World Journal of Educational Research
ISSN 2375-9771 (Print) ISSN 2333-5998 (Online)
Vol. 9, No. 2, 2022
www.scholink.org/ojs/index.php/wjer

Original Paper

Artificial Intelligence in Higher Education and Changing roles of Educators

Pramila Ramani[1*]

[1] Department of Education, Central university of Tamil Nadu, India

[*]Pramila Ramani,pramila.maths@gmail.com

Received: February 28, 2022 Accepted: March 12, 2022 Online Published: March 19, 2022

doi:10.22158/wjer.v9n2p56 URL: http://dx.doi.org/10.22158/wjer.v9n2p56

Abstract

Artificial intelligence has created many imagination among movie makers, cartoonists and science fiction authors they imagined how AI will change our life. Even though it has not changed our life as they imagined but it has entered in every aspect of our life. This paper discusses about the basic things about artificial intelligence. Artificial intelligence mainly uses computer science, robust data base, and our structure of our brain, nervous system and learning theory from psychology. Artificial intelligence has wide applications in higher education especially in teaching and learning process. It can be used in institutional, student support and pedagogical process. This paper discusses about application of artificial intelligence in higher education and changing roles of educators.

Keywords

artificial intelligence, machine learning, deep learnig, facilitator, human learning

1. Introduction

Artificial intellegence has created imagination among movie makers, futerists, cartoonists and science fiction authors how AI will change (or catestropic) our life. We can call it as imagination or prediction. But actually no drastic changes happened till today. But for sure AI has entered in every aspect of our lives we can say it has created ubiquitous changes in our lives. Intelligence censors for taking perfect photos, automatic cars, search engine which remembers our previous behaviour and show result accordingly, google search which displays result according to our location, personal assistance in smart phones all these are examples of use of AI in our day to day activity. In some educational institutions humanoid is used for teaching purpose in schools. But they are still in infancy stage. Now this is time to think why we cannot use AI for educational purpose especially in higher educational institutions. We have seen computer intelligence is used for teaching and learning purpose in some cases. First we will

try to understand some basic concepts related to AI.

1.1 Artificial Intelligence

(IBM Cloud Education, 2020) [1]Artificial intelligence is a field, which combines computer science and robust datasets, to enable problem-solving. It also encompasses sub-fields of machine learning and deep learning, which are frequently mentioned in conjunction with artificial intelligence. These disciplines are comprised of AI algorithms which seek to create expert systems which make predictions or classifications based on input data.

1.2Machine Learning

Machinelearning is the study of computer algorithm it is a part of AI. (Bigsquid.AI, 2021) [2]Machine learning is the science of programming computers to automatically recognize patterns in data. With a machine learning approach, we don't "teach" a computer how to do something; instead, we expose it to a dataset and let it learn how to do a task on its own based on patterns it found in the dataset. There are different types of machine learning.

