ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26apr2474

Artificial Intelligence Enabling Technologies for Higher Education Institutions

N. Keinahanbi Devi[1]; Sanasam Thoibi Devi[2]; R. M. Krishna Sureddi[3]; Mutum Indrakumar Meetei[4]; Sanasam Bimol[5]

[1]Assistant Professor, Department of Computer Science, S. Kula Women's College, Nambol, Manipur
[2]Assistant Professor, Department of Computer Science, Biramangol College, Sawombung, Manipur
[3] Associate Professor, Department of Computer Science, Arunodaya University, Arunachal Pradesh
[4,5] Assistant Professor, Department of Physics, Kamakhya Pemton College, Hiyangthang, Manipur

Publication Date: 2026/05/19

Abstract: AI technology is reshaping higher education classrooms, teaching, learning, and research, and much of higher education administrators and faculty are end users of AI. In this paper, we review some core AI technology, values and challenges of AI technology, and meanings for changes needed in institutions. The strategy of AI in creating efficient, equitable, and personalized learning environments is emphasized, with examples used from Georgia State University, Arizona State University, University of Murcia, and Indian institutes like IIT Bombay and Amity University. We analyze the impact teaching and learning have on institutional performance and student success from AI applications like predictive analytics, chatbots, intelligent tutoring systems, and best practices, including AI implementation, challenges, and potential solutions in institutional scale.

Keywords: *Artificial Intelligent; Higher Education; Enabling Technologies.*

How to Cite: N. Keinahanbi Devi; Sanasam Thoibi Devi; R. M. Krishna Sureddi; Mutum Indrakumar Meetei; Sanasam Bimol (2026) Artificial Intelligence Enabling Technologies for Higher Education Institutions. *International Journal of Innovative Science and Research Technology*, 11(4), 4884-4888. https://doi.org/10.38124/ijisrt/26apr2474

I. INTRODUCTION

Artificial Intelligence (AI) is quickly reshaping higher education institutions (HEIs) globally by improving administrative efficiency, customizing learning experiences, and enhancing research activities. In educational contexts, the application of AI is supported by a range of enabling technologies which are fundamental to catalyzing the digital transformation of education to improve educational outcomes and prepare students for the future shaped increasingly by AI. The introduction of AI technologies facilitates data informed decision-making and personalized learning, through the ability to review large volumes of educational data, predictive analytics, and the automation of repetitive administrative tasks. Amid this, key enabling technologies that support the impact of AI in the higher education workspace are machine learning, natural language processing (NLP), robotic process automation (RPA), and intelligent tutoring systems (ITS) which are considerably enhancing both the operational and educational capacity of HEIs to meet increasing demands for quality, efficiency and accessibility in education. As higher education universities focus on improving student success, managing growing volumes of data, and responding to demand for personalized education, AI is becoming increasingly important. The paper will investigate trends in the landscape of AI in higher education, including practical applications and implementations while focusing on Georgia State University as a case study. This paper is investigating the needs of AI adoption higher education sector and clarify the AI technologies can make how HEIs effectively use to accomplish their strategic mission to successfully operate in modern education landscape.

II. UNDERSTANDING OF AI IN HIGHER EDUCATION

The use of AI in higher education represents a significant shift in educational practice by introducing intelligent systems and support to enhance teaching, learning, and administration. AI applications have broad range, such as intelligent tutoring systems (ITS), predictive analytics to estimate student achievement, automated grading system, chatbots for administrative support, and data mining for research [1]. These applications necessitate sophisticated infrastructure that incorporate a verity of technologies like machine learning algorithms, data storage systems, and natural language engines, for smarter behaviours in educational contexts. The impact of AI-powered technologies tools is significant, advancing personalized learning experiences through applications that respond to students' unique needs and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26apr2474

increasing student engagement [2],[3]. In addition to the application of AI in educational institutions incorporate predictive analytic tools that can predict the success rate of student and help to optimize resource allocation. The Indian National Education Policy (NEP) 2020 is focus on to supports AI for promoting quality and equitable access [4]. In order to install equitable and innovative innovative educational frameworks for the future, it is very essential to understand the complexities surrounding AI in higher education.

