

# Artificial Intelligence in Education



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**Abstract** Artificial intelligence-deployed applications for learning are in use and made way into the field of education for quite some time. Therefore, its requirement forces teachers, learners, and stakeholders more than ever in the past. The aim of the current study is to provide focus on the matter that implementation of AI is not a choice but a need. As education technology evolves as a new standard, all the stakeholders involved in education must deploy AI to obtain the basic education goals, i.e., it must be individualized, effective, transformative, output based, integrative and long lasting. The current research is to portray the transformation in methods of education and put forward the current directions in incorporating artificial intelligence. The investigators contemplate on this issue and attempt to address how advancement of AI is contemporaneous with advancement in education. The pursuit to examine this circumstantial believes to add productive surface for a fruitful consideration on probing the power of artificial intelligence-based e-learning applications.

**Keywords** Education · Artificial intelligence · Online learning · Education technology

## 1 Introduction

In recent years, the educational environment has undergone a significant transition. Changing cutting-edge technologies has transformed teaching and learning across the globe. Every sector is benefiting from artificial intelligence, so is education sector. Significant advancements have developed in the education field, and with the combination of artificial intelligence approaches in teaching styles, educational institutions

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have modified their methods of offering education from the past times. Artificial intelligence is one of the revolutionary approaches that allows varied learning groups, professors, and instructors to have their experiences tailored to their needs. Machines with artificial intelligence can analyze and make accurate judgments much like humans. Applications of AI include robotic technology, deep learning, and natural learning process. AI is omnipresent, from voice assistants in electronic devices, i.e., TV, fans, lift, chatbots, which we use in daily life to robots in industries.

Learners, educators, and all the stakeholders have no choice but to adapt themselves in these newly advanced modalities of virtual learning. The instructing means applied for virtual learning are basically through assignments, pre-captured lectures, videos, online case studies, multiple answer questions, etc. Of late, the most accessed education platforms are Udemy, Skillshare, Teachable, Coursecraft, EdX, Byju's, Vedantu, etc. A few other ways of the EdTech platforms being used are Zoom, Microsoft Teams, Skype, Google Classroom, and Google Meet. Several learning enthusiasts across the globe are making the most of these EdTech platforms accolades to the information technology (IT) aids which have proliferated into the classical classroom to make learning and participation more lively, effective, engaging, individualistic, and inclusive. This redefining practice of combining educational practices and information technology (IT) for active and engaged learning is how 'education technology,' 'EdTech,' is described.

Until 2019, EdTech was one of the least supported industries, but the advent of remote learning in the COVID ridden 2020 has given it new wings. The world EdTech market was estimated at USD 85 billion in 2021 and is poised to reach USD 218 billion in 2027, increasing at CAGR of roughly 17% [1], while the Indian EdTech business was valued at US\$ 750 million in 2020 and is predicted to grow at a compound annual growth rate (CAGR) of 39.77 percent to reach US\$ 4 billion by 2025 [2]. Despite the fact that everything seems to be going well, the EdTech business is confronted with substantial hurdles. Cybersecurity is one problem that could slow down the growth of the EdTech market, while some writers say that the user interface and user experience could be problems for the company.

The chapter is organized as follows. Background of artificial intelligence in education history and objectives is provided in Sect. 2. Artificial Intelligence (AI) development in education. Section 3 presents tools and technologies in education sector. Evolution and impact of AI are presented in Sect. 5. Practical implications and conclusion are provided in Sects. 6 and 7, respectively.

## **2 Background of Artificial Intelligence in Education History**

Artificial intelligence in education, AIED, questions the normalcy and is reviewed suspiciously by traditional advocates in the education field on results of potent student or learner categorization and emotional engagement and active involvement with

students or learners. This gives way to plenty of chances to combine not only competence to excite facilitators or teachers and allow student or learner categorization but also advances emotional engagement [3, 4]. Nonetheless, an aspect on the premise of which the advocates and skeptics meet is the fact of the matter which the range and pace of advancement are swift, and change is inevitable [5, 6]. Although traditional universities are not yet been replaced by e-learning universities, the stakeholders involved in the learning system have begun to focus and contemplate what the current normalcy will be.