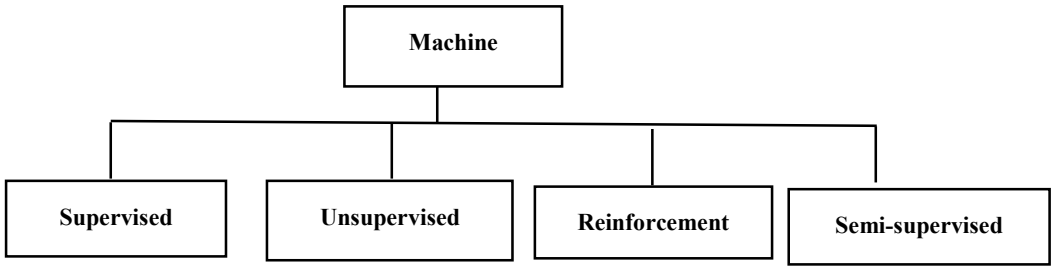

Figure 1. Categorising Machine Learning on the Basis of Nature of Response

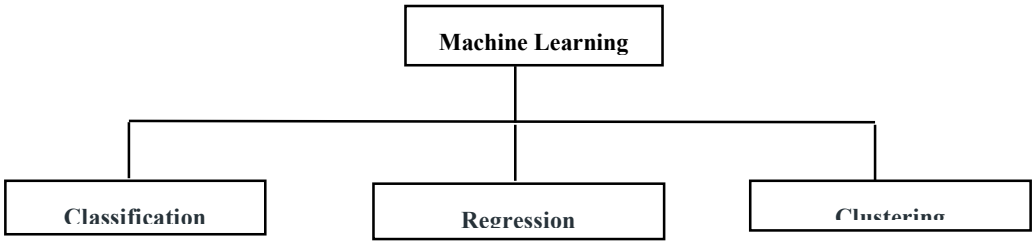

Figure 2. Categorising Machine Learning on the Basis of Required Output

1.3 Deep Learning

[3] (Oppermann, 2019) Deep Learning, on the other hand, is just a type of Machine Learning, inspired by the structure of a human brain. Deep learning algorithms attempt to draw similar conclusions as humans would by continually analyzing data with a given logical structure. To achieve this, deep learning uses a multi-layered structure of algorithms called neural networks.

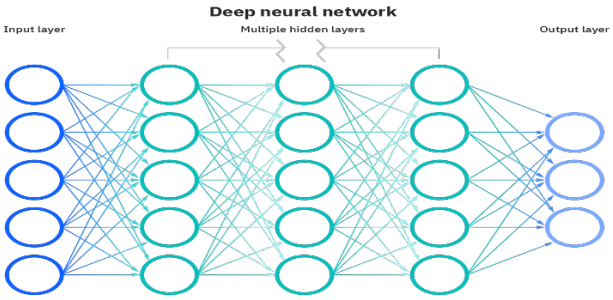

Figure 3. Deep Neural Network

1.4 Relationship between Artificial Intelligence, Machine Learning and Deep Learning

From the above discussion it is clear that deep learning is the subset of machine learning whereas machine learning is a subset of Artificial Intelligence. Artificial Intelligence is a programme that can sense, reason, act and adapt. Machıne learning means algorithms whose performance improve with more data set. Deep learning is multi-layered neural network learn from vast data set. Deep learning is a type of machine learning it can be called as bio mimicry. Inspired by structure of human brain the way it processes information.

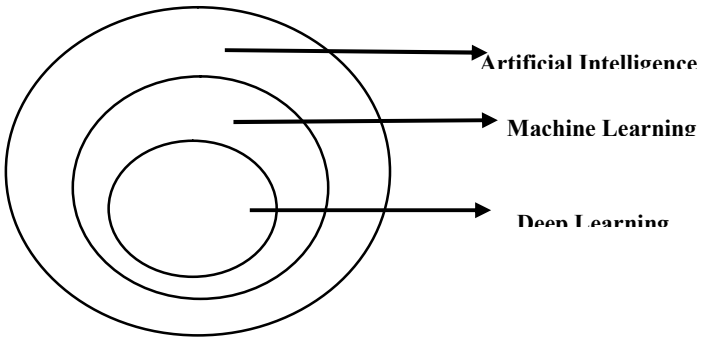

Figure 4. Deep Learning

2. Human Learning and Machine Learning

In the previous discussion we tried to understand about artificial intelligence now we will understand how it is related to human learning. We have seen that reinforcement learning is a category of machine learning we will see how it is connected to operant conditioning. (McLeod, 2018) [4]The cocept of operant conditioning is given by the psychologist B.F. Skinner. Operant contitioning is also known as instrumental conditioning. Using operant conditioning a behaviour is repeated using a reinforcement and it is reduced using punishment. The behaviour which is followed by pleasent consequence will increase the occurance and the behaiour which is followed by unpleased consequence will decrease the occrance. Skinner discussed about three types of responses or operants they are

Neutral Operants: Response from the environment (which is exhibited naturally by an organism)

which isneither increased nor decreased the probability of behaviour being repeated.

