EO 13859) stipulating federal agencies to take various steps to ensure that the country remains at the forefront in the development and use of artificial intelligence. At the same time, leadership in artificial intelligence (along with "quantum information science and strategic computing") was named the second most important R&D priority after ensuring the safety of the American people for the 2020 financial year. The American AI Initiative is guided by principles that include (in short form) [1]: 1. Moving forward to achieve technological breakthroughs. 2. Moving forward to develop appropriate technical standards. 3. Training the employees to form the needed skills to develop and use AI technologies
.

Research Questions
The transformative potential of Artificial Intelligence (AI) in education is being recognized globally, with regional adaptations influenced by socioeconomic, political, and technological factors. This study aims to investigate the integration of AI in educational systems within two distinctive yet dynamically evolving regions: Russia and India. While both countries are investing in digital transformation, their strategies, challenges, and socio-political landscapes vary significantly.

The central research question guiding this study is:
How are global and regional trends in Artificial Intelligence shaping the education systems of Russia and India, and what are the prospects and challenges for sustainable and inclusive AI integration in their educational sectors?

Sub-Questions
To address the main research question comprehensively, the study further explores the following sub-questions:

Global Trends
What are the prevailing global trends in the application of AI in education (e.g., adaptive learning, intelligent tutoring systems, AI-based assessments)?

How do international organizations and global policy frameworks influence AI adoption in education?

Regional Developments
What are the national policies and strategic initiatives regarding AI in education in Russia and India?

How is AI currently being implemented in educational institutions in both countries (case studies, pilot projects, curriculum changes)?

Comparative Analysis
What are the similarities and differences in the implementation of AI in education in Russia and India?

How do cultural, economic, and political factors affect the adoption and integration of AI in their educational ecosystems?

Opportunities and Challenges
What are the major opportunities presented by AI for improving access, equity, quality, and efficiency in education in Russia and India?

What are the barriers (e.g., infrastructure, ethics, teacher training, data privacy) to successful AI integration?

Future Prospects
What are the potential future pathways for AI in education in Russia and India?

How can both countries align their AI in education strategies with global best practices while addressing regional specificities?

The Research Questions that Scholar has designed about this study are-
The Objective for this study can be divided in major parts as under-
1- What are Global trends in filed of AI
2-What are Regional Trends in field of AI
3-What can be studied about AI (Origin,History,Growth,Changes and Evolution) in Field of AI
4-What and How will be impact of AI on Russian Education System
5-What and how will be impact of AI on Indian Education System
6-How AI will sustain in Era of Advancements of New Technologies.
7-What can be the detailed Results and Conclusion of entire Study.

Scope of Study
The Scope of this study is wide enough to study Global and Regional Trends in field of study and spans to Origin,History,Growth,Challenges and future. Further it details the impact of AI on Russian and Indian Education System and ends with detail findings and conclusion. The scope of study covers a continent like country that is spread in two continents Europe and Asia and further studies Global trends as well as regional trends and proposes a detailed study and framework.

This research focuses on exploring the global and regional trends in the adoption and integration of Artificial Intelligence (AI) technologies within the education systems of Russia and India. The scope is delineated to ensure a comprehensive yet focused investigation into the current status, development trajectories, challenges, and future prospects of AI in education in these two countries, set against the backdrop of global advancements.

Limitations of Study
While this research aims to provide a comprehensive analysis of global and regional trends and the potential for implementing artificial intelligence (AI) in the education systems of Russia and India, several limitations have influenced the scope, methodology, and interpretation of the findings:

Scope and Generalizability
This study focuses specifically on Russia and India as case studies, representing two large and diverse educational ecosystems. While this provides valuable comparative insights, the findings may not be fully generalizable to other countries or regions with different socio-economic, technological, or political contexts. Additionally, the study prioritizes formal education systems (primary, secondary, and tertiary), and does not deeply explore informal or vocational training settings.

Data Availability and Access
One of the main constraints encountered was the limited availability of up-to-date, disaggregated data related to AI implementation in education, especially in the Russian context. Many governmental and institutional reports were either inaccessible, outdated, or lacked transparency. In India, while some national AI initiatives are documented, implementation data at the state or district level was fragmented or anecdotal.

Language and Translation Barriers
A portion of the primary and secondary data sources, particularly those from Russia, were in Russian, requiring translation. Although efforts were made to ensure accuracy, there is a possibility that certain nuances or technical terms may have been lost or misinterpreted during translation.

