

## ARTIFICIAL INTELLIGENCE AND TECHNOLOGY ADOPTION IN HIGHER EDUCATION IN INDIA

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**Abstract:** Artificial intelligence is reshaping the future of Global Higher Education and Academic research. Hence, it is important to understand the necessary anticipations, outcomes, challenges and required interventions for preparing the higher education system for transformation and restructuring. The global adoption of technology is impacting the lives of many in terms of standard of living, education, employment and economic development. No technology can simply replace face-to-face teaching and personalize classroom experiences. EduTech companies are observing the opportunities and latest investment patterns and trends in South Asia, especially India and China. AI-powered tools are already used by authors, teachers, administrators, students and research scholars in developed countries. However, developing countries also show positive trends in AI usage in education. On the other side, there is a fear that dependence on AI tech tools can create a threat to many languages, creativity, human expressions, humanistic feelings in writing, cognitive thinking, summarizing abilities, aboriginal ideas etc. Moreover, AI may help in finding out the missing knowledge links in research and human development if used efficiently. It also impacts the employment opportunities and job market scenario. This micro-level study will present an overview of AI in higher education and inclinations towards AI tools and techniques in India. The study will analyze the possible threats and potential of AI in higher education.

**Key Words:** AI, Power BI, Machine learning, Simulation, Blended Learning, Data Visualisation

**Introduction:** AI in higher education is rapidly changing teaching-learning methods and pedagogy in developed nations. Artificial intelligence in Education (AIED), and Education Technology (EduTech) companies are ready to experiment in the entire South Asia including Indian market in the Era of Machine Learning and Blended Learning. Global AI market size was estimated around USD 136.55 billion in 2022 whereas it reached around USD 196.63 billion in 2023. It is reported

that the AI market in India is expected to reach US\$7.8 billion by 2025 at the rate of 20.2 percent compound annual growth (UNESCO, 2022).

The growing EduTech market of India was estimated around USD 2.36 million in 2023. India has the fastest-growing EdTech market, which is expected to reach 13.06 billion US dollars by 2030 (Maximise Market Research (MMR), 2023). Currently, there are more than 3,500 EdTech startups in India with almost 700 million US dollars of funding being invested across 56 different companies. Byju's, Extramarks and Infinity Learn are leading in the EduTech Market. Private players are investing in higher education and it is high time the government must prioritize investment in AI research and infrastructure. However, NITI Aayog initiated to focus on five sectors that are envisioned to benefit the most from AI in solving societal needs; healthcare, agriculture, education, smart cities and infrastructure, and smart mobility (NITI Aayog, GOI, 2018).

On the other side Indian government already introduced the National Programme on Artificial Intelligence (NPAI) Skill Framework intending to enhance the skills of youth. It is also intended to develop standards for the ethical use of AI and create a robust AI ecosystem. Open Educational Resource (OER) initiatives of the central and state governments in India. The National Repository of Open Educational Resources (NROER) and Diksha (National Teacher Platform) are developed by the Government to make teachers and students tech-savvy (Kashinathan, 2020). NIST National Information Technology Laboratory along with Big Data Public Working Group also established to enable Big Data stakeholders such as data scientists, researchers, etc. Technology-led capitalism may create a big challenge for the marginalized in receiving education and getting a reputed job. AI automation is expected to reduce employment in India and many people have already lost their jobs in the recent past in IT sector. On the other side, algorithm-based prediction and outcomes will be highly influenced by the professionals and developers coming from specific castes which may not include the interest of the majority. Therefore, it is essential to understand the impact of AI on human and technical dimensions in the context of higher education in the interest of compatriots. Because technology interfaces normally influence human emotions and learners' cognitive abilities. Digital safeguarding of teachers and learners is another important aspect which using AI in higher education.

**Methodology:** This study is based on secondary data collected from reports, newspapers and Journal articles. Relevant information is collected, summarized and presented in this article.