Reinforcers: Response from the environment (which is exhibited naturally by an organism)which increases the probability of behaviour being repeated. There are two types of reinforcers positive and negative reinforcers. For example a father gives candy to his son whenever he keeps his toys in proper place. İf the frequency of placing the toys in proper place increases then we can say that candy serves as a positive reinforcer. A person leaves from home early in the morning to office to avoid traffic and being late to the office this is example of negative reinforcement.

Punishers: Response from the environment (which is exhibited naturally by an organism) which decreases the probability of behaviour being repeated. Punishment weakens the behaviour. Punishment is of two types they are positive and negative. Scolding a child if he breakes a window is postive punishment. Taking away a child's toys for misbehaving is a negative punishment.

This concept of reinforcement is used in machine learning. (Błażej Osiński & Konrad Budek, 2018)[5] [6] (Guru99, 2021) In reinforcement learning the artificial intelligence faces a game like situation. The computer uses trial and error method to solve the problem. To make the computer what the programmer wants the artificial intelligence gets a reward or penalty for the action it performs. The machine goal is to maximize the reward. Although the designer sets the reward (the rules of the game) he gives no hint or suggestion forhow to solve the game. Therefore the model should find the ways to perform the task its aim is to maximize the reward. The following figure will make the point clear

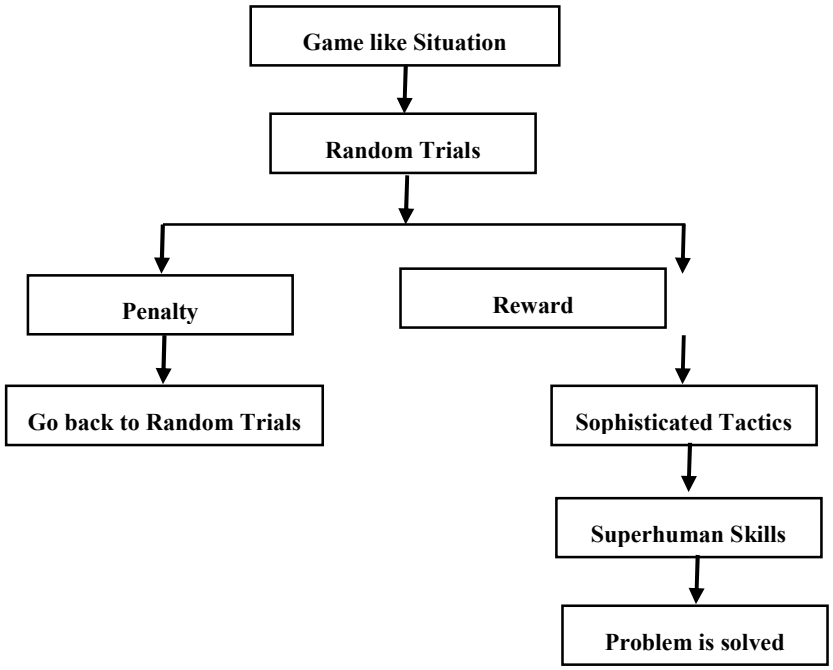

Figure 5. Reinforcement Learning

3. Review of Literature

Artificial intelligence can be used in the field of education because it will bring certain benifits to the learner. İnvestıgator have reviewed seven papers related to use of artificial inteligence in teaching and learning.

[7] (Marlene Jones, 1985) in his paper entitled “Applications of artificial intelligence within education” have discussed the use of AI in education. He opines that from the recent studies which he has reviewed he found that AI is having positive impact in the field of education. In addition to CAI (Computer assisted instruction) there exists ICAI (Intelligent Computer-Assisted Instruction) systems for teaching and learning different subjects. He discusses about the development of learning environments that are designed to facilitate student-initiated learning. AI can also be used for diagnosis and assessment but at present AI is having some limitation which we can overcome. [8] (Borge, May-June -2016) in his paper entitled “Artificial Intelligence to Improve Education / Learning Challenges” have discussed about use of AI in teaching and learning process. He opines that educational goal can be easily achieved and managed using the new technology. Using this technology we can easily analyse each and every student in the class and their understanding on each and every topic is also possible. After analysis we can prepare detailed report and appropriate action can be taken.AI can be used after analysis to teach students in the topic where they are weak and this will enhance their learning.

