The impact of A.I on teaching and learning

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Abstract

The breakthroughs in AI have been ground-breaking in many fields such as military and industry, which have been deemed successful. It promises to be implemented and shows its importance in future opportunities. Following the development and advancement of artificial intelligence, there has been a need to incorporate artificial intelligence in teaching and learning. This paper shows a culmination of information from research to establish and emphasize the advantages that AI and Machine Learning will bring to the teaching process in years to come. The aim of this paper is to understand the benefits of this change in the teaching process, in the ease of understanding, and the ease in the acquisition of knowledge of the teachers' students. The findings from this research affirmed this.

Keywords: machine learning, classroom, education, learning, intelligence

1. Introduction

It is impossible to deny the impact rapid advancements in the development of Artificial Intelligence have left on every single field imaginable that is integrated with the use of technology, from the industrial field to the medical field and even the education sector. For example, in the education sector, IBM's Watson is used to enhance information gathering by students in real time. These advancements, even by referring to the aforementioned example, have transformed the educational sector and are continuing to transform it into a more beneficial, interactive and impactful learning and teaching process. The introduction of Artificial Intelligence into the classroom situation is a gradual yet fruitful process that will eventually nurture the student into being a better student overall in learning and the teacher as well in their teaching. This can be shown in the cases of teacher bots (Bayne 2015) or in Ozobots (Žáček and Pavel 2019) where they enhance the skills and abilities of the students as well as feeding them with necessary information in their respective studies.

In order to fully maximize the analysis of the literature review, we propose a definition of AI as outlined in the papers of the various respectable authors. Thus, we can define Artificial Intelligence as computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and use of data for complex processing tasks (Popenici and Kerr 2017). By the definition in itself, we must therefore recognize the potential of the transformation of the education sector, specifically in teaching and learning by Artificial Intelligence. Some of the transformations have already been seen and likewise, their impact has been felt by the students, the main beneficiaries of teaching and learning.

Therefore, this paper serves as evidence, with information cited from many reputable journal articles, of the impacts of the developments in AI in teaching and learning.

Results and discussion

The study of AI and Machine Learning and its integration in the classroom have led to many developments. These technologies now augment the learning interactions of all students globally, enhancing possibilities opened for teaching and the design of educational experiences. (Popenici and Kerr 2017). Developments such as the Ozobot (Žáček and Pavel 2019) have had a positive impact on Education. An Ozobot is a miniature luminous robot of about 3cm in length and is designed to read the guidelines with sensors located at the bottom of the robot (Žáček and Pavel 2019). The robot can be controlled using blocks that the manufacturer named Ozoblocky and allows the student to program the Ozobot using individual commands and entire blocks of these commands. The programming element enables students who use this robot to develop their computational and analytical skills as well as the algorithmic thinking of the student. (Žáček and Pavel 2019)
Can AI ever replace the position of a teacher? Well, (Popenici and Kerr 2017) beg to differ. In the paper, Popenici and Kerr clearly outline that we should admit the current limits of technology and that AI is not(yet) ready to replace teachers but presents the potential to augment them. Although the positions of a teacher and a teaching assistant are not the same, we can still bring up the current achievements of AI as a teaching assistant. In (Popenici and Kerr 2017), Popenici and Kerr define a teacherbot as "any machine-based software or hardware that assumes the role traditionally performed by a teacher assistant in organizing

information and providing fast answers to a wide set of predictable questions; it can be facilitating, monitoring, assessing, and managing student learning within the online learning space." An example of AI as a teaching assistant is seen in the situation at Georgia Tech where professor Ashok Goel used teacherbot, a virtual teaching assistant based on IBM's Watson platform, as a teaching assistant while offering a course on knowledge-based artificial intelligence (KBAI) in the online Master in Computer Sciences program. The TA managed to meet the highest expectations of the students and was so valued by the students that one wanted to award the TA the teaching assistant of the month award. But to their surprise, they found out that Jill Watson, the name used by the teacherbot, was not a real person but only a teacherbot. (Maderer 2016)