III. CORE ENABLING TECHNOLOGIES OF AI IN HIGHER EDUCATION

AI enabling technologies are a collection of computational tools and systems used to imitate intelligent behaviours in machines. In higher education, the most prominent technologies are:

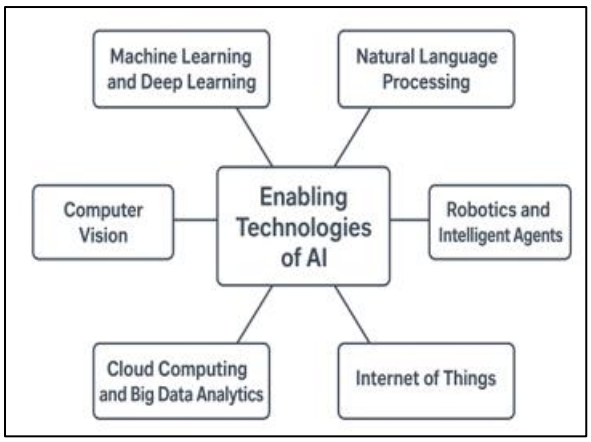

Fig. 1 Enabling Technologies for AI in Higher Education Flowchart

A. Machine Learning (ML) and Deep Learning

ML is an important component of artificial intelligence (AI) applications in education since it enables the system to learn from previous student data, facilitating results and personalization of learning. ML models, for example, can identify students who are likely to drop out based on specific factors such as attendance, grade, and general participation [5]. Moreover, Baker & Inventado [6] emphasize that these algorithms are fundamental to the whole process of finding the students who are in danger of failure, adjusting the educational path for the students, and the retention of the students, by the application of the predictive analytics. The ML tools, by taking into account both past and current data, make a forecast of the student success, and thus, a timely intervention can be made for those who are in need.

B. Natural Language Processing (NLP)

NLP enables the system to understand and interpret human language, which in turn makes AI chatbots, automated grading systems, and academic writing assistants possible [7]. These tools communicate with and provide services to the staff and students of higher education institutions (HEIs). It allows machines to comprehend language, thus powering virtual assistants, automated essay scoring systems, and performing sentiment analysis on student feedback. AI-powered chatbots are equipped with NLP to handle student queries, which leads to faster response times and better institutional efficiency [8].

C. Robotics and intelligent agents

Artificial intelligence and automation are blended to handle tasks that need to use human-like intelligence [9]. Robotics refer to the machines that are able to feel, think and do something, while intelligent agents are systems that independently perform their functions in various settings [10]. Such systems learn from the data they gather and modify their modus operandi to make the achievement of the desired goals more efficient; for instance, Robotic Process Automation (RPA) is implemented for the simplification of administrative chores like admissions and scheduling, thus, the expenses are minimized and the staff that are freed can be used for strategic roles [11]. Additionally, AI-based virtual assistants contribute to turning education into a more accurate and productive process [12]. The combination of robotics and intelligent agents is a major factor in innovation that pulls beyond the boundaries of different sectors, thereby, making it possible to have a more intelligent and technologically advanced ecosystem [13].

D. Internet of Things and Edge Devices

Among the IoT devices are smart classrooms, biometric attendance systems, and wearable technology, which are all capable of generating real-time data needed for the evaluation of learning environments and student engagement. When coupled with edge computing, they make AI more responsive as workloads are completed close to the data source [14]. IoT refers to a group of physical devices that are linked together in a network, and that by use of the internet can collect, exchange and take action on data which would lead to automation, efficiency, and better decision-making. In education, IoT facilitates smart classrooms adoption, while in health-care, it allows for remote monitoring and flash detection of health issues. IoT in general is changing the way people are dealing with technology, thus, making the concept of smart living and innovation more foreseeable.

E. Cloud Computing and Big Data Analytics

AI is data-driven, where most of the data cover the performance of students and include course feedback. To process and depict this data, big data tools are used, through this visualization, challenges, and opportunities for teachers, present themselves as they can employ these data to improve instructive techniques and helpfulness in policy redesign [15]. The predictive analytics is one of the options, that refers to the use of historical data to forecast potential results such as student attrition or accomplishment. Besides, the use of cloud platforms makes AI applications more accessible by providing the necessary computational resources and storage. Meanwhile, cloud-based LMS, for example, Canvas and Moodle, supported by AI technologies, offers educational institutions environments for facilitative and scalable collaboration[16].