(Popenici & Kerr, 2017) [9] in their paper entitled “Exploring the impact of artificial intelligence on teaching and learning in higher education” explores the use of AI in teaching and learning in higher education. They investigated about educational implications of emerging technologies on the way students learn and how institutions teach and evolve. They also discussed about recent technological advancements and the increasing speed of adopting new technologies in higher education. They also predicted about in future how higher educational system will use AI in their teaching and learning process. They also discussed about the challenges faced by students and teachers in adopting to these new technologies in the field of education, student support and administration. They also discussed about furure disrections of this research. (Richter, Marín, Bond, & Gouverneur, 2019) [10] in their paper entitled “Systematic review of research on artificial intelligence applications in higher education – where are the educators?” gives an overview of research on AI applications in higher education through a systematic review. They reviewed around 2656 publications for the period between 2007 and 2018 after review they included 146 articles for final synthesis according to the criteria they have decided. They found that most of the disciplines involved in AIEd papers come fromComputer Science and STEM and in most of these studies quantitative methods were used for data analysis. The four areas they found where AI is used was 1. profiling and prediction, 2. assessment and evaluation, 3. adaptive systems and personalisation, and 4. intelligent tutoring systems.

(Chen, Chen, & Lin, 2020) [11] in their study entitled “Artificial Intelligence in Education: A Review” did research related to AI on innovations and developments. This is a qualitative researchand

theresearch design used is literature review. They found that AI is extensively used in educationin different forms. [12] (Ahmad, Qadir, Fuqaha, & Iqbal, 2020) in their paper entitled "Artificial Intelligence in Education: A Panoramic Review" did research related AI in education and paid attention to particular issues by highlighting the future scope and market opportunities of AI. They analysed research trends, current limitations and pitfalls of AI in education.

In particular, the paper reviews the various applications of AI in education including student grading and evaluations, students' retention and drop out prediction, sentiment analysis, intelligent tutoring, classrooms' monitoring and recommendation systems. The paper also provides a detailed bibliometric analysis to highlight the research trends in the domain over six years (2014-2019). (JenHwang, Xie, Wah, & Gašević, 2020) [13] in their research entitled "Vision, challenges, roles and research issues of Artificial Intelligence in Education" have done research related to roles of AIED studies they presented definition from the perspective of educational needs. They proposed framework of implementing AI in various teaching and learning situations. This structure will help various researchers in the field of AIED studies.

4. Use of Artificial Intelligence in Higher Education

Artificial Intelligence (AI) gives us promising benefits in the field of higher education. AI can be used for personalised learning according to the preferences of students, students can select different pace of learning according to their capacity and mastery of topics can be achieved. The following figure describes the application of AI in higher education.