A holistic study of two concerns, viz. MOOCs and Proximate Education, would be of great help to differentiate the norms for AIED in the future. We witnessed a digital revolution toward the final decade of the twentieth century. The invention of the Internet encouraged mechanization and integration of education globally [7]. This type of education or learning was instantly followed in several universities with the intention of substituting traditional lecture halls, course materials, video lectures, and digital learning material with regard to administer affirmative instructions for participants across the globe. Yet, it missed smart aspects like human-to-human interaction, physical instruction and touch, and live feedback and analysis. Severe critique followed and then [8], it was challenged that proximate education was advancing to sale of education, hindering the learning ability of professionals, and lastly online platforms were just ‘diploma disposing outlets.’

In the early 2010, MOOCs, Massive Online Open Courses, were started which targeted at bulk amount of lecture material or content [9]. MOOCs targeted at streaming the learning and educational technology toward skill-focused digital learning or education distinct from the grade-based education in live environments. Universities and institutions moved at greener meadows and began catering to learning needs of participants or students looking to learn courses and earn points of credit depending on their interests. The huge rate of participants leaving the MOOCs was disturbing. The confirmed participants for MOOCs were natives of developed markets, and most of them were well educated. The credits for the courses so earned were observed as simple extensions and not as replacement of deeply practiced modes of education.

Presenting artificial intelligence in education is observed as a transition where the students will be equipped with inconceivable more data and information which would have been likely given to them by any individual instructor [10]. It is to be noted that an intelligent tutoring system, based on AI, will begin to change the dimensions of education [11]. Few schools of thought opine that human interface might not appreciate and recognize the competence and potency of brilliances, but adaptive systems which rely on AI can definitely create wonders [12]. We can visualize the quantum of influence and impact of AI on education, by deploying approaches of technological prediction that considers both the qualitative and quantitative elements, wherein we will have realistic goals and advisory narrative at both the ends, respectively.

The current inquiry is a pursuit to understand, acknowledge, and identify the purview of how AI has proliferated into education and the kind of transformation it is about to create. The study comprises five sections.

The initial section is introduction and discussion on the background. The next portion accords with a comprehensive review of accessible literature on adopting AI for digital learning. The next part in the sequence explains proliferation of AI on various standards. The penultimate aim affirms on the results, and lastly the final objective mentions the feasible suggestions and conclusion.

## ***2.1 Objectives of the Study***

The aims were to:

- Analyze the different means by which digital education is utilizing AI
- Examine the outreach and effectiveness of AI-oriented digital learning applications to various users
- Provide space for predicting the future of digital education.

## ***2.2 Rationale for Education Technology***

It is vital to initially investigate into the information why education technology has grown in prominence:

Person-centric learning experience: The means by which we know, learn, and engage with colleagues or classmates and instructors, and our comprehensive enthusiasm for the erstwhile courses or subjects is distinctive. In such a case, there is vast possibility for the upgradation of person-centric learning. The education technology applications make it smooth for instructors to design person-centric course outlines and learning engagement adventures that propel a feeling of inclusiveness and enhance the learning competencies of students or participants, irrespective of their learning competencies or age. In particular, the experiences created are not confined to live environment between the instructors and pupil; such an experience is served with every individual participant in the process of learning as per their own flexibility and convenience.

Enhanced communication, participation, and comprehensive value of education: enhanced expertise in learning: AI intensifies similar learning interests in shorter span of duration [13]. The intention of EdTech is to transfigure the sphere of learning and the processes of learning. EdTech aims on unfolding skills and abilities in participants or students that ought to be useful in the future.

Education frameworks in several nations are not transformed for many years. Education technology, EdTech, assists in collaborating technology and education for the reason that if participants or students are hidden from technology and its applications since schooling, by collaborating technology with learning, the gap between ones with online skill sets and those who were hidden to such digital education is going to be immense.

### **3 Artificial Education (AI) Development in Education**

Debate about advancements of artificial intelligence in education field drives us rationally to a conversation on changing dimensions of education. This portion contemplates on the equal lines and makes an attempt to discuss how advancement of education is equivocal with advancement in artificial intelligence.

