

# Artificial Intelligence and Machine Learning: A Game Changer for Sustainable Education and Skill Development

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**Abstract**—Automation in the Education sector is happening at a very fast pace due to induction of cutting-edge technologies like Artificial Intelligence (AI), Machine Learning (ML), Augmented Reality (AR) / Virtual Reality (VR) etc. making it very difficult even for an experienced and dedicated educator to keep pace. This paper presents an overview of how Artificial Intelligence (AI) and Machine Learning (ML) is impacting learning paradigm for the benefits of students, teachers, administrators and educational institutes. With the introduction of technologies and automation in education, learning is becoming more inclusive and collaborative irrespective of location as there are many omnichannel platforms available to deliver the knowledge to the students irrespective of their location. To study the impact of these technologies on education and learning paradigm we conducted a study. The result of the study indicated that Artificial Intelligence and Machine Learning are having great impact on changing the existing learning paradigm resulting in redesign of teaching and learning processes. We have summarized our findings as to how Artificial Intelligence and Machine Learning are impacting the current education paradigm by making it more inclusive and collaborative. We have also listed some of the tools available in the market which can be readily adopted by the educators to jump the queue. At the conclusion of our study, we found that newer technologies will keep impacting existing education systems and there will be more adoption of these systems by larger number of institutes to deliver their education material both offline and online.

## INTRODUCTION

Today's world is impacted by Artificial Intelligence (AI) in almost every industry, and the educational landscape is no exception. Applications of AI in education are expanding and have drawn a lot of interest in recent years. With introduction of these technologies in education domain, the learning model is evolving away from the traditional model of rows of students listening to a teacher from the front of the room while studying the same textbook. We are moving to a new paradigm where teacher and AI/ML driven applications collaborate with each other to deliver an inclusive and personalized learning experience to the students.

Artificial Intelligence primarily employs machine learning, deep learning and advanced analytics algorithms to track a

specific student's learning ability and benchmark it against other students. As AI solutions continue to advance, they make it easier to spot where there are gaps in teaching and learning thereby helping students achieve their learning goals. It also helps teachers by freeing them from routine teaching and administrative tasks thereby allowing teachers to have time to improve learning process and content. This way AI enabled tools are driving efficiency in learning process, providing personalized learning contents and streamline administrative procedures.

It is now feasible to achieve the best results for students by combining technology and teachers. The future of learning and training environments is going to be driven by Artificial Intelligence tools. AI powered online learning platforms allow teachers to develop new teaching strategies that can be tailored for specific needs of students and delivered effectively by the learning platform improving student learning experience. pupils. AI driven tutoring programs can give students individual personalized advice, support and feedback by customizing the learning materials to meet their individual learning styles or skill levels. Answering students' easy, repetitive inquiries in online classes with the aid of AI teaching assistants helps instructors save time.

The teaching and learning process is being significantly impacted by Artificial Intelligence, Machine Learning, Augmented Reality, Virtual Reality technologies. These technologies are being embraced by the education sector to change the way we impart education. It will determine how the educational environment will evolve in the future.

## WHAT IS ARTIFICIAL INTELLIGENCE?

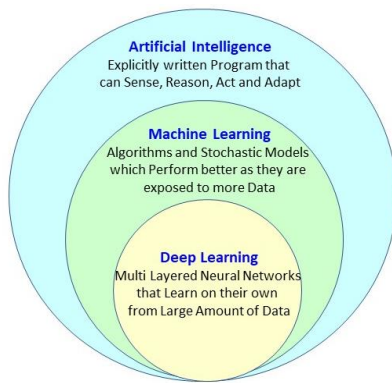
Traditionally, the term 'Artificial Intelligence' (AI) refers to an artificial invention of intellect that can learn, explain, plan, observe or comprehend natural Language. AI is the study of how to make computer systems capable of doing activities that often require human intelligence, such as speech recognition, visual perception, sustainable learning and decision-making

[1]. AI continues to have an impact across every domain with novel applications and use cases, starting with sporting events, smartphone applications and development in education. Our lives have been made easier and more intriguing by the introduction of AI. In technical domains, it is being utilized to automate processes for improved performance and efficiency.