F. Computer Vision

Computer vision is an AI unit that allows the machines to obtain and comprehend the visual data presented in images or videos [17]. This operation basically consists of processing, feature extraction, and recognition of the image, which enables machines to decide depending on the visual data (Gonzalez & Woods, 2018). The application of these technologies has significantly been diversified from areas like facial

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26apr2474

recognition, medical image diagnostics, autonomous vehicles, and the quality inspection part of industrial production [19]. The uses of computer vision in education include the monitoring of the students' participation levels in classes and the facilitation of AI-based posture detection for physical training [20]. Szeliski [21] states that computer vision fuses pattern recognition and deep learning, which are major components in obtaining human-level accuracy in dealing with complicated visual tasks, thereby making the creation of intelligent systems that can "see" and interact effectively in various settings possible.

IV. IMPLIMENTATION OF AI

AI-powered tools are utilized in several universities and higher educational institutions have pioneered implementation of AI in all over the globe for the enhancement of academic and administrative functions across the board. Here we have discussed few universities and institutions.

The first and most significant step of GSU's initiative to implement AI technology in its strategy is turning the university into a leader of the success of the American data-driven student projects [22]. The decision taken by GSU led to the creation of a predictive analytics system that churns data on more than 800 students, the data is monitored, and early alerts are generated for the advisors to have a timely intervention through which the students receive the required support [23]. One of the university's most spectacular achievements is the creation of the AI-powered chatbot "Pounce," which has gone a long way in preventing summer melt—students who do not enroll after admission—and raising the general student engagement and participation levels [24].

AI is applied at Arizona State University (ASU) in all academic services such as using AI-based algorithms for course recommendations, adaptive learning, and performance analysis. In addition, automated grading systems, and the use of AI to produce insights, help faculty and improve the curriculum. Moreover, faculty members receive assistance from automated grading systems and AI-powered data insights to refine pedagogy and curriculum design which then turns the university into the leader of the digital and AI-enabled education sector [25]. Incredible analytics technologies like Machine Learning along with the AI platform at the Indian Institute of Technology Bombay (IIT Bombay) are extensively applied for making precise predictions about student learning capabilities across different subjects in the STEM area [26]. Furthermore, these systems are also helping the development of intelligent tutoring frameworks that can automatically adapt to the individual needs of students thereby resulting in the facilitation of research and the smooth flow of quality education. Really, the Center for Machine Intelligence and Data Science (C-MInDS) at the IIT is well known for deepening the AI research, nurturing the interaction of the different disciplines, and producing AI-based educational tools for the purposes such as adaptive learning and data-driven teaching. The amalgamation of these activities is enabling IIT Bombayto be recognized as the forerunner in the implementation of AI in education and research at the level of higher studies in the country of India [27].

Indian Institute of Technology (IIT) Hydrabad has gone all out to put AI at the centre of their wide range of innovative projects. TiHAN's report in [28], AI-driven driverless busess react swiftly to the surroundings and drive autonomously on campus by using sensor fusion and computer Vision. AiSwARYAM project from IIT is utilizing artificial intelligence for sustainable urban infrastructure while allowing real-time data analytics and predictive modelling to stimulate efficient city management, as per the source from IIT Hyderabad [29]. Besides that, based on deep learning, AI-based helmet detection [30]. Beyond the mention of the GPU and the NVIDIA AI Technology Centre, the installation of the AI innovation at IIT Hyderabad constitutes a significant milestone in the Indian AI research & applications landscape and is among the Top IIT AI Centre of Excellence worldwide.