#### ***3.1 Results of Learning***

The objective of new age education is to convert students or learners into active on the job specialists and flexible experts but not necessarily prepare a mechanistic workforce for a specific task. Institutions need to design syllabus which is aimed on application of knowledge, integration, and self-operative learning abilities [14]. An investigator states, knowledge is what we do, a verb, rather than what we have, a noun [15]. It is essential to mention that assessments or examinations will also revise after the learning results change. Therefore, assessments or examinations will face the challenge to record the learning processes and positions instead of quantifying the knowledge phase of the learner or participant. Subsequently, examinations or assessments have transformed from being an aggregate quantification of achievement to a continuous developmental measure which gives scores or grades instantly [16]. For example, the AI-supported ExamSoft platform offers a good cooperation amid the two notions of examination or evaluation, by initially evaluating learners on the necessary knowledge for graded exams, and then by person-centric assistance as required.

#### ***3.2 Lecture Room Practices***

A distinct set of changing dimensions of education is the main reason for the varying aesthetics of the lecture room methods. There is a paradigm shift toward technological applications and usage of information systems [17]. Another dynamic change is from person-centric to collaborated teams' interactions [18], and the new normal will be individual-oriented learning graph as learners or participants represent various backgrounds, experiences, and cultures [16]. Even in this case, artificial intelligence will be an enabler, an impetus, and an application for different partners in this environment. As instructors, it is vital to appreciate and recognize that although digital education is a very essential mode of delivering experience and skill; however, it cannot accommodate the social and interactive environment among learners and the instructors needed to build a learner's psychology, abilities, and personality to facilitate social communication.

### 3.3 *Environment*

When we refer education, previously it was described within the model of a place, duration, and structure. As a result of fast-moving dynamics happening in all walks of life, education by description involves career-long and career-wide engagement and learning. This transformation in prospect has provided ground to the increasing flow of open online courses to which hundreds of thousands of learning enthusiasts enroll annually [3]. This has transformed the view of courses convenience and learner populace [13]. Indeed, it is known source to obtain certificates of open online course providers such as Edx, Swayam, Great Learning, Coursera, SkillShare, and UpGrad. Therefore, the instructors are not anticipated to have and deliver knowledge and skills to participants or learners, and they are donning the hat of creative intellectuals for the learners in knowing, finding, obtaining, and collaborating knowledge [19].

## 4 Technology Tools in Education and its Applications

Education technology bots are making it effortless for learners to be involved and engaged via fun and exciting ways of learning. Internet of Things (IoT) appliances are being praised for their effort to generate online lecture rooms for participants, if they are present in an institution, on the transport system or at their private place. Blockchain tools and machine learning are helping instructors with evaluating assessments and holding participants liable for take home assignments. For learning vocabulary, **Knowji** is a novel audio and visual vocabulary application. A well-known designed digital collaboration tool is **Padlet** which makes it easier for creative collaboration using a wide range of varied communication sources. For providing good understanding to learners about real-world mathematical concepts, **QuizNext** is used. It creates concept-based questions, instead of offering basic practice assignments, makes learning mathematics fun, exciting, and immersive. The methods of teaching an experimental-oriented or numerical-based course and a theory-oriented course on a digital platform must be distinct. A course on problem-solving approach, for example mathematical science, is clearly complex and a bit uneasy to understand and hence needs real-time-based examples, assessments, projects, and experience-based learning with the help of various frameworks. Digital instruction for a theory-oriented course demands more interactive live sessions. Thus, there is a need for the synergy of hands-on importance and pedagogical discussion in digital learning. The limit of educational technology platforms offering digital learning to enthusiastic participants is infinite. Due to the advancements of information technology and various modes of digital instruction tools, the traditional ways of education may at certain point in the future face crisis.

## 5 Evolution of Artificial Intelligence's Impact on Education

Artificial intelligence has been concentrating, to a greater extent, on resolving the two-way dilemma by designing approaches which are competent as one-on-one instruction; [20] as it is noted, a key role of artificial intelligence is to deliver a personalized engaging learning experience. Impressively, the learner or participant is not only personalized, [21] but also competent, which means exhibiting equivalent learning outcomes in a short span of interval. As we exceed the expansion of learning results from field-level data to design thinking, critical analysis, and associations, these transformations in education field can be viewed as a chance: Present educational frameworks vouch for personalization and agency [13]. Artificial intelligence has made significant influence on education via system evaluation and description, various categories of learning behaviors, if exploratory or step based, [22] associated designs that could be autonomous or with contemporaries, technology application formats in terms of software applied and institutional settings which could be legal.