The emergence of AI is bringing about substantial improvements, but we are not knowledgeable enough to know how it influences daily life to make it simpler and better. One impact of AI is the improvement in efficiency, efficacy and speed of human endeavors. It has already made its way into the field of education and is showing how valuable it is in delivering sustainable education. AI and ML are being used to produce elegant, cost-effective solutions that are superior to those attained using conventional methodologies [2]. The ideal procedure in the sphere of education requires the presence of teachers. The employment of teachers, who are vital to the educational system, is altered by the development of artificial intelligence. The AI primarily employs machine learning and advanced analytics to track a specific student's relative speed of learning with respect to other students [3].

### Machine Learning and Deep Learning

Among the most significant technical approaches to AI, Machine Learning and Deep Learning are sub fields of AI that are the foundation for many current developments and practical applications of AI [4], but there is a difference between the two. ML is a subfield of AI whereas DL is a subfield of ML. Machine Learning is based on development of algorithms and statistical models that enable computers to learn and make predictions or decisions without using explicitly written programs. The process involves training the algorithms on large set of data to identify patterns and relationships which may involve human intervention. Once the models are fully trained then they can be used to make predictions or decisions about new data. Deep Learning (DL) uses multi layered neural networks to analyse complex patterns and relationships in data without explicitly trained using datasets. It consumes large number of datasets and deduces on its own the knowledge. Figure 1 clearly explains the relationship and the difference between AI, ML and DL.



**Figure 1: Relationship between Artificial Intelligence, Machine Learning and Deep Learning**

Machine Learning automates the decision-making process and analyses the data to generate predictions [4]. In context of education and learning, the algorithms used would analyze all aspects of student performance, including topic understanding, lesson completion, study skills, and score analysis [5]. Additionally, to assess their learning speed, the application would also analyze the students', thinking and understanding by reviewing and explanation speed and precision that would also incorporate voice analysis algorithms. Curtailing the need for human intervention in such analytics will free up more time for teachers and students to develop and put new strategies and processes to work [5].

Deep Learning (DL) delivers personalized learning by simulating the hierarchical organization of the human brain by processing data from low to high level and composing growing semantic notions. Using ML and DL algorithms and model, AI has accomplished numerous significant breakthrough projects including face recognition, image processing, speech recognition, and many others [5].

### CURRENT STATUS OF AI IN EDUCATION

Artificial Intelligence and related technologies have significant effects on education, not just by directly assisting students but also by enabling teachers to be more responsive to the needs of their students rather than being bogged down by mundane, repetitive tasks. During our study we found that more than 50% institutes both in Education and Corporate Skill Development are using AI in one or the other forms for their Content Delivery or Administrative Tasks. This is not restricted to Online Training but also in offline training. It covers right from schools to colleges and universities of higher learning.

The machines of today are equipped with AI based tools to impart knowledge-based teaching which is personalized as per student needs and interest. We are all aware that different students have different learning styles, therefore the standard method of teaching with the same plan may not be suitable for all students. While some students learn quickly, others may struggle and ultimately fail. According to a survey, students are more interested in learning from study materials with visual illustrations, charts, and diagrams than from texts. Using the conventional methods of teaching and learning, this was not possible, but with the use of AI and ML enabled tools it is possible to work on methodologies to deal with issues and find possible solutions [5].

Using AI tools today education institutes and corporate skill development companies are engaging students with customized courses, interactive lectures, gamified class rooms etc. These helps in better management, bridging the gaps between students and teachers and leading to collaborative learning. Most of the institutes are using AI tools for Virtual Assistance, Task Automation, Personalized Learning, Natural

Language Chatbots, Computer Vision, Image Recognition and Online Examinations and Evaluation.

### **AI Tools and Technologies in Education**

As mentioned above Artificial Intelligence (AI) tools are being used for varied kind of work by different institutes both in offline and online mode. It is enabling them to process vast amount of data to make learner experience better and also improve quality of research carried out scholars and researchers. We are listing some of the most widely used tools and technologies driven by AI and ML that are being used for varied purposes including educational institutes.

#### **GFP-GAN – Photo Restoration Tool**

A free AI tool called GFP-GAN, or Generative Facial Prior-Generative Adversarial Network, can rapidly and quickly correct outdated images. It miraculously and quickly fixes old, faded images in a realistic manner. It was created by Tencent researchers by combining the data from two AI models to fill in the blanks in a photo. It is being used by many art students to restore old images.

