Artificial Intelligence in Education – A Case Study

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***Abstract*—Education is one of the most important elements of any civilization. It is way of passing values and knowledge that have been gathered over the course of human history since its inception. In most of the countries of the world, it is divided into four parts; kindergarten, primary school, secondary school and university education. It is further classified into classes in which students' study about a particular discipline for which they have been enrolled and this discipline is taught by a teacher i.e. a subject matter expert. To keep the track of progress of each of the student, there is a system called an examination by which a student is evaluated against their understanding of a specific subject. Teaching has gone through several evolutions over the period of time and with arises of technologies. Earlier teachers used to use blackboards and books to teach students, however, with the emergence of computers, the modes of teaching have changed drastically. These days mobiles, tablets and laptops are used to deliver lectures, materials and sometimes for the evaluation. Not just only teaching, that has been more personalized but most of the user activities are being tracked for the further analysis of a student understanding about a subject by using artificial intelligence (AI). Several aspects of AI, such as Knowledge Space, Adaptation Learning and Reinforcement Learning are used to enhance student experience of learning. Similarly, AI is used for the purpose of grading by using OCR and character recognition technology. In this paper, we presented a case study for the uses of AI in education in various areas of teaching, how it is being used for universities, industries, schools and startups.**

***Index Terms*—artificial intelligence, adaptive learning, reinforcement learning, knowledge space graph, intelligent tutoring system, natural language processing, chatbot.**

I. Introduction

Education is a process by which one obtained knowledge that the previous generations have obtained and pass it to the current generation, it is also important for the prolongation of both knowledge and culture for the society. The process of gaining knowledge is called learning and it plays a very important role to accelerate this learning process. Education is provided by educators such as, teachers in schools or professors in universities; however, sometime learners prefer to be educated by themselves. Education can be delivered in a well-formed structure such as, schools and universities or in informal structure such as, private tutor, online websites and mobile apps as preferred by the learners. Kindergartens, Primary Schools, Secondary Schools and Universities are the major components of formal education in most of the countries. In formal structure such as schools where it is further divided into classes where in each class, a group of learners are gathered based on their ages and learning capacities and each class is taught by teachers. Teacher is a well-qualified person who is trained on a specific subject, such as Math, Science and English for teaching students. For the purpose of teaching, a teacher uses several traditional mediums, such as books, blackboards and classroom-based teaching, however, these days several new mediums have been emerged to aid on traditional ways of teaching that we will discuss later in this paper. Study [1] suggests benefits that education brings to the society and for the students, it helps in excavation of poverty, employment reduction, improves economies, improves income, promotes equality, health benefits, discourages crime, environmental benefits, reduces gender-based violence, reduces child marriages. On the other hand, in formal education, where an educator teaches a whole class, does not cater for the need of an individual student in a classroom because of the limited time that a teacher can spend in a classroom and another reason is the large number of students that needs to be taught. Moreover, each individual student has different learning capabilities, therefore, each student responds and understands differently in a similar class. Some students are more equipped with thinking skills because their left side of brain is more active, on the other hand, others are thinking creatively and communicate better as their right side of the brain is more active. In a formal education, a teacher spends most of its time in grading and hence it reduces effective time for the teaching for a particular teacher.

With the growth of internet, online education has emerged as a new medium for teaching, most of universities and colleges are delivering their lecture videos and courses content online. Online education includes technologies, such as, email, learning management systems (lms), videos, social media and discussion forums. It has not just only benefitted local students studying in an institute but the international students who could not afford to attend universities in person, however, Study [2] has suggested that some specific kind of students such as younger, male and Black are not comfortable to adapt this online teaching medium. Moreover, the same study suggested that students taking online courses reported more engagement as compared to regular classes with the uses of several collaboration tools.