**Literature Review:** Many research articles and reviews for understanding the current scenario of AI in higher education in India. A summary of reviewed reports and articles in presented below:

The AI was introduced by McCulloch and Pits in 1993 (Negnevitsky, 2002). Machine learning and Virtual reality concepts were explored in the late nineties. Total publications on AI almost doubled till 2010 (Kashinathan, 2020). AI is useful in higher education but there are many ethical concerns such as data privacy, user safeguards, displacement of human educators, transparency

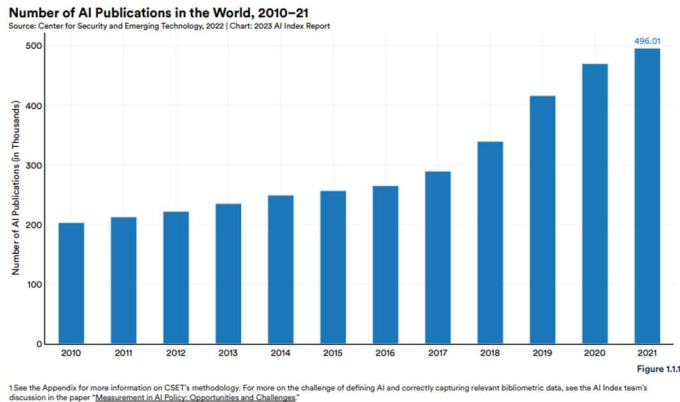
and accountability in the decision-making process (Tony Bates, 2020). Under NEP various Indian Universities started offering undergraduate degrees in AI or computer science and engineering with a specialization in AI 21,22 and machine learning (Ministry of Education , 2021). CBSE is also introducing a subject at plus two level on artificial intelligence. AICTE-approved institutions are also suggested to offer AI as an elective course. Online certificate courses, MOOCs and research projects are also offered in similar areas. Moreover, from degree courses to short-term courses, AI is gaining popularity. According to one study conducted by UNESCO research scholars are publishing and conducting research work in the areas like AI, ML and Data Science (UNESCO, 2022). According to another study the number of AI-related job postings has increased on average from 1.7% in 2021 to 1.9% in 2022 (Nestor Maslej, Loredana Fattorini, Erik Brynjolfsson, John Etchemendy, Katrina Ligett, Terah Lyons, , 2023). In one study it was proposed that AI in Education (AIED) research focuses on reducing teachers' workload in the future by developing intelligent tutoring systems (Muhammad Ali Chaudhry, 2022). Later Alan Turing suggested that computers could learn to think and behave like humans (COSN, 2023). AI extended most in the nineties and presently AI is almost escalating in every sector. The Association for the Advancement of Artificial Intelligence (AAAI) recommended defining AI under the following themes; perception, representation and reasoning, learning, natural interaction, and societal impact (COSN, 2023). A recent systematic review was conducted and details of 146 papers was analyzed in the context of AI in higher education (Olaf Zawacki-Richter, 2019). Another study by Crompton and Burke This systematic review provides unique findings with an up-to-date examination of artificial intelligence (AI) in higher education (HE) from 2016 to 2022 (Crompton, 2023).

**Observation and Findings:** Popular AI tools and techniques rare discussed briefly in this section whereas data related to research, publication, courses and employability are also presented with the help of tables and graphs. Following are the popular AI paraphernalia:

1. **Large Language Models (LLMs):** These models are most advanced form of artificial intelligence system used in higher education systems. ChatGPT is a type of LLM which is quite popular among students. LLM allows users to interact with computers naturally and conversationally almost similar to human beings and their reactions.
2. **Generative Pre-trained Transformer (GPT):** GPT is a name assigned to a family of natural language models developed by OpenAI. There are many other similar large language models known as Bard, LLaMA, and Claude. These are used to generate large text on a topic.
3. **Chatbots:** Usually Chatbots Systems are designed to respond automatically to questions or messages through the interpretation of natural language and contents. Users think that the teachers or experts are interacting with them in their natural language.
4. **Big Data:** Deals with large volumes of heterogeneous and volatile data sets, generated rapidly from different sources, that are cross-referenced, combined and mined to find patterns and correlations, and to make novel inferences. The analysis is not possible without data visualization, machines and algorithms.