#### **Copy.ai – Copywriting Tool**

It is a free AI tool that helps users with all kinds of copywriting needs such as writing product descriptions, ad copies, email writing, blogs, video content and website copies. This tool generates unique and user- friendly content that engages the readers. Copy.ai is also ideal for writing social media captions, Facebook content, start-up ideas and many more.

#### **Presentation Translator**

Presentation Translator displays subtitles directly on PowerPoint presentation as the speaker delivers it talk. It supports about 60 languages. This allows audience to join their own devices with translator app or browser. This is very help for people who are deaf or hard of hearing.

#### **Lumen5 — Video Creator**

The Lumen5 is a free online video-making platform that has many tools that allow user to make videos effortlessly. It has many predefined templates and support multiple formats for use on different social media platforms. The tool generates a whole video sequence based on user provided transcript and images.

#### **Generative Engine**

The generative engine is an AI/ML application that builds artwork from the text provided by the users using its model built on algorithms. It again very helpful for students of creative art.

#### **Tensor flow**

It is a very popular library built using multi-layered neural networks. It enables programs written in Python to run either on CPU or GPU. It is very easy to set up, train and send counterfeit neural systems with huge datasets.

#### **Keras**

Keras a high-level library for neural networks, using TensorFlow or Theano as its backend.

#### **H20: Open Source AI Platform**

It is AI based Deep Learning platform which is business oriented and help businesses to make a decision from available data and draw insights into business operations. It is widely used for predictive modelling, risk and fraud analysis, insurance analytics, advertising technology, healthcare and customer intelligence.

#### **ChatGPT**

ChatGPT is a chatbot developed by OpenAI based on the GPT (Generative Pretrained Transformer) language model. It interacts in a conversational way with the users using deep learning techniques to generate human-like responses to text inputs. The dialogue format makes it possible for ChatGPT to answer follow up questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests.

### **ARTIFICIAL INTELLIGENCE IMPACT ON EDUCATION**

Artificial Intelligence plays a major role as an enabler to automate some of the routine work for the educators in addition to development and delivery of content to the students. Our study found that following are some of the major areas which have been or can be positively impacted by use of Artificial Intelligence and Machine Learning.

#### **Creating Optimized Course Content and Delivery**

Course Content Creation is a very time consuming and costly activity. AI speeds up and streamlines the course creation process by assessing student learning history and abilities which enables the system to identify student knowledge gaps. It identifies the additional content that need to be created to fill these gaps. Artificial Intelligence with Machine Learning enables systems to create optimized content for the student meeting his specific needs in multiple format which can be Digital Guides, Textbooks, Videos, Instructional Snippets etc.

#### **Offering Personalized and Adaptive Learning based on Student Needs**

Needs of every student is different, some grasp concepts quickly whereas other needs more time. With the help of Artificial Intelligence and Machine Learning the system can adapt to the student's pace and identified knowledge gaps. Based on the student's feedback received by the system, AI enabled systems can identify the weaknesses in the course and provide suggestion for improvement. Various AI algorithms and models are available to help in analysis of student's interest resulting in personalization of content. This minimizes the burden and stress on the student [7].

#### **Inclusive and Universal Access**

Artificial Intelligence has made it possible to reach global audience irrespective of language they speak. It has also helped to reach the people with visual or hearing impairment. Microsoft Presentation Translator provides real time subtitles

for Virtual Lectures in the language of the student choice. In our survey [6] we found that about half of the education businesses are relying on some form of AI/ML based tools while training and it is projected to grow around 15-20% every year. The main driving force for this growth is the availability of online delivery platforms that enable the students to learn subjects which are not taught in regular classes and that too at student pace and level. This has been made possible due to personalization of learning content powered by AI and ML. We found that in next 5 years more than 90% of the businesses will be using AI/ML based tools to impart skill development training.

### **Promoting Remote and Virtual Learning**

The engagement level between teacher and student has significantly increased with the help of Artificial Intelligence and Machine Learning. Gamification and Virtual Reality creates environment to provide group educational experience to students. This helps in involving students in learning process leading to an immersive learning experience for them. AI/ML powered chatbots can also offer counselling services to students in their language at their time of convenience as these systems are available 24x7. This timely intervention and attention help students to learn more efficiently and improve their grades leading to better outcome even in remote areas.