Study [3] suggests disadvantages of education, there might be some situations where some of the individuals get more or less benefit as compared to their peers and it can be reflected in the system by seeing their poor participation in the learning process. These problems occur due to social and economic

differences of the society. Similarly, online education brings disadvantages as suggested by study [4], such as online feedback is not that engaging as compared to face-to-face feedback, social isolation is another problem in online study among students, self-time management in online study is difficult for students and online cheating is another aspect that needs to be taken care by educational institutes.

Artificial Intelligence (AI) has been part of several domains of today's modern world, such as voice recognition, image classification, autonomous self-driving vehicles. Since, AI is a part of our daily lives, therefore, educational institutes are trying to integrate the latest developments in AI into their ecosystem to keep themselves up to mark and provide advantages to their students. AI is used in educational institutes for increasing the learning experience and it uses technologies, such as machine learning, natural language processing and deep learning for an education learning tool. It is suggested by study [5] that it will be a $6 billion market by 2024. Figure 1 illustrates how much part of budget for a specific technology is going to use and education stands second after AR and VR.

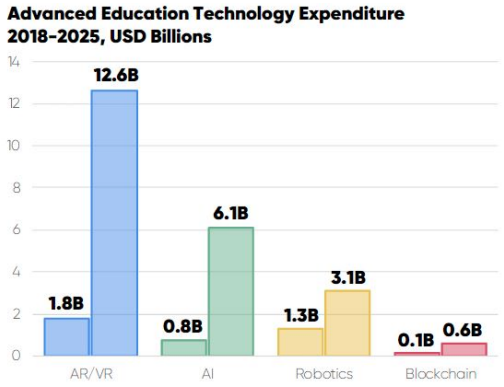

Figure 1 Budget extent of technologies in education. [6]

A. Advantages of AI in Education:

Education on the Go: AI based educational solutions, that are also cloud enabled, can be accessed at any time beyond the traditional teaching hours and from any devices, such as mobiles, tablets and websites, other than that, a lesson or an exercise can be resumed or paused at any time as per the convenience of the learner. Similarly, a virtual teacher can be assigned to a student who can track the progress of that particular student. Moreover, a learner gets the feedback from the virtual teacher in a real-time.

Flexible Content: AI based solutions are designed to cater the need of all students from the wide spectrum of learning capabilities, it works for the student that is below to an average student and receives materials and exercises that are simpler as compared to a student that is above the average and who gets different materials and exercises.

Gamification: With the help of gamification techniques, a better engagement can be achieved and then, this improves a student's involvement in educational process. With every exercise and lesson that is completed successfully will promote student to the next level and encourage them to perform better. By this, a student progressively learns a concept by going through from easier to tough challenges.

Learning Analytics: Educational institutes wide deployed data capturing tools could help a teacher to give better understanding for a specific student in term of its weaker and stronger section for a particular subject by using and by analyzing the captured data, similarly, data could be used for finding the weakness in a subject or problem in an exercise if it was not performed by all the students.

B. Disadvantages & Challenges of AI in Education:

Lack of a formal data strategy: As suggested in the study [7], most of the educational institutes do not have a formal data strategy which is a big impediment for the implementation of AI in educational organizations. Initial cost for the deployment of AI based tools is another challenge for the implementation of AI in educational organizations. Similarly, lack of AI knowledge is a bigger hindrance for the implementation of AI in educational institutes, though everyone realizes its importance.

Data usage privacy concerns: The most important question that can be asked to any educational institute is about data security and privacy. How they are going to maintain the security of personal data of the students and further the extent of data from a user they will use for designing AI model. Will they not sell data to other companies and will they use the data with purpose as they mentioned earlier? What are their polices around personal data information and historical data retention.

Unemployment: As AI, robots and technology will replace most of the repetitive tasks, and therefore reduces use of humans. Therefore, it will increase unemployment in the education domain as jobs will be replaced.

Lack of Creativity and Emotions: As teachers are going to be replaced by machines and bots, it will remove the scope of learning progressively, thinking out of the box would not be part of system because system is designed to work in a particular way, moreover, a student will deal with machines, therefore there will be no emotional connection with the teachers.

