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## “Role of Artificial Intelligence in Teacher Education: Opportunities and Challenges”

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### **Abstract:**

*Artificial intelligence is reshaping the education landscape and ushering in a new era of innovation and change. New educational paradigms are being reshaped through artificial intelligence which have the potential to take the world of education to new heights. Teacher education has also not remained untouched by these revolutionary changes. As a result of these changes, teacher training, assessment is playing a vital role in providing opportunities for professional and personal teacher development. It not only helps teachers to communicate with students more effectively but also empowers the dissemination of education. This article presents an in-depth analysis on the use of artificial intelligence in teacher education, its benefits, challenges and future prospects.*

**Keywords:** Artificial Intelligence, Teacher Education, Higher Education, Machine Learning

### **Introduction**

Education plays a vital role in the development of human civilization. The method of acquiring and learning knowledge has been constantly evolving since ancient times. It has undergone many changes due to new technologies from time to time. We are all familiar with the traditional education system, where education is imparted to students within the walls of classrooms. With the intervention of the

internet and digital technology, online platforms are slowly and surely replacing classrooms. Thus the modern education system has completely eliminated the limitation of classroom space by encouraging the participation of more students from every corner of the world. By imparting knowledge through online platforms or websites, the modern education system has been able to attract a wide variety of students and teachers to participate in technology-based learning in which artificial intelligence is playing its vital role.

Scientists started studying artificial intelligence in 1956, but it was first named artificial intelligence by John McCarthy in 1955 and said that 'artificial intelligence is the science of creating intelligent machines for the future with the help of software and hardware.' In the words of Dorfler, 'artificial intelligence can be defined as machines that can perform those tasks which humans do through their thinking and experience.' Although the study of artificial intelligence began in 1955-56, evidence shows that artificial intelligence was talked about even before this. Turing wrote in his paper *Computing Machinery and Intelligence* (1950), 'We can expect that machines will eventually compete with men in all purely intellectual fields.' His predictions seem to be correct as we face ChatGPT in the year 2022. Artificial intelligence is also called machine intelligence. A machine (computer system) imitates human intelligence. Artificial intelligence has become an integral part of our lives, knowingly or unknowingly. In recent years, the use of artificial intelligence and Learning Analytics (LA) has been effectively introduced in the field of education. Education involves many aspects of teaching and learning and includes both school education and higher education. Teacher education is an integral part of our education system as it serves as a means to shape the future. There is a close positive relationship between college and university teachers and higher education. The National Council for Teacher Education (NCTE) has defined teacher education as a programme of education, research, and training of individuals to teach students from pre-primary to higher education. The ultimate aim of teacher education is to develop skills and competencies in future teachers so that it enables them to meet the requirements of the teaching profession and prepares them to meet the needs of the future. It is important to understand that just as artificial intelligence is reshaping various other fields, it is also reshaping educational applications in teacher education. There are continuous efforts by educators to integrate artificial intelligence in education for task automation, personalized learning, providing

universal access, smart content creation, identifying weaknesses of students, 24/7 support, etc. The integration of artificial intelligence in education has the potential to change the way teachers are trained and enhance the quality of teacher education. India has been at the forefront of adopting artificial intelligence in education, but we need to identify the challenges and opportunities associated with it. The rate of adoption of artificial intelligence in teacher education is comparatively low compared to other sectors such as medicine, industry and finance. The present article provides educational innovations through the application of artificial intelligence in teacher education.

### **Features of the Application of Artificial Intelligence**

- the ability to act intelligently like a human being
- Ability to simulate the functioning of the human brain
- The ability to adapt and learn as an intelligent human being
- the ability to act intelligently
- The ability to process symbols and natural language like humans

### **Need of Artificial Intelligence in Teacher Education**

The need for artificial intelligence in teacher education is increasing due to many important reasons. The need to adopt artificial intelligence in the modern education system is felt due to diversity, individual needs, and technological development. Some of the key points are explained in detail below:

- Using artificial intelligence, a personalised study program can be designed for each learner, taking into account any knowledge gaps. AI makes it easier to determine what a learner understands and what he or she does not understand
- Artificial Intelligence can transform curriculum and content, making it more interesting and relevant to students.
- Artificial Intelligence is capable of producing content that interacts with learners by analyzing massive amounts of data about students' preferences, interests, and learning outcomes.
- Artificial Intelligence has the potential to expand and enhance the educational experience of students by providing personalized learning along with unique ways of accessibility for each learner.