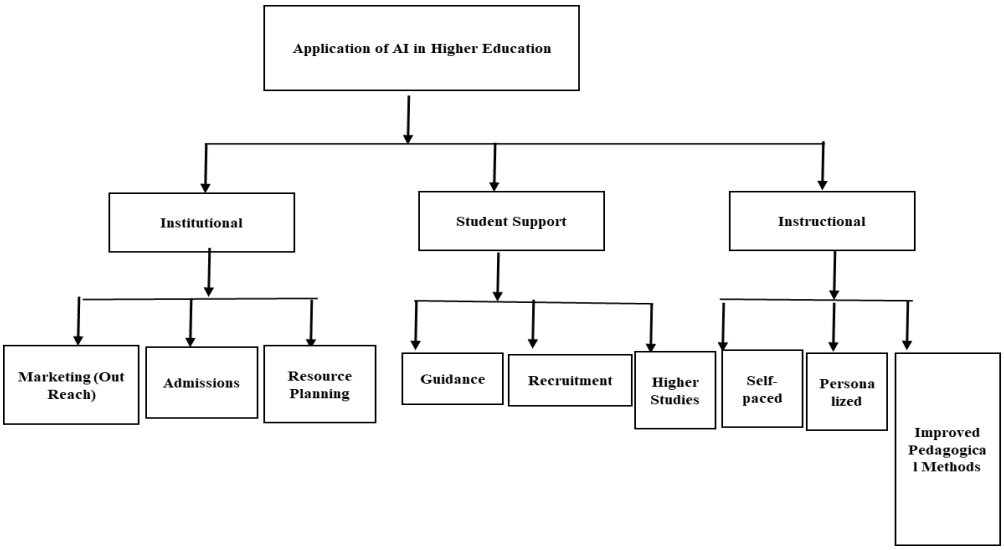

Figure 6. Application of Artificial Intelligence in Higher Education

Artificial Intelligence (AI) can be used by the institution, Student Support and for instructional purposes.

4.1 Institutional Purpose

AI can be used for Marketing, admissions and resource planning in higher educational institutions.

Marketing: Courses, facilities, teaching and non-teaching staffs etc., available in the institutions can marketed using AI. (Zeide, 2019)[14] Schools, particularly in higher education, increasingly rely on algorithms for marketing to prospective students, estimating class size, planning curricula, and allocating resources such as financial aid and facilities.

Admissions: AI can be used for admissions of students for various courses.

Resource Planning: Optimization (effective and efficient) of resources available is very important part of higher educational planning. AI can be used for this purpose.

4.2 Students Support

Guidance: Students needs different types of guidance right from selection of courses suitable for them, to solve their individual problems and various other help and psychologically support students. [14] (Zeide, 2019) Schools utilize machine learning in student guidance. Some applications help students automatically schedule their course load. Others recommend courses, majors, and career paths—as is traditionally done by guidance counsellors or career services offices. These tools make recommendations based on how students with similar data profiles performed in the past.

Recruitment: After students successfully completing their studies they generally approach placement cell for finding their suitable jobs. AI can be used for this purpose.

Higher Studies: After students successfully completing their studies some may prefer to study further AI can help them to choose courses and universities from their respective countries and abroad.

4.3 Instructional

Students many times feel that whatever they learn in normal classroom situation is not enough for them to understand the subject completely therefore they need some assistance to make the concept clear. Moreover lecture delivered in the classroom is for large group and cannot be made tailor made. In this situation AI can help us to make the instruction personalised, giving personalised feedback, assessment and self-paced.

Self-paced: Learning style of students vary therefore AI can be used to make learning more comfortable and easy.

Personalized: AI can deliver personalised instructions to the learner can satisfy individual needs. It can encourage them to learn further without fear. Personalised feedback can be given in time and in depth learning of the concept can be achieved using AI.

Improved Pedagogical Methods: Educators use variety of pedagogical methods to transact syllabus in spite of this students find difficult to understand completely. AI is useful in this situation because AI can modify pedagogical methods according to student's specificneeds.

Educators: Artificial intelligence will be of great help to educators. Most of the time educators struggle to make the students to understand the concept and to complete the syllabus in specified time limit this problem can be minimized using AI. They can design learning materials in advance using AI

which cater the individual need of students. Learning materials can be individualised, personalised and in built feedback mechanism. The role of educators are changed they are more like facilitators than instructors. There is gap between the teachers teaching and learners learning this gap can be minimized using AI. Next educator's time is consumed in assessment and evaluation of students, preparing mark sheet and analysing the result. AI can be helpful in this process and the workload of educator will be minimized and this precious time can be used for other purpose.

Learners: Learners find difficulty in understanding the concept in normal classroom teaching. In this choice based system they wanted to opt for courses from different department and may be from different universities also. In this case they cannot travel to the place of learning as it is not feasible. If there is some self-learning material with individualised instructions is available it will be of great help to them. Many problems of learners' can be solved.