II. AI IN OTHER DOMAINS

A. AI for Healthcare:

AI is being used in several areas of healthcare, such as AI-assisted robotic surgery, a robot can collect medical data and advise a surgeon before the surgery, another use case is virtual nurse, that could be available 24 * 7 to monitor patient, to answer questions from patients and their relatives. AI is also used in automating administrative tasks and could be used for as voice to text assistants for writing tests and for prescribing medicines. Image analysis is better and faster than human analysis, moreover, it can be used remotely and without presence of a doctor for analysis and diagnosis.

B. AI for Cyber Securities:

Currently, cyber security solutions come into the picture after vulnerabilities have been discovered in cyberworld, however, AI based solutions could help in predicting cyber-attacks by analyzing patterns and loopholes. This could be help in vulnerabilities management. Using biometric solutions, such as, face recognition and iris recognition could improve security over old legacy method of authentication using login_id and

password. Behavior of a user can also be used as an input for AI to detect abnormalities of the system due to malwares present in the system and report to the user. Similarly, AI can be used for stopping phishing, AI can recognize most common patterns and sources of phishing and report to this to the user.

C. AI for Agriculture:

Food requirements for the raising population of world with limited land on earth can be improved by using technology such as AI. Autonomous tractor can be used to ploughing large field by programing them. Similarly, AI robots can be used for controlling weeds and crops in higher volumes. AI can be used for controlling pest infection, since, it is one of the big threats for farmers and destroys most of their crops. With the help of satellite images and historical data, smart algorithms can predict the next attack of pests and satellites could also be used for tracking pest's movement and informed farmer on the time. Deep Learning based solution developed by Plantix [8] is used for detecting health and infertility of the soil by analyzing the data of the soil.

D. AI for Autonomous Car:

Autonomous vehicles are being used in several industries, such as military and transportation. If we consider cars, AI is used for analyzing several sensors data, such as location data from GPS and objects detection by using car's camera to calculate trajectory of journey and execute that trajectory. Another way for using AI in automobiles is to monitor several parts of the car to predict the life of those parts and when that parts are going to be replaced to avoid accidents. Similarly, data collection from car could also be used to collect driver's data that eventually can be used for analyzing accidents and for claim and this will reduce the cost of the insurance.

E. AI for Finance:

AI in finance is utilized broadly, it is used for making a decision about user's loan taking capability by taking into account his history of transactions and other sources of income and liabilities. It is also used for the detection of frauds in a financial sector by analyzing the behavior of transactions and by using smart AI algorithms. AI is also used for predicting the future so that right investments can be made and stokes can be purchased or sold on the right time by analyzing historical data and trigger points and any anomalies.

F. AI for Social Media:

These days social media is omnipresent and is a large channel to promote products on these platforms that require good strategy where one needs to do experiment with various form of content, such as images, caption on images, tag lines, subject line for the email's and title of the video. Cost for the advertisement on social media can be reduced is a research topic. And since, huge data is being produced by social media, therefore AI based tools are used for social media for increasing engagement of the post for its content, it is analyzed for its content and engagement, after that AI predicts a future post for the better results. Similarly, images and videos analyzed for their content. Another use case is to determine the sentiment of customers by analyzing their comments.

G. AI for Legal:

Like in Machine Learning, an algorithm is trained on historical data and predicts the future results, similarly, law infer rules form historical cases. Therefore, historical data of cases with the help of machine learning can help in current cases and for current hearing to reach to a conclusion. Another use case is to use NLP to process textual data and to find contextual meaning of a word, it could help in finding required information from large pool of data. Since, reviewing a contract takes ample amount of time for a legal department in a firm. AI based solution after being trained for contract data can be used for the verification of the contract.