As mentioned previously, education is moving from concentrating on product or service to processes, growing above field knowledge to combine collaboration, self-sustenance, and intrinsic motivation with a viewpoint of learning outcomes. On one side, big percentage of investigation focusses on field-level learning, and considerably a less percentage of research papers investigate into self-sustenance learning, [23] intrinsic motivation [24], and learners' satisfaction from an artificial intelligence (AI)-assisted learning atmosphere. Self-effectiveness is another component which is required to be incorporated into AI-supported learning experience [21].

### 5.1 *Limitations to Artificial Intelligence's Application in Education*

Few of the specifications that are not considered in artificial intelligence initiatives involve considering sufficient capital or funding, instructor training and their continuous professional advancement, applying additional coursework support and teaching methods, involving parent community as a key participant in the steps of learning, etc. [25]. A structure which has evolved as an answer to jump over the limitations is the design-oriented application research. This method considers on multi-participant collaborative design which propels sustainable competence [26]. The practitioners who are a part of the process infuse conceptual, territorial, and demographical components which are essential for fruitful design and application.

Another limitation is information technology symmetry. To incorporate artificial intelligence in education field, it is needed which information technologies advanced must capture the appropriateness to social teams so as to become fair as well known and certain. This requires a non-symmetrical association among technological abilities and the implementation of the novel AI-oriented educational technological systems [27]. For competitive advantage of any artificial intelligence technology,

innovation and transformation by learners and instructors will be mutual ground. This truth rather than astonishing the designers must in fact inspire and motivate them. An application designed for one use may be applied for another, and the demanding essence of technology will be interrupted [28]. Technological symmetry is also a limitation when viewed in space of social events. Information technology primarily classifies the fundamental criteria of education—course outline, pedagogy, learning goals, regional culture only to quote a few—and later strengthens and retains them [29]. If we can counter and diffuse these limitations, non-symmetry of technology will be exposed.

The difficult limitation in applying technology in education field is the instructor–learner interaction. Traditionally, range of assessing quality of education was performed by placing greater significance to material over structure, and the authentic framework was taken away in the form of scales of measurement. Even educational advocates, designers, and assessors have stressed that online learning platforms are no way substitutes to the lecture halls we are habituated to learn [30]. While few investigators debate although elementary ability can be obtained by digital education [31], genuine competence can only be obtained only when human interaction is involved. Participants experience better learning when they have a chance to present, discuss, debate ideas, experience and analyze phaseouts, and acknowledge networking dynamics. This truth has stated that massive open online courses offer a limited participant interaction [32]. Learning skills such as building propositions, networking in private capacity, feeling intrinsically motivated, and gaining expertise need the support of a human instructor; Web is a minimal proximate of the said skills. There is no second thought that actions are being shown by few instructional strategies which enhance social and motivational interaction like alerts, notifications, emails, reminders, lectures, quizzes, forum discussions, etc., by using big data and analytics, tracking participant’s clicks, tracing involvement to video lectures, and enhancing MOOC design and delivery [33]. Distributed Open Collaborative Courses, DOOCs, will be the substitute for MOOCs wherein importance will be on decentralized instead of central subject expertise, collaboration and involvement instead of seclusion, and inclusivity of opinions instead of unnormal opinions.

The last limitation to be overcome is personalization. Although this is a trademark of a physical instructor, it is evident by the lack of presence with MOOCs. This incorporation in an artificial intelligence-oriented framework depends hugely on the coursework chosen by the student. These applications require to be measure oriented and competent of collective-emotional involvement.

## ***5.2 Ethical Concerns in Educational Technology Platforms***

There is an entire transformation from conventional ways of teaching to transferring of knowledge with the help of online platforms in today’s world. Though the mechanisms and efforts of driving education in times of COVID-19 are laudable at the exact time, educational technology platforms built for delivering learning have been



charged of being complaint with terms and conditions which are not in tune with the privacy and digital laws as prescribed by a specific country. For example, the most vital concept of a digital or online class room is video conferencing as it acts as a platform between the participants and instructors and enables better communication. Nevertheless, they carry a chord of privacy and security threats associated with them. These platforms, at times, may not guarantee that participant information would not be stolen, shared, or sold.