6. Technologies in AI That Can be Used in Teaching and Learning Process in Higher Education

Faculty perform many activities like teaching students, grading students assignments, tests, examinations, mentoring students etc., Faculty have other responsibilities also along with their regular teaching activities. They are supposed to increase their academic scores and also perform university related activities. In the choice based credit system they are supposed to design new courses which is open to all students of the university. If more students enrol in their course then their workload will increase. We will see how AI will be helpful to higher education faculty to decrease their workload.

5.1 Automated Grading with Paper Grader

Faculty normally uses rubric to grade essay type questions and assignments. They prepare rubric in advance and using this rubric they grade the students work. Manually assessing these assignments and essay type questions consumes lot of precious time of the faculty. Now we will see how AI is helpful in this process. Automated grading software will not only reduce faculty time but also compares with human grading and will make the grading realistic. It divides the students' written notes into discrete categories and compares with rubric prepared. AI uses machine learning techniques for this process. First AI learns this technique using already graded assignments by faculty it goes through all previously graded assignments this acts as sent of data and finds the some common patterns using machine learning. This process is simultaneously improved as it actually starts grading students work. For this Linear regression technique, clustering techniques, Bayesian theorem and many other similar techniques can be used. They mainly use comparison that is comparing data sets prepared by them using previously graded work of faculty and students performance. (Ramalingam, Pandian, Chetry, & Nigam, 2018) [15] Intelligent Essay Assessor (IEA) is a software tool which assesses (grades mainly) the essay quality. In IEA Latent Semantic Analysis (LSA) is used, it is mainly used to check the semantic similarity of words, phrases and passages in any given text. Results from constant simulations suggest that LSA does its work with much precision. To grade an essay and assess it, LSA is first trained in a certain specific domain (of topics). Once it is done then the student essays are analysed by

LSA based on their meaning, words used, the content of the essay and the concept explained.

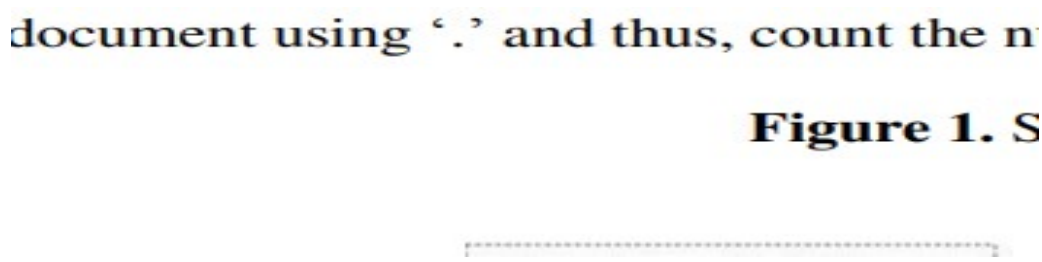

Figure 7. System Architecture

https://iopscience.iop.org/article/10.1088/1742-6596/1000/1/012030/pdf

Advantages of Auto grading

i. Graded students work is free from bias therefore score is more reliable.
ii. AI works with Speed, accuracy and diligence.
iii. Faculty workload is reduced
iv. Gives accurate feedbacks to students

Disadvantages of Auto grading

i. Cannot be exact like human being because it lacks thinking ability it cannot think in multi directional like human being. (complex thinking process)
ii. Homoscedastic (if we use linear regression model)
iii. AI can do wrong grading by grading the data fed to algorithm rather than actually grading students work. (Meenu, 2021) [16] An article in the Harvard Business Review reveals how AI grading systems by the International Baccalaureate Organization produced varying results from the predicted ones and the students went on a protest.

5.2 Educational Auto Instructional Materials can be adapted to Students Needs

Self-learning material that is custom-tailored education can be prepared using AI after students learn using AI faculty can facilitate learning of students to consolidate the concept being learnt. For this data analytics and artificial intelligence techniques can be used to develop learning systems. In this system analysis of historical data of previous users is done which enables to model learning process from students' viewpoint so that computer can adapt to the rapidly changing environment. Thus AI can develop high quality learning material thus satisfying individual needs of learners. AI can be designed to use constructivism to deliver effective learning environment. (Pliakos, et al., 2019) [17]Using machine learning and information retrieval techniques AI can suggest potential useful items for students to learn the content.