IIT Delhi's and Table's Delhi researchers and institutes have been on the frontlines of AI developments in health, eco-friendliness and city projects: for instance, IIT Delhi and AIIMS through a Centre of Excellence Initiative in AI for Healthcare. Furthermore, IIT Delhi has sagely welcomed a Centre of Excellence in Precision & Personalized Healthcare (with Wadhwani Foundation) that works on bio-imaging, AI-based diagnostics, non-life support tech, and cost-effective health wearables [31]. Rationalizing their R-Systems-sponsored CoE for Applied AI in Sustainable Systems, IIT Delhi is undertaking unexplored roads such as indoor navigation, eco-friendly AI on-chip accelerators, and green ML workflows [32]. Moreover, the VayuAnukulani system utilizing adaptive attention-based bidirectional LSTM networks is forecasting air pollution levels (e.g., PM2.5, PM10, NO_2) throughout Delhi, and improving over previous models by ~15-20% in some metrics [33].

IIT Guwahati's AI-powered projects showcase a number of the most outstanding applications of technological breakthroughs in educational mobility and healthcare sectors. One of the most notable developments at the institute is ALBELA, a chatbot powered by AI and created by the EEE department to help new students gain access to required information concerning schedules, exams, courses, etc., even if it is in unstructured documents (PDF/Word [34]). On the other hand, Smart-Engineer is an engineering design software with integration of AI technologies that was set up at the e-mobility lab (IITG) to speed up designing of the induction motors by taking the help of IBM Watson and cloud-based AI to put in practice of our motor experts' knowledge on motor design [35]. Besides that, the researchers of IIT Guwahati also planned for the help of the team to develop OsteoHRNet, which is a deep learning model to evaluate knee osteoarthritis severeness based on the KL grading scale through X-ray images; thus, making the medical image analysis as a tool for early diagnosis [35].

To improve learning and to make the operations run smoothly, Chandigarh University has integrated Artificial Intelligence (AI) in all its academic and administrative systems. The university set up the Centre for Artificial Intelligence Research (CAIR) which concentrates on AI-based innovations for education, healthcare, and smart cities [36]. AI-enabled systems, for example, smart tutoring, student performance predictive analytics, and automated admission

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26apr2474

and attendance management have been put in place to raise the academic outputs as well as the decision-making processes. Besides that, the institution is working with big names in the tech industry like IBM and Microsoft for creating the AI-based curriculum and research projects which thereby make the university one of the top Indian institutions in AI uptake in higher education.

Amity University has adopted Artificial Intelligence (AI) into learning management system, sentiment analysis of student feedback, and visual assistants [37]. Such changes not only make students' learning more personalized but also increase their participation in different academic programs [38]. Besides, the partnership of Amity with tech giants like Microsoft and IBM has led the incorporation of AI into the student services, administrative efficiency, and academic operations, thus greatly facilitating the overall progress [39]. As a result of these innovations, the application of advanced AI technologies in the higher education sector can be seen as a great impact.

V. IMPLIMENTATION CHALLENGES AND ETHICAL ISSUES

Though AI has immense capabilities to revolutionize the educational field, its utilization faces several obstacles. The problem is that there is anxiety about privacy of data, bias of algorithms, and the digital gap between different groups.

A. Data Privacy and Security

Privacy refers to people who control over their personal data, collecting, usage, and sharing. The adoption of AI in education sector necessitates the wide range of data collection and student information analysis, making the protection of these data and crucial to prevent misuse or theft. Bias, privacy rights violation, and identity theft may lead due to Laking in data management [40]. At the same time, sensitive data like students' academic performance and health information may track at any moment by AI. Therefore, it is important every educational institution to establish clear privacy policies to protect students' data, as unauthorized access can lead to privacy violations and discrimination based on sensitive data.

B. Algorithms Biases

If the education system is based on biased data sources, leading to algorithmic bias that reinforces existing social disparities, then AI systems can substant educational inequalities. It is a crucial job to develop AI system based on fairness and equality as core principle. For example, the use of AI in listing and recruiting candidates and law enforcement areas like justice in criminal, finance, and health, are the area's most prone to bias. O'Neil highlights the dangers of these "weapons of math destruction," noting their potential to exacerbate issues like over-policing in marginalized communities [41].