H. AI for House Automation:

Integration of Internet of Things (IoT) and AI within a house can be seen as a smart house. In this house, AI is used for the automation of several activities of the house, such as switch on or off of air conditioners, fans and electric bulbs after analyzing user's behavior collected from devices installed in the house without intervention of the human. Similarly, data collected from amenities present in the house could be used for the purpose of maintenance. Another way in which AI is present in the house is voice assistance device such as, Amazon Alexa or Google Home where a user can command a device for switching on and off that specific device.

I. AI for Ecommerce:

AI has been used widely across various fields of ecommerce. It is used to creating customer centric search so that it is easier for a customer to explain what they are searching for. Therefore, there are solutions around natural processing have been implemented to contextualize user's search, moreover, besides textual search a user can also search by an image. AI is also used for retargeting potential users and prospecting targes by analyzing user's behaviors. Sales have been improved by channelizing advertisement across various social media platforms. A Chabot is also used to stop customers churn by giving real time solutions for customer complaints. Most of the ecommerce these days use robots to improve their processes of logistics management. Recommendation Engine is what made after analyzing the tons of data of customers and it predicts precise personalized products to a customer.

J. AI for Human Resources (HR):

One of the toughest works for a HR in an organization is to analyze and classify resumes from candidates. A resume from separate candidates are in different format as compared to what organization is looking for. Therefore, NLP is used to extract information from each resume and convert it into meaningful information for the organization. Another area where AI is used for the evaluation of a candidate. Since, the numbers of applications for a particular job is too high, therefore, it is required to narrow down candidates by using AI to filter more relevant candidates specific to a job.

III. AI Technologies Used in Education

A. Reinforcement Learning in Education:

Reinforcement Learning (RL) is one of the types of Machine

Learning techniques in which an agent learns by interacting with its environment and through trials and errors it accepts feedback for every action it performs against the environment. Every positive behavior leads to a reward while every negative behavior leads to a punishment. In the end agent tries to find best set of actions that leads to a best solution of the problem as shown in figure 2. In the paper [9] and [10] authors used RL to find best teaching approach for teaching students from pedagogical module of ITS. Author clubbed students with same learning capabilities into similar groups to train the model. In another study author [11] used robots and RL to teach children by using a very personalized method of storytelling specific to that student, in this, a robot chooses stories as per student abilities and linguistics preferences. Author performed experiments over three months by deploying robots to several schools and on children with age range 4-6 years. They divided children into

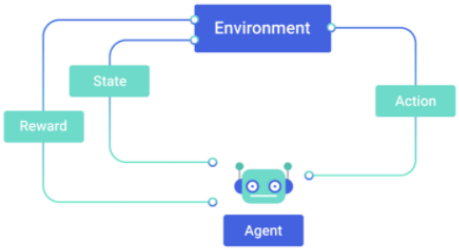

Figure 2 Reinforcement Learning Agent [12]

three groups, one with personalized stories, another group with non-personalized and last with base group with no robot intervention and their compared their results and found students with personalized learning showed better engagement and outcome as compared to children of other groups. Author in study [13] used smart classroom equipped with sensors, such as camera, heartbeat recorder, eye blinking recorder, facial expression and quiz score recorder. They used smart questions generator and used RL to enhance the performance of each individual students and they found by using smart classroom had improved the average score of the class.

B. Adaptive Learning in Education:

Data mining techniques, such as supervised learning (e.g. Neural Networks) and unsupervised learning (e.g. k-means clustering), Fuzzy logic and Genetic Algorithms are used to create tailored solutions specific to a student and subject which are formulated in the form of student persona profile and models of learning as suggested in survey study [14] . A system learns about a suitable learning pedagogy and therefore, provides appropriate content to the student.