Raise in the usage of proximate-learning tools must bring consciousness among universities and educational schools regarding privacy of data and security. There are numerous forms through which education technology firms can address issues related to these privacy and security. It is essential to verify the privacy concerns regarding the third-party operators or vendors with whom they are associated with. This will also involve the application of top range of encryption for all of their applications, databases, and secure cloud supported tools. It is compulsory to be compliant with the data privacy terms and conditions of that specific nation. Students, parents, and all the others involved should have prior knowledge that their information is being collected, stored, and used and also must be aware of the logic for the data compilation. Users must have the privilege to obtain, access, and edit their data whenever needed. All the data should be carefully secured via access control systems, encrypted, and safely stored. Strict compliance and vigilance need to be carried out so in order to reprimand misuse and manipulation of data, for instance, complete closure of an educational technology firm in a specific nation or prohibiting its financial operations to continue further transactions. Experts in cybersecurity can highlight the ambiguities from the origin of leakage and manipulation of confidential information experts by using tool kits such as vulnerability scans and tests of penetration.

Firms, such as FlaskStack and G Suite (for education), are main players which assist in coping with the variety infrastructure problems of data or information collection with the help of advanced interoperability. Google's G Suite issues a privacy and security note to help parent community in appreciating the ways in which compiled data could be applied to use.

The contemporary scenario over the globe specifically defines the ambiguity of place and time when participants would be coming back to the traditional school. To strike a balance among safety and secureness of the instructor and the participants and progress of academics, security and technology experts should maintain the flag post of information security for cloud-based tools, applications, and platforms, applied during distance learning soaring high.

Therefore, we can conclude that the artificial intelligence (AI) in the education encompasses a series of actions which creates efficient, effective, individualized, and interactive learning experience.

## 6 Practical Implications

Educational technology platforms are incrementally increasing since last decade. The COVID-19 pandemic has forced conventional education methods to be replaced with digital education conducting everything remotely. Even though pandemic effects have subsided, it is still uncertain reopening educational institutions with their full capacity in the near future. In this context, we can safely state that artificial intelligence will be central hub aiding and shaping the educational system. The main advantage in digital education is its flexible nature of timings, place making it adaptable by teachers as well as students according to their needs. AI offers the necessary transformation required for the digital platforms to function more efficiently in terms of integration, collaboration, and decentralized learning ecosystems. In a study conducted in 2018 noted that 65% of school going children will be graduating to a new era of jobs which are non-existing at present. A study conducted in the UK in the year 2017 states that recruitment and retainment of talented populace are the challenges to be succeeded. Pioneers in the industry speculate that AI will be the cutting-edge revolution that can take digital education to new heights, but in reality, only minimal preparations have been done to accommodate it. The skeptical notion of AI bots replacing humans can be changed, only when students become adept in AI functionality and counter further complications arising in the predictable future. The synchronization of developments in the areas of artificial intelligence and education is obscure due to the impact on the primary education level. According to a MIT study on technology in 2020, nearly one hundred and ninety-nine percent of educators are in agreement that the implementation of AI is the unmatched solution to face the competition given by EdTech companies, and nearly ninety percent of educators have already begun to execute the necessary steps of integrating AI into educational realm.

## 7 Conclusion

Due to COVID-19 pandemic, the whole world has faced an impasse. This gave an opportunity for the technological educational institutions to flourish by catering to the educational needs through digital learning platforms, filling the deficiency created by lack of offline operational institutions which are closed indefinitely. This is a big breakthrough for the digital learning methodology. A large consumer base consisting of distinct groups of students, faculty, curriculums, and steadfastly advancing technologies will be outreached to many more people after the relaxation of imposed lockdown. Flexible and adaptable learning is preferential to all categories of users. The career-oriented conceptual digital education is in high demand and is being progressively looked up by different organizations to meet such demands and deliver them to digital platforms. This gives an exponential surge in the online education enrollment giving rise new companies in the view of unpredictable and uncontrollable circumstances like pandemics, etc. This change in mode of learning will be preferred

even the after the pandemic gets under control. The need of soft skills cannot be replaced and will be complacent with new method of learning. The practice of being able to learn new concepts and relearn the updated skills accordingly new necessary requirement for all kinds of students. Artificial intelligence has transformed the education realm and will aid in the betterment of all stakeholders involved.

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