- Artificial Intelligence involves the combination of systems with intelligence, computation, and data analysis, to provide personalized and flexible learning experiences to students.
- The aim of artificial intelligence in education is to enhance learning outcomes, encourage student participation, and provide students with the support they need.
- It can improve teaching and learning by using multimedia tools to bring abstract concepts into reality.
- Artificial Intelligence can help teachers develop specific plans for instruction and assessment that align with each student's particular strengths and weaknesses, which can increase their engagement and motivation and ultimately lead to better academic outcomes.
- Artificial Intelligence makes it easier for students to access high-level learning content. It can also help teachers give more in-depth and accurate feedback by evaluating students' performance data and identifying areas in which they need development.

The integration of Artificial Intelligence in teacher education is no longer a luxury but a necessity. It empowers educators with advanced tools and techniques to address the evolving challenges of modern education. By leveraging Artificial Intelligence, teacher education can become more efficient, personalized, and impactful, ultimately leading to better learning outcomes for students.

### **Types of Artificial Intelligence**

- **Artificial Narrow Intelligence (ANI):** This type of intelligence has the ability to accomplish a specific task such as- playing chess; retrieving information based on voice instructions (SIRI or Alexa); detecting spam emails; driverless cars, etc.
- **Artificial General Intelligence (AGI):** This type of intelligence has the ability to perform various tasks that humans can do
- **Artificial Super Intelligence (ASI):** This type of intelligence involves the ability to learn from its experiences and new data, perform a variety of actions, and generate new computer code on its own to help achieve its objectives.

### **Role of Artificial Intelligence in Teacher Education**

Artificial Intelligence has made the teaching and learning system more flexible, transparent, and inclusive which can play a vital role in improving the quality of



teacher education. It enables teachers to teach more effectively and provide personalized, customized and interesting education to students. Below is a detailed description of how the role of artificial intelligence in teacher education is important:

- 1. Improving the Quality of Teacher Education** – Artificial intelligence can play a vital role in improving the quality of teacher education. Artificial intelligence is becoming an integral part of smart ICT-based apps aimed at digital learning in India. One of the key challenges in teacher education is to ensure that teachers have a strong foundation in the subject they teach. It can provide teachers access to high-quality educational resources and learning materials that are tailored to their individual needs. It can also help teachers identify knowledge gaps and give them feedback on areas where they need improvement.
- 2. Personalized Learning** – Artificial intelligence helps teachers provide personalized learning experience. Every student has different learning ability, interest, and pace. Artificial intelligence-based systems can create personalized learning plans for students by analyzing their learning patterns and performance. This process helps in providing education to students tailored to their individual needs, allowing them to learn at their own pace.
- 3. Customized Learning** – Customized learning platforms use artificial intelligence to customize learning content based on students' abilities, interests, and weaknesses. The system keeps changing its content according to the students' response and performance. In this way, students get learning content according to their needs, making the learning process more effective. Artificial intelligence also allows teachers to use content suited to different students in the classroom.
- 4. Universal Access** – Artificial intelligence technology will help create smart content. This will benefit all students, including those who cannot see or hear. It can provide students with real-time subtitles for everything the teacher says. This technology can break the barriers that prevent students from progressing.
- 5. Identifying Learning Styles** – One of the important aspects of teacher education is developing teachers' skills in identifying and catering to the different learning styles of their students. Artificial intelligence can help

teachers identify students' learning styles and provide recommendations to adapt teaching methods.

- 6. Access to High-Quality Educational Resources** – One of the most important challenges in teacher education is ensuring that teachers have a strong foundation in the subject they teach. This can provide teachers with access to high-quality educational resources and learning materials that are tailored to their individual needs.
- 7. Professional Development** – The National Education Policy 2020 emphasizes on the professional development of teachers. Artificial intelligence can provide opportunities for continuous professional development for teachers in several ways. For example, artificial intelligence can provide feedback on a teacher's performance, highlighting areas where they may need further development.
- 8. Encouraging Innovation** – Artificial intelligence brings with it opportunities and challenges that require critical and innovative thinking. It is essential that educators encourage students to develop these skills through teaching and assessment methods. By encouraging critical and innovative thinking, individuals capable of adapting to change and generating innovative solutions in the context of new businesses can be created.
- 9. Multidisciplinary Approach** – Changes in professions often come with an increased need for a multidisciplinary approach. For example, technology professionals must have a thorough understanding of the social, ethical, and legal issues associated with artificial intelligence. Therefore, education should promote collaboration between different disciplines and encourage interdisciplinary understanding of complex issues.
- 10. Develop Unique Human Skills** – As automation and artificial intelligence are taking over some tasks, it is important that education focuses on developing unique human skills that cannot be easily replicated by technology. These include communication skills, empathy, creativity, critical thinking, and complex problem solving. Education should provide opportunities for the development of these skills and promote holistic learning.
- 11. Automated Assessment** – One of the major benefits of artificial intelligence is automated assessment. This system is a time-saving tool for teachers, as artificial intelligence-based platforms can automatically evaluate