C. Knowledge Space Theory (KST):

KST is a concept that is used to access one's state of knowledge for a specific domain. Accessing one's knowledge is important part of designing tailored system according to their capabilities. KST can determine detailed report about one's knowledge state as compared to traditional methods of evaluating a person and hence help them to find their weakness. In paper [15] author explained KST process, it is based on set and combinatorial theory. In KST, "Knowledge Space" is set of problems that a person is well versed in, such as solving a quadratic equation and simple harmonic motion. And individual items in a set id called "Item" and a specific example is called "Instance" e.g. calculate velocity of a car after 5 seconds, acerated with the speed of 4m/s^2. "Knowledge Structures" is defined as pair (Q, K) where Q is set of items and K is subsets of items from Q. Then "Learning Space" is defined as directed graph were a state is achieved after finishing earlier states as shown in figure 3.

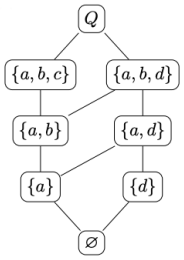

Figure 3 Knowledge Space Q with multiple states [15].

D. Voice Recognition and Natural Language Processing (NLP) in Education:

Artificial Neuron Network (ANN) based model such as Long Short–Term Memory (LSTM) [16] and Recurrent Neural Network (RNN) [16] have been proved as state-of-the-art for voice recognition and have been used in several commercial produces such as Amazon Alexa, Apple Siri and Google Home. These solutions have helped building inferences that are used by educational institutes to deliver courses content and academic repetitive tasks such as timetable access and FAQs.

E. Image Text Recognition and Optical Character Recognition (OCR) in Education:

Similar to Voice recognition, ANN is also used for the text and character recognition from the image. It is useful for grading assignments. A student can submit answers to an assignment in textual format on a paper that later on can be submitted after taking the photo from mobile camera, and system with the help of OCR [17] could grad the assignment. On a similar line, a teacher can prepare digital copy of the assignment from hardcopy of that assignment.

IV. Applications of Artificial Intelligence in Education

A. Intelligence Tutoring System:

In the early days, Intelligence Tutoring System (ITS) has been used profoundly and it's been in industry for 20 years [18]. ITS is used for providing progressive tutorials, specific to a student from a well-defined domain, such as Math or Physics. As student solves questions and based on their performance, system react by giving hints and tells area for the improvement to a specific student. ITS [19] comes with several AI models and models are used to represents knowledge about a teacher and learning techniques. Domain model is used for topics that

are going to be learnt. It contains information about the domain e.g. it may have knowledge of trigonometry and its rules. Approaches for teaching a Domain model is called Pedagogical model. It contains best teaching approaches suggested by expert in teaching or from best things from learning sciences. And a Learner Model that represents student's knowledge. It represents individual knowledge state, weakness and strength of the student, it can be formulated using Knowledge Space Theory (KST). Figure 4 shows the interaction of Domain, Pedagogy and Learner model. All models combined and create an adaptive leaning for a specific student with the help of data analysis or Reinforcement Learning (RL).

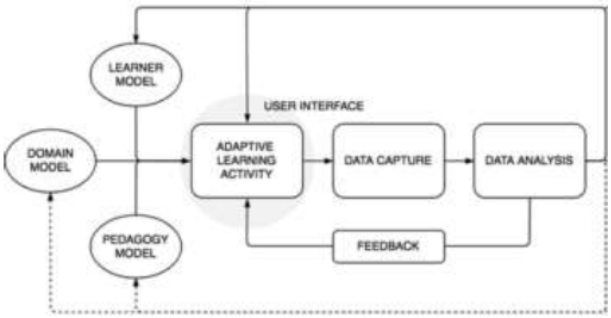

Figure 4 Intelligence Tutoring System; interaction of Domain, Pedagogy and Learner models [20].