C. Digital Divide

The digital divide/gap is the divide between those that have access to and can make use of digital technology, and those that do not, with a focus on those that are disadvantaged and live in rural communities or developing countries. The pandemic of COVID 19 has brought this issue to the forefront as there was an increased utilization of online learning and students were unable to partake in online learning due to limited supplies or reliable Internet Service [42]. The divide has also created disparities in healthcare, employment, and civic engagement, thus, making people in these communities more isolated from the rest of society.

VI. CONCLUSION

One of the major impacts of AI-related technologies on universities is the simplification of the numerous operations that these institutions carry out, besides the possibility of a more personalized learning and the improvement of the institutional efficiency. In order to fully utilize the power of AI, higher education institutions (HEIs) need to make a strategic investment in the faculty training, ethical frameworks, and infrastructure. Despite the clear benefits of AI, there are still issues related to ethics, technology, and policy institutions faced in incorporating AI. These institutions, as they adapt to this new era, must ensure that implementing AI is carried out with the characteristics of being transparent, inclusive, and continuously assessed. Their further research could focus solely on creating models that are not only scalable but are also capable of solving efficiency and equity issues for students at the same time.

ACKNOWLEDGMENT

We extend our gratitude to all the authors whose valuable works we have cited in this paper. Their contributions in the field of artificial intelligence and higher education have greatly influenced the development of this paper. Without their contribution, it may not have shaped this paper.

REFERENCES

[1]. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. International Journal of Educational Technology in Higher Education, 16(1), 39.
[2]. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson Education.
[3]. Holmes, W., Bialik, M., & Fadel, C. (2021). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Center for Curriculum Redesign.
[4]. Government of India. (2020). National Education Policy 2020. Ministry of Human Resource Development.
[5]. Lu, O. H. T., Huang, A. Y. Q., Huang, J. C. H., & Yang, S. J. H. (2018). Applying learning analytics for the early prediction of students' academic performance in blended learning. *Educational Technology & Society*, 21(2), 220–232.
[6]. Baker, R. S., & Inventado, P. S. (2014). Educational data mining and learning analytics. In *Learning Analytics* (pp. 61–75). Springer. https://doi.org/10.1007/978-1-4614-3305-7_4
[7]. Jurafsky, D., & Martin, J. H. (2024). Speech and Language Processing (3rd ed.). Stanford University.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26apr2474