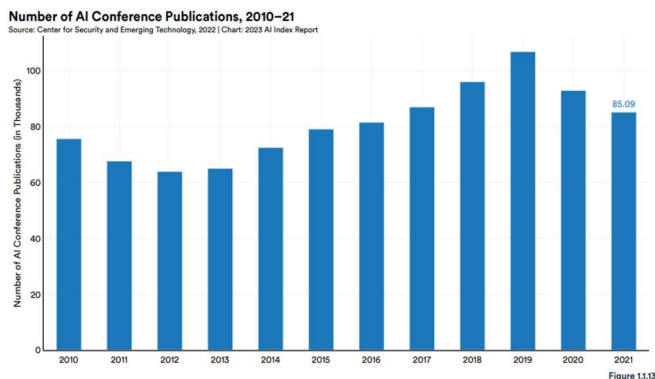
5. **e-proctoring:** Surveillance and fraud detection can be performed with the help of e-proctoring and the use of AI-driven systems can monitor learner taking examinations to detect fraud and cheating during exams.
6. **Educational Data Mining:** Institutions and business firms deals with a large database of students, teachers, research, journals, articles and scientific projects. Sometimes, archives are not enough to store important information through Large database management. Therefore, Educational Data Mines are used to manage the large data efficiently. Further large databases are used for analysis and data visualization.
7. **Machine Learning (ML):** A high level of AI specifically used for predictive analysis with the help of artificial intelligence based on algorithms. ML is currently a dominant and powerful tool used in education. It is based on algorithms and statistical models to analyze big data, sequence of data, identify data patterns, connect links, draw inferences, finding results to predict something with utmost accuracy.
8. **Natural Language Processing (NLP):** NLP or Speech-to-text and Natural language generation are also used by many students and teachers. These are divided into two broad categories; i) Systems that use AI to transcribe, interpret, translate and create text and spoken language ii) Personalized learning systems used for tutoring and mentoring.
9. **Plagiarism Checking:** There are many plagiarism detection software used by educational institutions. A few institutions started using AI-driven content scanning tool that help identify the level of plagiarism in the documents/articles submitted by the students and faculty members such as assignments, reports, books and articles by comparing a submitted text with existing texts.
10. **Computer Based Instructions:** CBI is used to develop a user-friendly environment according to the user needs and step by step instructions are provided during the user interface.
11. **Human In the Loop:** It is gives an opportunity to the instructors to interrupt the learner in case the instructions given by AI tools are not clear or the users find some difficulty in understanding or in completing of assigned tasks or projects.
12. **Automated Grading:** It is used for evaluation and assigning grades to the students with the help of AI and saving the time of evaluators from repetitive tasks by feeding the answer keys or key terms in the system.
13. **AI Repositories:** AI repositories such as GitHub are quite popular among Indian educators and scholars.
14. **AI Labs:** Educational institutions are setting up AI labs with advanced simulation models used in science and other relevant subjects.

The secondary data related to teachers and students is analyzed for this study. AI usage in research, publications, employability, and courses. Graph 1 shows the increasing trend of publishing on AI-related topics between 2010-21.



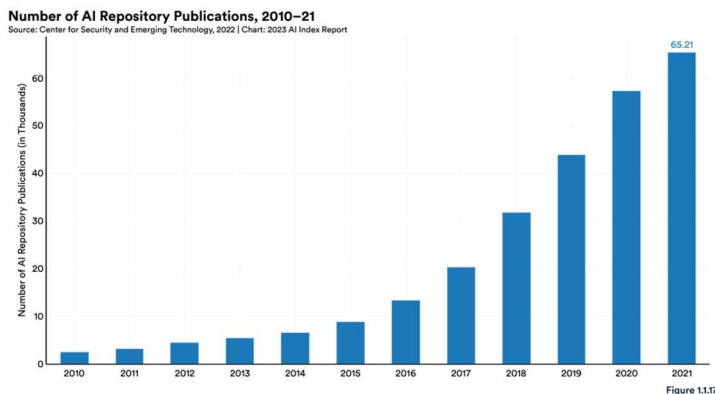
**Graph 1: Number of AI Publications in the World**

In Graph 2 the **increasing** trend of conference publications on AI-related topics in the world during 2010-21 are plotted.