B. AI-Based Hyper-Personalization Learning [15]:

High dropout rates [22] of students from colleges and universities are a major concern for educational institutes. It can be seen as a disengagement of students from the educational institute. If AI is used correctly then it can provide hyper-personalized experience to a learner with the help of machine learning. With the help of Big-data and AI, a persona of a student can be constructed and then a tailored curriculum as per the abilities of a specific student can be suggested, it will increase student interest and motivation towards a specific subject of their choice, and therefore, it reduces the chances of dropping out of a student from the educational institute. Data from a student is the key ingredient for such system and privacy of that student is another important aspect that must be taken into consideration while designing such systems. Therefore, data from student must be processed in manner that it must be transparent, secure, ethical and their identity information (name, address, contact information) should be masked.

C. Implementation of Voice Assistants:

Voice assistant technologies, such as Amazon Alexa, Google Home, Apple Siri and Microsoft Cortana are being used by educators to assist learners in order to give them access to the educational content at any time without any need of real teachers and beyond office hours.

D. Administrative Tasks:

Teachers in an educational institute not just only teach students but perform administrative tasks, such as examination preparation, grading a student for their exams, parents reporting and preparing lesson plans and on, an average they worked for 50 hours in a week as suggested by study done my McKinsey [23]. They further suggested that in US 16% of teachers are going to leave their jobs while in UK 81% of teachers thinking to leave their jobs because of demanding job. As shown in figure 5, working hours spend by a teacher in study performed by McKinsey [23]. It suggests that on an average each teacher spends half of their teaching time in clerical work.

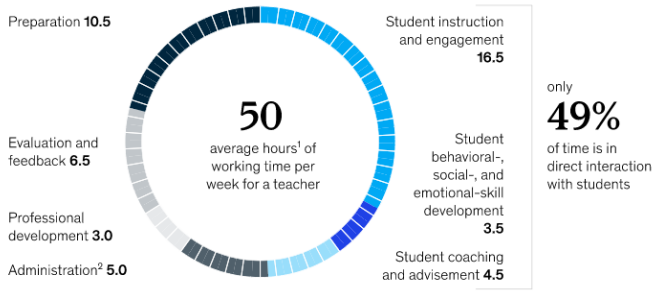

Figure 5 A teacher's working hours [23].

With the uses of automation and AI, time wastage on clerical work can be avoided.

E. Global Access:

Online platforms that can be accessed from anywhere across the globe, could be used for providing education worldwide with the help of natural language processing (NLP), a spoken sentences will be sent to the cloud and converted into English sentence and then, it can translate videos and presentations into multi-language subtitles that can be accessed by students from various countries in their native languages as performed by tool from Microsoft [24] . Moreover, with this, real time transcripts can be generated that could help deaf students to learn without any further assistance. Similarly, any written conversations could be converted into native language of the student. Other than audio solutions, visual solutions could also help blind students as it was implemented by tool from Microsoft in [25]. It could help blind students to read images with the help AI based solutions.

F. Chatbot:

Several universities such as University of Murcia [26] from Spain deployed AI-enabled chatbot for answering questions related to steam for study and about campus. Chatbot interacts with various entities of educational institutes as shown in figure 6. It has answered approximately 38,000 questions with the accuracy of 91%. This chatbot worked after official hours and therefore, it has

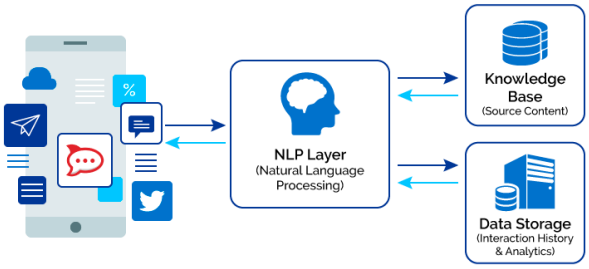

Figure 6 Chatbot Architecture and interaction with several components of the system. [27]

reduced the burden from the administrative staffs. Moreover, with the huge data that is generated during interaction with chatbot can be used to improve services. Similarly, Staffordshire University form UK [28] and Georgia Tech From US [29] have deployed chatbots with availability 24 * 7. It answers FAQ to students so that teachers can focus on their research and get enough time for teaching students.