[8]. Huang, M. H., Rust, R. T., & Maksimovic, V. (2023). The Feeling Economy: How Artificial Intelligence Is Creating the Era of Empathy. Journal of Service Research, 26(2), 147–163.
[9]. Russell, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach (4th ed.). Pearson Education.
[10]. Poole, D., & Mackworth, A. (2023). Artificial Intelligence: Foundations of Computational Agents (3rd ed.). Cambridge University Press.
[11]. Willcocks, L., Lacity, M., & Craig, A. (2016). Robotic Process Automation and Risk Mitigation: The Definitive Guide. SB Publishing.
[12]. Rosemary Luckin, Mutlu Cukurova, Carmel Kent, Benedict du Boulay.(2022). Empowering educators to be AI-ready. Computers and Education: Artificial Intelligence. Volume 3, https://doi.org/10.1016/j.caeai.2022.100076
[13]. Kaplan, A., & Haenlein, M. (2020). Rulers of the world, unite! The challenges and opportunities of artificial intelligence. Business Horizons, Elsevier 63(1), 37–50.
[14]. Gartner. (2020). *Top 10 Strategic Technology Trends for 2020*. https://www.gartner.com/smarterwith gartner/gartner-top-10-strategic-technology-trends-for-2020
[15]. Daniel, B. (2015). Big Data and analytics in higher education: Opportunities and challenges. *British Journal of Educational Technology*, 46(5), 904–920.
[16]. IBM. (2022). *Cloud Solutions for Education*. Retrieved from https://www.ibm.com
[17]. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
[18]. Gonzalez, R. C., & Woods, R. E. (2018). Digital Image Processing (4th ed.). Pearson.
[19]. Forsyth, D. A., & Ponce, J. (2023). Computer Vision: A Modern Approach (3rd ed.). Pearson.
[20]. Zhou, Y., Chen, H., & Wang, J. (2021). Application of Computer Vision in Smart Education Systems. International Journal of Emerging Technologies in Learning (iJET), 16(14), 45–58.
[21]. Szeliski, R. (2022). Computer Vision: Algorithms and Applications (2nd ed.). Springer.
[22]. New America. (2021). How Georgia State University Uses Predictive Analytics to Boost Student Success. Washington, DC.
[23]. Phillips, D. (2020). Artificial Intelligence and Predictive Analytics at Georgia State University: Transforming Student Success. EDUCAUSE Review, 55(2), 34–42.
[24]. Page, L. C., & Gehlbach, H. (2017). How an Artificially Intelligent Virtual Assistant Helps Students Navigate the Road to College. AERA Open, 3(4), 1–12.
[25]. Crow, M. M., & Dabars, W. B. (2020). The Fifth Wave: The Evolution of American Higher Education. Johns Hopkins University Press.
[26]. IIT Bombay. (2023). Centre for Machine Intelligence and Data Science (C-MInDS). Retrieved from https://www.cse.iitb.ac.in/cminds
[27]. Chakraborty, S., & Rao, P. (2021). Artificial Intelligence Applications in Indian Higher Education: A Case of IIT Bombay. Journal of Educational Technology System, 50(2), 189–205.
[28]. NDTV (2024). IIT Hyderabad Launches AI-Powered Driverless Buses on Campus. Retrieved from [https://www.ndtv.com/education/iit-hyderabad-launches-ai-powered-driverless-buses-on-its-campus]
[29]. IIT Hyderabad (2023). AiSwARYAM – AI for Sustainable Infrastructure. https://aiswaryam.ai.iith.ac.in
[30]. Times of India (2018). IIT Hyderabad develops AI-enabled software to catch riders without helmet. https://timesofindia.indiatimes.com
[31]. Times of India (2025). IIT Delhi gets centre of excellence in precision and personalised healthcare https://timesofindia.indiatimes.com/city/delhi/iit-delhi-gets-centre-of-excellence-in-precision-and-personalised-healthcare/ articleshow/ 123307367 .cms
[32]. IIT Delhi, (2020) Amar Nath and Shashi Khosla School of Information Technology :: IIT Delhi, (2020) https://sit.iitd.ac.in
[33]. Madaan D. et al (2019). VayuAnukulani: Adaptive Memory Networks for Air Pollution Forecasting. https://arxiv.org/abs/1904.03977
[34]. NDTV (2019). AI- Enable Chatbot to teach student ib IIT Guwahati. IIT Guwahati Team Develops Artificial Intelligence-enabled Chatbot 'ALBELA https://www.ndtv.com/education/iit-guwahati-team-develops-artificial-intelligence-enabled-chatbot-albela-2094949?
[35]. Times of India (2023). IIT Guwahati researchers develop AI-based model to predict Knee Osteoarthritis severity from X-ray images - India Today. https://www.indiatoday.in/education-today/ news/story/iit-guwahati-researchers-develop-ai-based-model-to-predict-knee-osteoarthritis-severity-from-x-ray-images-2404325-2023-07-10?
[36]. Chandigarh University: https://www.culko.in/ research-and-innovation/caria.php
[37]. Sharma, P., & Gupta, A. (2022). Adoption of AI Tools in Private Universities: A Case Study of Amity University. International Journal of Advanced Research in Computer Science, 13(4), 210–219.
[38]. Siddappa M (2021). Artificial Intelligence for Personalized Learning in Indian Higher Education. Journal of Educational Technology Development and Exchange, 14(1), 45–58.
[39]. Amity University. (2023). AI and Emerging Technologies Initiatives at Amity Institutions. https://www.amity.edu
[40]. Diane, L. J., Courtney G. D.(2024) Bridging the gap for underserved populations:Personalized AI solutions for college access andlearning support. New Directions for Higher Education. Wiley Periodicals: 47–62,
[41]. O'Neil, C.: *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown Publishing Group,(2016).
[42]. Arfa, A., Saima, K., Sana, D., Zahoor A., Ayesha, B.: Addressing the Digital Divide: Access and Use of Technology in Education. 3(2), 883 – 895, (2023).