### **Examination Automation**

Advancement in Artificial Intelligence has made it possible to conduct examination securely even in the remote locations. AI/ML enabled programs keep track of Students through Web Cameras, Microphones and perform Keystroke Analysis and alert the examiner of any suspicious behavior. This ensures the authenticity of the student taking the exam and prevent him from cheating. Another important activity of the examination is the grading of the test papers. Automatic grading of papers is very useful for Multiple Choice Questions based on Optimal Marking Recognition (OMR) and Fill in the Blank type of questions. Artificial Intelligence powered evaluation programs using Natural Language Processing are now being adapted for normal free text answers evaluations as well. The automatic testing removes the biases in evaluation and reduces human errors. To provide feedback to a student after evaluation is very important, it gives a wholistic learning experience to the student. Artificial Intelligence and Machine Learning based tools analyze performance and work related reports recorded in the learning system to provide continuous feedback to the student, this continuous feedback to the student helps him understand where skills are lacking and improve upon them.

### **Providing Tutoring Support**

Artificial Intelligence driven Chatbots and Tutors have revolutionized the online tutoring. They are designed to handle customized feedback to students. They are specifically very useful for subjects that can be evaluated online. There are online tutors available to teach subjects like Mathematics, Chemistry, Physics, Computer Programming, Circuit Designs, Genetics, Medical Diagnostics etc. The biggest advantage of

this approach is that it is available 24x7 for the students to use at their convenience.

### **Educational and Administrative Assistance**

Artificial Intelligence and Machine Learning have helped in developing Conversational Applications collectively referred to as Chatbots [8]. These applications are very effectively used in education to help users both in Virtual Learning and Administrative tasks. During the recent Covid pandemic people across the world opted for distance learning for both regular classes and skill development courses. In this scenario, the Chatbots were very useful to solve enrolment queries, answer student queries and deliver instant solutions, guide students to the relevant study and reference material, collect students answers through a dialog interface and provide timely feedback to student related to tasks thereby improving their skills. They were specifically very useful in remote training and skill development programs. In addition to being a Virtual Teaching Assistant, Chatbots also proved to be useful in completing regular administrative tasks of an Educational Institute. They also answered student queries related to Campus Life including Campus Events, Interviews, Test Schedules, searching for Lecture Hall, Cafeteria, Parking Lot, Library etc. In addition to routine administrative tasks, they are also being deployed to answer queries related to application procedure for next semester, courses offered, getting assignments, examination schedule and disseminating test results.

### **Task Automation**

Artificial Intelligence tools in addition to being a Teaching Assistant or Administrative Assistant can also help the teacher in back office tasks like customized replies to student queries, evaluating homework, grading tests, maintaining reports, organizing research papers, notes and presentations. This frees teacher to focus on value added tasks like tailoring teaching process as per the need of students or institute policies. Some of the administrative tasks which can be delegated to programs driven by Artificial Intelligence are Rescheduling Curriculum, Rescheduling Classes, Preparing Class Attendance, Sharing Progress Reports, Answering Questions/Queries of Students and Parents related to Fee and Other Administrative Issues. As these are programs, they are available 24x7 enabling students and parents to interact any time of their convenience.

### **CONCLUSION**

Over the last few years application of Artificial Intelligence and Machine Learning has enormously helped teachers deliver educational content to the students. Using AI/ML based systems has allowed teachers to deliver personalized smart content to the students meeting their specific needs and interest. Rather than remaining a niche notion in education, eLearning is quickly becoming the dominant method of imparting knowledge to people of all ages. It was observed that immersive learning has increased the knowledge retention rate by more than 40 – 60% in comparison to face-to-face training.

Artificial Intelligence and Machine Learning systems not only helped in delivery of course content to students but also helped relieve the teachers and administrators of many routine teaching and administrative tasks. Due to their ability to deliver the content in multiple languages with translation they were also found to be useful in addressing students globally as well as students with visual and hearing impairment. The acceptance of intelligent systems is very high due to personalization and 24x7 availability.

It was observed that more than 50% of the education businesses are relying on some form of AI/ML based tools while training and it is projected to grow around 15-20% every year. The main driving force for this growth is the availability of online delivery platforms that enable the students to learn subjects which are not taught in regular classes and that too at student pace and level. We predict that in next 5 years more than 90% of the businesses will be using AI/ML based tools to impart skill development training. Online Learning will become the leading method for delivery of Skill Development Courses with the help of technologies like Artificial Intelligence, Machine Learning, Augmented Reality and Virtual Reality.

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