G. *Smart Content:*

With the help of Knowledge Space Theory (KST), smart contents are being generated by breaking subjects, lessons and concepts into bit sized sections and then, these small chunks of concepts can easily track the understanding of a particular student about a specific topic and trigger the signals to increase or decrease the complexity for the next concept or exercise.

V. Enterprises and Startups Working For AI in Education

A. *Carnegie Learning [30]:*

They provide several AI enabled Math solutions for grades 6 to 12, it includes both textbooks and software. In 2019 they won award named "Best Artificial Intelligence/Machine Learning App or Tool" for their product MathHia and with LiveLab. MathHia is a virtual smart Math Tutor tool, it gives one-to-one personalized learning experience for a student and track the activities of students and gives hints if a student gets stuck at some point. On the other hand, LiveLab helps teacher to manage and see activities performed by the students during lab session and help a student who is in need, it points what skill a student is lacking that teacher could help with.

B. *Third Space Learning [31]:*

At Third Space Learning, they teach 7,000 pupils every week on their platforms. They work on learner's engagement by introducing online tools. For example, at the beginning every pupil is asked for their favorite topics apart from math and given a reward, such as images of football players or cakes. With their tools they provide one-to-one tutoring and with AI keep monitoring the speed of a teacher and notify them if they are too fast or slow. They adapt learning as per the need of each pupil, if one takes longer time with respect to peer pupils then the content of the learning would have adapted as per the need of that pupil.

C. *Brainly [32]:*

Brainly is a social learning network for students where students ask questions to other questions based on certain topics. It is very popular among students within a year of its launching, millions of students had joined Brainly. Now, it is being used on more than 35 countries and in many languages. They used AI for filter content based on their languages and filter out spams automatically so that students and experts receive high quality content. They used it for targeting questions based on student's age and what they have asked previously and tagging a question so that it is reached to relevant students.

D. *DreamBox [33]:*

DreamBox has won over 40 industry awards and it used by 150,000 teaches and 3.5 million students across US, Mexico and Canada. DreamBox is an online tool developed to teach learners by using adapting learning techniques. It is kind of personalized math tutor but teaches in the form of video games and gamification makes it more engaging for learners. DreamBox continuously monitor learner's growth and suggests path to master a concept based on its strategy for adaptive learning. Learners use this tool without paper and pencil, and they keep practicing until they are hands on a particular topic by awarding or punishing using reinforcement techniques.

E. *Nuance [34]:*

They used machine learning to convert voice to transcript with a speed of 160 words per minute. It is used by students with hearing impairments and for those who has difficulties in writing. It is also used for learning spelling and recognizing words. Even it helps in searching a Wikipedia by voice command.

F. *Knewton [35]:*

It is based on adaptive learning technology in higher education. They have developed a program called ALTA. It is used subjects such as, math, statistics, chemistry and economics. ALTA combines adaptive learning with courses content available openly for delivering personalized learning experience. It has 40 million students across the globe that use Knewton platform for learning higher education.

G. *Gradescope [36]:*

This is a tool for grading automatically using AI. It was acquired by Turnitin. In this tool they used domain knowledge expertise and AI to grade a student unbiased, better statistic for evaluation and digitization of paperwork.

H. *Photomath [37]:*

Photomath app utilizes OCR technology for text recognition. As they mentioned on their website that their app solves more than 1.2 million problems each month. In this app students use their phone's camera to scan a particular math problem, after that image captured from camera is passed through the OCR solution and AI models, and gives step-by-step procedures for the solutions of that specific problem. This app has alleviated the use of private tutor for the parents, moreover their paid version of app shows results in animation for the better understanding of a learner. Moreover, they provide graphical

explanations of the problem using AI model and learners can create their own problems using their tools.