Technological Evolution and Temporal Relevance
Given the fast-paced evolution of AI technologies and educational policies, some information or trends identified during the research period may have shifted by the time of submission. This temporal limitation affects the long-term applicability of some policy recommendations and technological assessments.

Policy and Institutional Opacity
In both countries, policy discourse around AI in education is still developing. Official documentation often lacks detailed implementation metrics or measurable outcomes. This restricts the ability to conduct rigorous impact assessments or longitudinal studies within the thesis scope.

Cultural and Societal Factors
While the study recognizes the importance of cultural, linguistic, and socio-economic diversity in shaping the educational use of AI, it does not delve deeply into ethnographic or community-level studies. These dimensions could provide a richer understanding of AI's societal reception and ethical implications but were beyond the scope of this research.

Methodological Constraints
Due to the interdisciplinary nature of the topic, integrating technological, pedagogical, and policy frameworks posed methodological challenges. While mixed-methods approaches were employed, certain qualitative dimensions (e.g., student/teacher attitudes, classroom interactions) were less explored due to time and resource constraints.

AI is helping educators unlock talent in differential learning paths who may typically have unrealized potential. AI for multilingual education is helping students bridge learning gaps from language difficulties. Development of voice-based learning models in local languages is on the rise. A stream of companies are continually working to enrich datasets in Tamil, Telegu, Hindi and other such Indian languages. This is helping students bridge language gaps by offering lessons in local languages or learn new languages effectively. Learners also have access to GenAI tools which can adapt to dialectal differences, enabling more inclusive education. Tools like Duolingo for Autism use AI to develop personalized lesson plans, providing immediate feedback and designing engaging learning activities. With respect to special needs education with AI, the capability to create customized content that aligns with their abilities is turning out to be a gamechanger. Auticare, an innovation by ISTI, under the Dept. of Science and Technology, GoI, is an assistive technology learning platform which uses different virtual reality scenarios based on applied behaviour analysis to assist learners with autism.

Though the scope of study is wide but certainly there are some limitations to study that can be understood as below:
1. Though study coveres Global trends but narrowly.
2. Study is primarily focused on Russia and India
3. It does not include West or USA or any other part of world

and if it covers as part of studying regional trends,it covers narrowly.

4. So study does not represent a true global prospective but is based on two countries namely Russia and India
5. The detail findings may give narrow references from west which are not sufficient to present trends in advancement of AI,Impact on Education in West or USA.
6. This is also a fact that Russia and India can not represent entire global population, however, may give at a glnace reflection on this subject and geography.
7. It should then be kept in mind by future scholars that this study by scholar focuses the origina,history,growth,challeng es and future trends in AI in two countries where technogical advance ment and specially advancemnet in AI is relatively slow when we compare it to West or USA. Same is applicable while studying AI in general in these two countries and specially in Education sector and proposing detailed results and framework.

Literature Review

The integration of Artificial Intelligence (AI) into education systems is rapidly transforming pedagogical practices, administrative processes, and learner engagement worldwide. As global interest in AI-driven education accelerates, it becomes imperative to explore the specific trends and prospects within national contexts particularly in emerging economies such as Russia and India, where large-scale digital transformation initiatives are underway. This literature review synthesizes global developments in AI in education and compares regional dynamics in Russia and India, offering a foundation for evaluating both countries' readiness, policy directions, and practical implementations.

Global Trends in AI in Education

AI's role in education has expanded significantly over the past decade, particularly in areas such as personalized learning, intelligent tutoring systems (ITS), administrative automation, and learning analytics. Globally, AI is seen as a catalyst for inclusive, equitable, and quality education aligning with the Sustainable Development Goals (SDG 4). Key technologies include natural language processing (NLP) for language learning, machine learning (ML) algorithms for predicting student performance, and computer vision in remote proctoring and augmented learning environments.

Several multinational initiatives (e.g., OECD's "AI and the Future of Skills," UNESCO's "AI and Education: Guidance for Policy-makers") provide comprehensive frameworks for AI integration into education. These emphasize ethics, data privacy, equity, and the need for teacher training. Developed countries like the U.S., UK, China, and Singapore have invested heavily in AI-driven education infrastructure, creating models for adaptive learning platforms and AI-based curriculum design [1-9].

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