Technology Enhanced Learning (TEL) includes all technology which helps to improve students learning. Website contains lots of information we can call it as information explosion to search from this vast ocean is very difficult we may get lost. (T. A. Syed, V. Palade, Iqbal, & Nair, 2017) [18]

Therefore Personal Learning Recommendation Systems (PLRS) helps students to search the material of their interest it saves students precious time in searching information in website. Students can monitor their learning using automated feedback cycles which helps the students to progress to higher level of learning. (Hwang, Xie, Wah, & Gašević, 2020) [19] This can be achieved through AI (intelligent tutors), learning analytics and educational data mining techniques. (Wolf, Miller, & Grodzinsky, 2017) [20] A smart tutee could be a chatbot such as Microsoft Tay with a natural language processing interface and artificial neural networks

Advantages of Auto Instructional Materials

i. Adaptive learning system helps students with tailor made learning environment. It considers behaviour and needs of the individual learner.

Disadvantages of Auto Instructional Materials

i. Adaptive learning system is not aware of the entry level of learners therefore it heavy impacts the quality of personalised learning environment. [17] This we can overcome by using item-response theory and machine learning.

ii. Learning environment does not take into account of psychology of the learners and their psychological needs.

6. Changing Role of Educators in Higher Educational Institution

Artificial intelligence can be used to teach the students of higher educational institution in a more personalised environment. Therefore educators' role is not to teach students but should take the role of facilitator. Teacher educational institutions should teach the use of AI and its applications. They should equip the future teachers with knowledge of AI and methods for creation self-learning materials using AI. Educators should use AI to know the places where courses need improvement. AI uses techniques to know why large number of students do mistake in a particular concept. (TeachThought, 2014) [21] When a large number of students are found to submit the wrong answer to a homework assignment, the system alerts the teacher and gives future students a customized message that offers hints to the correct answer.

With the advent of AI educators should be techno savvy should be ready to learn new technologies, computer programming and creation of auto instructional material using AI. Now a days only content knowledge, psychological methods of teaching and knowledge of learners is not enough but they should be ready to change themselves according to fast moving technology enabled world.

7. Conclusion

Now a days AI is used for teaching purpose but it can be further enhanced and used to make learning more enjoyable.AI can be used in higher education in many ways like admission of students, guidance, teaching and learning process. AI application in pedagogical process is very useful because personalised learning is possible. More application can be explored to make learning more enjoyable

and especially in distance learning.

Reference

Ahmad, K., Qadir, J., Fuqaha, A., & Iqbal, W. (2020, June). *Artificial Intelligence in Education: A Panoramic Review*. Research Gate. https://doi.org/10.35542/osf.io/zvu2n

Bigsquid.AI. (2021). *Introduction to automated Machine Learning*. Retrieved June 5, 2021, from https://bigsquid.ai/wp-content/uploads/2021/03/Introduction-to-Machine-Learning-2021.pdf

Błażej, O.,& Konrad, B. (2018, July 5). *What is reinforcement learning*? The complete guide. Retrieved June 7, 2021, from https://deepsense.ai/what-is-reinforcement-learning-the-complete-guide/

Borge, N. (May-June -2016, May-June). Artificial Intelligence to Improve Education / Learning Challenges. *International Journal Of Advanced Engineering & Innovative Technology (IJAEIT)*, *2*(6). Retrieved June 9, 2021, from http://ijaeit.com/Content/Paper/20192111081000011201921110810000001.pdf

Chen, L., Chen, P., & Lin, Z. (2020, April 17). Artificial Intelligence in Education: A Review. *IEEE Access*, *8*, 75264-75278. https://doi.org/10.1109/ACCESS.2020.2988510

Guru99. (2021). *Reinforcement Learning: What is, Algorithms, Applications, Example*. Retrieved June 7, 2021, from https://www.guru99.com/reinforcement-learning-tutorial.html