assignments and exams. It not only makes the job of teachers easier, but also provides exam results quickly and fairly. Also, it focuses on questions where students are facing difficulty, which also helps teachers in the assessment process.

- 12. Real-time Feedback** – Artificial intelligence can provide real-time feedback to both teachers and students. For example, if a student answers a question incorrectly, artificial intelligence can instantly give him the correct answer along with an explanation. Thus, students can learn from their mistakes instantly and teachers do not need to give feedback from time to time. This feature helps in accelerating the progress of students.
- 13. Development of Smart Content** – With the help of artificial intelligence, smart content can be developed, which is beneficial for both teachers and students. Using this, various courses can be presented digitally, such as interactive video lectures, artificial intelligence based guided programs, and virtual labs. These smart contents make education more interactive and interesting, which keeps the attention of the students focused and increases their understanding.
- 14. Virtual Tutors** – Artificial intelligence-based virtual tutors or chatbots cannot replace teachers, but they can act as supportive tools for students. Virtual tutors can answer students' questions, help them understand complex concepts, and are available 24/7. This allows students to get their questions answered anytime, anywhere, keeping their learning process continuous.
- 15. Prediction and Analysis** – Artificial intelligence can analyze student data to predict which students are struggling in which subject and need improvement. This helps teachers to identify the weak areas of students and adopt the right teaching strategies for them. Using artificial intelligence-based prediction, teachers can also decide when and how students may need additional support.
- 16. Inclusive Education** – Artificial intelligence promotes inclusive education for students with disabilities. Many tools, such as text-to-speech, speech-to-text, and screen readers, help students with special needs learn. This makes education more accessible and inclusive, giving every student equal opportunity.

17. **Classroom Management** – Artificial intelligence can also help teachers in classroom management. Artificial intelligence-based systems can keep records of class attendance, analyze student activities, and help maintain discipline. Moreover, it allows teachers to automate various classroom tasks, saving their time and allowing them to focus more on teaching.
18. **Language Translation** – Artificial intelligence can also be used for language translation. This is especially beneficial for multilingual students who may have access to learning materials in different languages. Artificial intelligence-based translation tools break language barriers and provide learning materials to students in their mother tongue. This allows teachers to better teach students coming from different linguistic backgrounds.
19. **Improvement in the Education System** – Artificial intelligence can play a vital role not only in teaching but also in the administrative functions of the education system. It helps institutions to automate their educational policies, student enrolment, and other administrative functions. Artificial intelligence-based decision systems are able to improve teaching policies using data and manage resources properly.
20. **Data-driven Insights** – Artificial intelligence can provide teachers with in-depth information about students, such as their learning pace, their difficulties, and their areas of interest. Through these data-driven insights, teachers can create better educational strategies for students. This not only makes the teaching process more effective but also encourages the overall educational development of students.

The role of artificial intelligence in teacher education has grown rapidly in the education sector. Artificial intelligence has not only made the teaching and learning process more effective and accessible, but has also contributed significantly to the quality and inclusiveness of education.

### **Challenges of Artificial Intelligence in Teacher Education**

The use of artificial intelligence in teacher education offers many benefits, but it also brings many challenges. It is important to understand these challenges and find solutions to them so that artificial intelligence can be used correctly and effectively in the education system. The major challenges related to artificial intelligence in teacher education are explained in detail below:



- 1. Lack of Technical Infrastructure** – Implementing artificial intelligence-based systems requires a strong technical infrastructure, including high-speed Internet, modern computer equipment, and secure servers. This technical infrastructure is not available in many rural and developing areas. In addition, even where the technology is available, it may lack adequate technical support or regular maintenance.
- 2. Technical Skills of Teachers** - Teachers need to be technically competent to use artificial intelligence. But many teachers do not have adequate knowledge or training about artificial intelligence or advanced technology. They need special training to use artificial intelligence-based tools effectively. Apart from this, there may also be fear or reluctance towards new tools and technologies, which needs to be overcome.
- 3. Personal and Ethical Concerns** - Artificial intelligence systems often collect sensitive data about students and teachers, including their performance, learning styles, and other personal information. This raises privacy and data security concerns. While using artificial intelligence, it is important to ensure that all data remains secure and confidential. Along with this, it is also a challenge to ensure fairness in the decisions of artificial intelligence, so that it is free from any kind of bias or discrimination.
- 4. Lack of Human Aspect of Education** – Artificial intelligence-based education systems may lack human emotions, empathy, and personal relationships. There is a deep human connection between a teacher and student, which makes the learning process more inspiring and effective. Artificial intelligence works only on the basis of data and algorithms, while teachers also understand students' emotions, psychology, and social conditions, which may be difficult for artificial intelligence to understand.
- 5. Attitudes and Inaccurate Data** – Since artificial intelligence is developed using data, the underlying data may contain implicit or explicit biases that can lead to prejudice against particular groups based on gender or race. This can exacerbate inequalities already existing in society and threaten the values of equality and equity in education.
- 6. Cost of Equipment and Applications** – Most educational institutions lack the funds to purchase and maintain the equipment needed to implement AI in the classroom. Developing and implementing artificial intelligence-based

tools and systems can be costly. Educational institutions have to invest a large amount of money in installing, maintaining, and upgrading artificial intelligence systems. This is a big challenge, especially for small and financially weak schools or colleges.

- 7. Dependence on Artificial Intelligence and Lack of Creativity** - Artificial intelligence systems only act on the information and algorithms they are given. The process is often limited and structured, while education requires creativity, exploration, and independent thinking. Artificial intelligence cannot encourage creative and critical thinking in students as much as a human teacher can.
- 8. Language and Cultural Barriers** – Artificial intelligence systems may be more efficient for developed countries and major languages, but may be less effective in the context of diverse languages and cultures. Many artificial intelligence tools lack an understanding of linguistic diversity and cultural contexts, which can hinder learning for students from different regions and linguistic backgrounds.
- 9. Algorithmic Bias** – Artificial intelligence systems are based on the data they are fed. If these systems include biased or incomplete information, AI may make incorrect decisions. For example, some AI systems may discriminate based on race, gender, or social class, exacerbating inequalities in the education system. To prevent this, it is essential to design and train AI systems ethically.
- 10. Regulatory and Legal Challenges** – Clear policies and regulations are needed for the use of artificial intelligence. Legal and regulatory issues related to data protection, privacy, and transparency may arise when using artificial intelligence in education. Many countries do not yet have an adequate legal framework for the use of artificial intelligence, leaving it vulnerable to misuse.
- 11. Lack of Proper Evaluation** – In artificial intelligence-based education system, students can also be evaluated by artificial intelligence, but it may lack accuracy or understanding like human evaluation. For example, artificial intelligence only checks the answers of students, but cannot evaluate their ideas, creativity, and efforts. Therefore, artificial intelligence-based evaluation system cannot completely replace the traditional evaluation system.

- 12. Mental Preparation for Modern Education System** – Teachers and students have to be mentally prepared to work with artificial intelligence. Teachers should be mentally prepared to change their teaching methods and students also have to adapt themselves to adopt new technology. For this, institutions have to develop a positive attitude towards change and progress in the way of education.

There are many challenges of artificial intelligence in teacher education, but they can be solved in the right way. For this, teachers and educational institutions will have to be prepared to understand, adopt, and use artificial intelligence technology effectively. Along with this, focus will also have to be on data security, ethics, and technical training, so that the use of artificial intelligence can bring a positive and long-term change in the education sector.

### **Conclusion**

In conclusion, it can be said that the educational system around the world is being revolutionized by artificial intelligence. The way artificial intelligence is changing the way students learn and teachers teach is having a huge impact on higher education in India. Artificial intelligence and other cutting-edge technologies will become more and more important as the Indian education system evolves to ensure that all students receive high-quality education. UNESCO is committed to assisting Member States in implementing artificial intelligence technologies in educational contexts while supporting the fundamental values of inclusion and equity. Artificial intelligence has begun to change the way teachers and students interact with each other, from providing customized learning experiences to curriculum optimization. It is hard to overstate how implementing this technology will enable educational institutions to save time, money, and resources. Therefore, it should be embraced enthusiastically so that educational institutions and their local communities can benefit from these outcomes, as they undoubtedly help mold the next generation into well-rounded individuals.

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