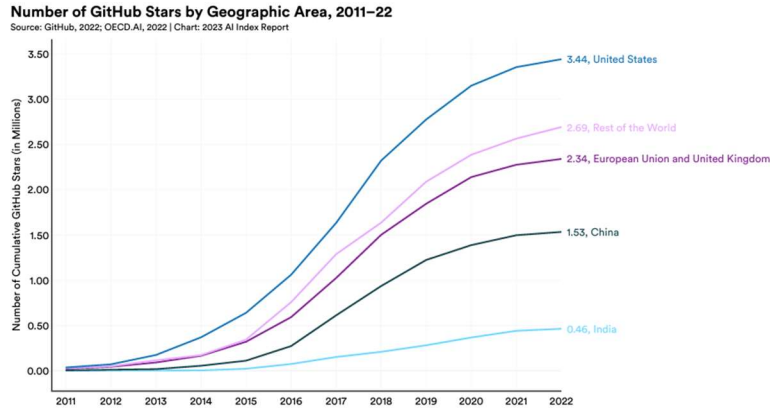
**Graph 2 Number of Conference Publications on AI in the World**

In another graph number of AI repository publications shows increasing trends between 2010-21 as per the data collected by Center for Emerging Technology in 2022.



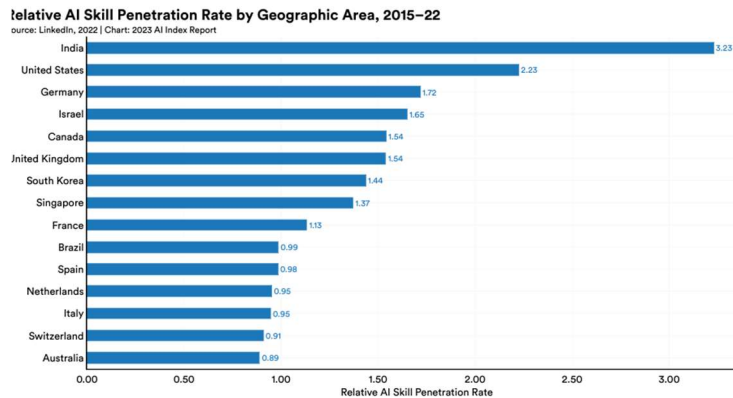
**Graph 3 Number of AI Repository Publication**

In Graph 4 number of GitHub Stars between 2011-22 are plotted by geographical areas and India ranked world average. GitHub ranking is a way to find out popular repository among users. Rating is given by the users for comparing GitHub with other repositories.



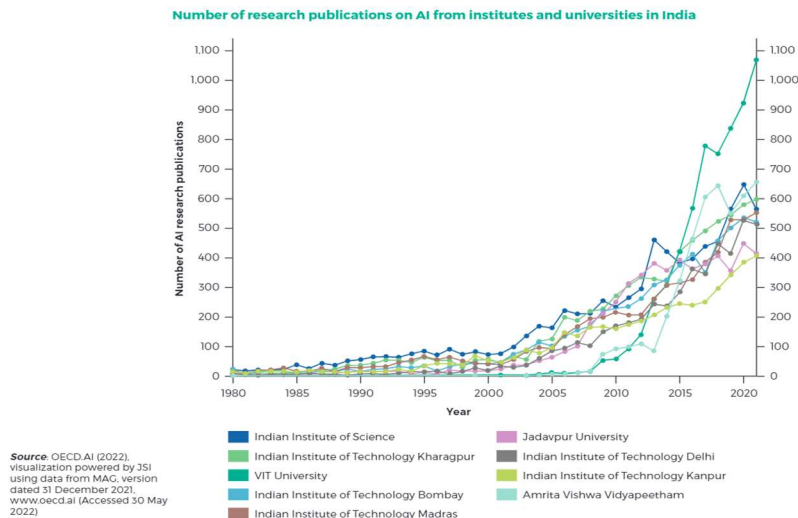
**Graph 4 GitHub Stars by Geographic Area**

According to OECD Data Graph 5 is showing the AI Skill Penetration Rate according to geographic area between 2015-22.