Hwang, G., Xie, H., Wah, B., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers & Education: Artificial Intelligence*, *1*. Retrieved June 22, 2021, from https://reader.elsevier.com/reader/sd/pii/S2666920X20300011?token=97FA16377ECE96ADC5A16E00821D7068EAF6560CD8FA0A74213CF2996EFBF61B0DAFEB19546310D65EF977F0B0376F11&originRegion=eu-west-1&originCreation=20210622131716

IBM Cloud Education. (2020, June 3). *Artificial Intelligence (AI)*. Retrieved June 6, 2021, from https://www.ibm.com/cloud/learn/what-is-artificial-intelligence

JenHwang, G., Xie, H., Wah, B., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, *1*. https://doi.org/10.1016/j.caeai.2020.100001

MarleneJones, (1985, May). Applications of artificial intelligence within education. *Computers & Mathematics with Applications*, *11*(5), 517-526. https://doi.org/10.1016/0898-1221(85)90054-9

McLeod, S. A. (2018, January 21). *Skinner-operant conditioning*. Retrieved June 7, 2021, from https://www.simplypsychology.org/operant-conditioning.html

Meenu, E. (2021, April 2). *ARTIFICIAL INTELLIGENCE LATEST NEWS*. (2. by April 2, Producer) Retrieved June 21, 2021, from https://www.analyticsinsight.net/students-can-now-argue-with-an-ai-system-for-extra-marks/

Oppermann, A. (2019, November 13). *What is Deep Learning and How does it work*? Retrieved June 6, 2021,

fromhttps://towardsdatascience.com/what-is-deep-learning-and-how-does-it-work-2ce44bb692ac

Pliakos, K., Joo, S., ParkJ.Y, Cornillie, F., Vens, C., & Van den Noortgate, W. (2019). Integrating machine learning into item response theory for addressing the cold start problem in adaptive learning systems. *Computer and Education*, *137*, 91-103. Retrieved June 21, 2021, from https://www.scopus.com/record/display.uri?eid=2-s2.0-85064929894&origin=inward&txGid=100326f6f244e74fa362da0f82b6d5fe

Popenici, S., & Kerr, S. (2017, November 23). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, *12*(22). https://doi.org/10.1186/s41039-017-0062-8

Ramalingam, V., Pandian, A., Chetry, P., & Nigam, H. (2018). Automated Essay Grading using Machine Learning. *Journal of Physics:Conference Series 1000 (NCMTA 18)*. https://doi.org/10.1088/1742-6596/1000/1/012030

Richter, O., Marín, V., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education-where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(39). https://doi.org/10.1186/s41239-019-0171-0

T.A. Syed, T., V. Palade, V., Iqbal, R., & Nair, S. (2017, November 1). A personalized learning recommendation system architecture for learning management system. *9th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management, IC3K 2017*, *1*, 275-282. Retrieved June 22, 2021, from https://www.scopus.com/record/display.uri?eid=2-s2.0-85055694526&origin=inward&txGid=acab5ca028b7dffe3f95ad78e6b08be9

TeachThought. (2014). *10 Roles For Artificial Intelligence In Education*. Retrieved June 22, 2021, from https://www.teachthought.com/the-future-of-learning/10-roles-for-artificial-intelligence-in-education/

Wolf, M., Miller, K., & Grodzinsky, F. (2017). Why we should have seen that coming: Comments on microsoft's Tay "experiment" and wider implications. *The ORBIT Journal*, *1*(2), 1-12. Retrieved June 22, 2021, from https://reader.elsevier.com/reader/sd/pii/S2515856220300493?token=4129F0440305E4F8614051A367D1D3DDC176CC9CE3FB67C33AAC84908D613FFC913381D64B2AF1B2197AEA75DD8D4641&originRegion=eu-west-1&originCreation=20210622133855

Zeide, E. (2019, August 26). *Artificial Intelligence in Higher Education: Applications, Promise and Perils, and Ethical Questions*. Retrieved June 11, 2021, from https://er.educause.edu/articles/2019/8/artificial-intelligence-in-higher-education-applications-promise-and-perils-and-ethical-questions