Recently, there has been hype concerning ChatGPT. To understand it better, we asked ChatGPT, an open AI, what it is and it gave the following response, "ChatGPT is a language model developed by OpenAI. It's part of the GPT (Generative Pre-trained Transformer) family of models, which are designed to understand and generate human-like text based on the input they receive. GPT models are trained on large datasets containing text from the internet, books, articles, and more." (By ChatGPT generated on August 26, 2023). We then followed up with another question and asked it how it works. It gave the following response," ChatGPT generates human-like text responses given input prompts, useful for tasks like answering questions, holding conversations, and providing explanations. It uses patterns from its training data to produce coherent and contextually relevant text. (By ChatGPT generated on August 26, 2023). Through this interaction with ChatGPT, we see that it is interactional and capable of holding human-like conversations on a wide range of topics. With using this feature of ChatGPT, one can carry out teaching or self-learning by themselves. However, some educators have mixed feelings about the potential of ChatGPT in relation to education. David and Leticia show this in their paper by saying," It has become a contentious topic among educators, while some perceive ChatGPT and related generative AI as the future of teaching and learning as well as educational research, others are sceptical and view it as a threat and a potential end to most educational activities and make teachers and students lazy with no or little analytical abilities." (Baidoo-Anu and Ansah 2023). In their paper, they go on to show the benefits and drawbacks that ChatGPT can have in the field of education. They outline the benefits of personalized tutoring and learning (even in personalised learning platforms which are called adaptive learning systems) (Kabudi 2020), automated essay grading, language translation, interactive learning and adaptive learning. As aforementioned, they also go ahead and show the possible drawbacks of using ChatGPT in education: lack of human interaction, limited understanding (as generative models are based on statistical patterns in the data they are trained on), bias in training data, lack of creativity, dependency on data, lack of contextual understanding, limited ability to personalize instruction and the most important of all, privacy. (Baidoo-Anu and Ansah 2023). Other benefits specifically for teachers have been brought out in other research articles as well. Benefits such as improvement in teaching skills, the introduction of adaptive teaching strategies and the creation of automated and intelligent systems by teachers through AI-powered Chatbots that enable teachers to analyse and assess a student's learning ability. (Adiguzel et al. 2023). However, due to the introduction of ChatGPT, many students have been dependent on the open AI tool in their work. This proves as a disadvantage to students in schools that forbid such technologies. To address this issue, guidelines have been proposed to help educators

mitigate the risk of student dependency on AI such as ChatGPT for academic work. (Grassini 2023). This simply goes to show that even though the encroachment of AI in the education sector is growing at an alarming rate, we need to be ready to impose guidelines and rules to curb such problems that we will surely face later on.

AI has also brought about the development of ITS (Intelligent Tutoring Systems) which can provide instruction by simulating a realistic working environment in which students can learn a task. ITS are defined as "computer-based learning systems which attempt to adapt to the needs of learners" with the "scientific goal to make computationally precise and explicit forms of educational, psychological and social knowledge which are often left implicit". (Schiff 2021) By simulating this working environment, the risk of danger that poses itself to students and the costs that would come with the actual working environment can be mitigated. (Beck et al. 1996). Augmentation of ITS in teaching and learning can be important as these systems can allow a computerized system to present material in a "flexible, learner-centric way that addresses all of the idiosyncratic needs of the students while simultaneously being able to make sound pedagogical decisions on how best to 'teach' the student", as explained in (Leahy et al. 2019). Likewise, ITS has the capability to interact with students at the step-level, rather than simply give feedback after completing the task. (Chassignol et al. 2018)

A persistent problem in the education sector was the inclusivity of all types of students, especially those with disabilities. (Vincent-Lancrin and Van der Vlies 2020) Recent developments actively show the effectiveness of AI in helping those with special needs to benefit from education. There are a number of mainstream AI tools that have been repurposed for learners with disabilities (Holmes and Tuomi 2022). An example of this is the app StorySign, an app made by Huawei that provides the sign translation of selected classics for children who have hearing impairments to also benefit from literacy education. (Huawei 2021). Another example is that visually impaired learners can wear wearables that use AI that can help the learner read a book or recognize faces and therefore can learn and socialize within their community. (Vincent-Lancrin and Van der Vlies 2020)

Conclusions

This paper presents the findings and shows the impacts and developments related to AI that are present in the education sector. It clearly outlines the advantages the integration of AI and the education sector has not only on the teaching process but in the acquisition of information by students methods such as personalized learning. By showing the advantages, it serves as an indicator for education systems to integrate these developments in order to reap the benefits shown in this paper. However, this paper also emphasizes the need to implement guidelines and policies to control the usage of these advanced technologies. Too much of anything is bad. We say this because letting students make use of the full potential of these technologies, can actually be counteractive as it would contribute to laziness in students and even lessen their creativity. Therefore as AI encroaches on the education sector, students need to be encouraged to not be too dependent on AI and rather use it to improve their learning process.

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