**Graph 5 AI Skill Penetration Rate by Geographic Area**

Graph 6 represents the number of research publications on AI from Indian Institutes and Universities where IITs are leading with maximum number of publications.



**Graph 6 Research Publications on AI related topics by Indian Institutions and Universities.**

Many AI courses are introduced by Indian Universities in the recent past as per the demand of AI based jobs in different sectors such as Ethical AI for good governance, Prompt Engineering for Generative AI, Chat GPT, AI for digital transformation, AI and Machine Learning, Generative AI with LLM etc. In addition, Indian Government started MOOCs, SWAYAM, DIKSHA, AI FOR Everyone and Future Skills platforms for the learners. INFLIBNET also developed different consortiums for librarians, teachers and students. The technocrats are working to transform the education sector as per the latest requirements of AI tools. On the other side there is a large segment which is struggling for ICT literacy and basic ICT infrastructure in schools and colleges. Henceforth, is essential to establish a parity between rural and urban institutions. Inclusion of the marginalized is another important agenda as a major workforce in banking, insurance, education, IT, healthcare is coming from marginalized sectors. These sectors are often blamed for exploiting GIG workers in the absence of clear guidelines and regulations at present. AI can be useful if it is used in a planned, fair and transparent manner. Before implementation, it is of utmost importance to understand the needs of different segments.

**Conclusion:** AI already expanded its annexes in India and it is beyond our control. The dynamism of current global marketplace is impacting Education System of India at a faster rate due to innumerable technological reforms. Global manpower is supplied from two big nations India and China. Hence, the entire world is eager to introduce education technology and educational products in South Asia to understand customer responses and to skim the cream of the market. Educational games, Apps, Platforms, Portals and AI tools are introduced here with an agenda to grab the second-largest education market in the world. If the Indian education system wants to move a step ahead from global firms it must understand the needs of a diversified population. Moreover, another big challenge is the social inclusion of marginalized segments in higher education system to improve our employment rate and GDP.

## 1. References

- COSN. (2023). *Artificial Intelligence in K2*. COSN.
- Crompton, H. (2023). Artificial intelligence in higher education: the state of the field. *International Journal of Educational Technology in Higher Education* .
- Kashinathan, G. (2020). *Making AI work in Indian Education*. New Delhi: Friedrich-Ebert-Stiftung, New Delh.
- Maximise Market Research (MMR). (2023). *India Edutech Market: Adoption of smart and connected devices to boost market growth*. MMR.
- Ministry of Education . (2021). *PIB*, . Retrieved from <https://pib.gov.in/PressReleasePage.aspx?PRID=1704878>
- Muhammad Ali Chaudhry, E. K. (2022). Artificial Intelligence in Education (AIEd): a high-level academic and industry note 2021. *AI and Ethics*. doi:<https://link.springer.com/article/10.1007/s43681-021-00074-z>
- Negnevitsky, M. (2002). *Artificial Intelligence* . Pearson Education .
- Nestor Maslej, Loredana Fattorini, Erik Brynjolfsson, John Etchemendy, Katrina Ligett, Terah Lyons, . (2023). *The AI Index 2023 Annual Report*. Stanford, CA: AI Index Steering Committee, Institute for Human-Centered AI, Stanford University .
- NITI Aayog, GOI. (2018). *National Strategy for Artificial Intelligence #AIFORALL*. NITI Aayog.
- Olaf Zawacki-Richter, V. I. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*.
- Tony Bates, C. C. (2020). Can artificial intelligence transform higher education. *International Journal of Educational Technology in Higher Education*. Retrieved from <https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-020-00218-x>
- UNESCO. (2022). *State of the Education Report (SOER) for India: Artificial Intelligence in Education – Here, There and Everywhere*. UNESCO.