I. Playosmo (OSMO) [38]:

OSMO has won an award called 'AI Breakthrough Awards' for their innovation called 'Reflective AI'. They have developed a proprietary solution based on iPad and iPhone with a base where a phone or tablet uses Reflective AI to scan things in front of camera and combines it to digital content of the tool. They have created in the format of the game, in a game a student is given as task such as, solving a puzzle, indemnification of colors and addition of numbers. A camera using visual AI to scan student activities and advise student to their progress.

J. Duolingo [39]:

Duolingo is an app for learning app, it has more than 300 million users and it is used for more than 32 languages with more than 90 courses. It is more known for personalized experience and gamification which motivates and engages a user. It uses AI driven adaptive learning; it presents exercises to evaluate the understanding of the user about a specific language. It also considers the difficulties such as vocabularies and grammar rule and predicts whether a learner would provide right or wrong answers. AI models are used to present the next exercise.

VI. Future of AI In Education

AI has been come a long way from its inception, now it is a part of almost every industry, such as healthcare, transport, sports and social media. It is being used for creating a futuristic world, for example self-driving cars, drones delivering ecommerce items, smart robots for surgery and smart homes. Similarly, AI is spreading its reach to the educational industry, however, education is considered to be more reluctant for changes. In the future, we will see more of solutions around adaptive learning where a more accurate leaning profile will be created for a learner and based on their preferences and learning capabilities. Not just only teachers' robots will complement teaching, moreover, learning mediums will emerge to enhance the teaching methodologies, such as interactive videos where a student interactively communicates with peer students, teacher and the system. Similarly, more voice and chatbot based solutions would be deployed with better understanding of natural language model so that chatbot would infer the context of conversation and answers correctly without the intervention of the teacher for things related to teaching by using NLP model GPT3 and administration for things related to back office.

Grading a student takes most of the time of a teacher, therefore, a more accurate model will be developed for grading that would not be biased, error free, and not be easily manipulative unlike this article [40] . In this article, they found an automated grading system can be fooled by gibberish and susceptible to human biases, it gave different results for students from China and African-American. This tool gave more marks by considering essay length and for choice of words, however, physical expert gave results oppositely.

Countries such as China and US are investing in education in a large scale [41] [42]. [39] suggest that US education will grow by 47.77% by 2022, similarly, China is planning to invest $150 billion in next 15 years to be the world leader. However, there is one example [43] in which professor David Kellerman has shown how he managed to develop an AI-based platform for his institute University of New South Wales (UNSW) in Australia side-by-side of his teaching. Other universities and educational institutes can learn from him to develop AI-based solutions for their own educational institutes. What he mentioned that "he connected 500 individuals from different islands to a single team". He introduced a chatbot for answering real time questions and provide learning materials, he used BI tool to generate reports and for the analysis of a student performance. With introduction of these tools student's satisfaction has increased from 75% to 99%.

VII. Conclusion

Artificial Intelligence has gained momentum these days and it has also become an integral part of education, with the help of AI in teaching has shown improved results over orthodox methods of teaching. Several online platforms and mobile apps have been developed to supplement traditional learning. In this case study we have presented applications of AI in other domains and also how it is being used in various sector of educational institutes. We introduced several startups working on developing solutions for the use of AI in education. Moreover, we explained what part of AI, such as Adaptive Learning, Reinforcement Learning , Knowledge Space Theory, Vision, NLP and Audio analysis contributing towards the integration of AI in educational institutes We have mentioned how a professor integrated AI in his daily curriculum that could be a guiding path for rest of the other universities. Situation like Covid-19 also played a large role in accelerating this momentum of AI and online education, and with this online platform enabled with AI, gives a democratic way of spreading education and learning, a quality education from all universities will be available across the globe irrespective of country, economic situation of students and learning capabilities(visual, hearing or mentally challenged) of a learner, therefore it is creating a level ground field for every learner. Lastly, we mentioned how human biases can also affects the results of tools that should be keep in check.

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