The application of artificial intelligence and Big Data analytics in personalized learning

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Abstract. The concept of personalized learning is not something new in the field of education but with the advent of artificial intelligence and Big Data analytics, new ways of implementing it are being discovered. This paper is focused on these new ways of its application through these technologies. First of all, it explains what personalized learning is and how it differs from traditional teaching methods. Then, it focuses on the artificial intelligence component of personalized learning, and how it can be utilized to make this type of education more effective. Furthermore, the paper discusses the role of Big Data in personalized learning, and how this data should be dealt with appropriately. Finally, the paper discusses some of the arguments against these trends in education.

1. Introduction
Discussions on how education should be handled have always taken place, and this is no surprise as this is one of the most important aspects of our lives. New ideas and methodologies are constantly being suggested. Like most of the areas of human activity, education has undergone many changes since the advent of information technologies. It will inevitably continue to transform as new information technologies keep emerging despite the fact that they may meet some opposition in the process. Many educators today are questioning traditional teaching techniques. They believe that the classical “one-size-fits-all” way of teaching must become a thing of the past because it is ineffective in many ways. For instance, according to them, the current education system does not take into account the fact that students have different abilities and uses the same approach for all students no matter what their level of education is. This type of approach to education is considered to be a major issue that needs to be addressed, and this is where the concept of personalized learning comes in [1].

Personalized learning (also known as competency-based learning) is an educational approach in which teaching is customized according to the needs and abilities of an individual student. This approach is considered to be an alternative to traditional education in which students receive similar assignments, instructions, and assessments. This type of education is said to be the most effective through the use of artificial intelligence and big data analytics. The proponents of this approach believe that it will result in better motivation and the number of students dropping out will decrease significantly [2].

2. The role of AI in personalized learning
Many people assume that AI is going to be another aspect of education that is just going to make the learning process easier and less expensive. However, in order to understand the true potential of AI in
education, it is necessary to look at personalized learning from a different angle. For instance, it is of paramount importance to understand that each student is different. The personalization of the curriculum for it to be suitable for an individual student based on their skill level is not achievable without the use of AI. The purpose of personalized learning is to turn students into more independent learners providing them with insight on how they are getting on with their studies [3].

The possibilities of AI will transform personalized learning because it will be the one ensuring that the learning activities of an individual student are effective. This will be possible owing to various types of machine learning that will be able to make certain predictions giving opportunities to provide content depending on the past progress of the student and personal goals [4].

3. Benefits of AI in personalized learning

Combining learning with AI makes the content more available and effective, particularly, when we talk about readily accessible learning possibilities through the use of tablets and smartphones. Some of the main benefits of this approach will be described below [5].

- Due to the ability of machine learning to predict, students are provided with content based on their past progress. For instance, online students who have a certain gap in knowledge receive recommendations on what content they should learn in order to fill that knowledge gap. This could further be developed to include situations in which the AI system would decide that a particular student may be able to skip some parts of the curriculum due to their advanced knowledge [6].

- Students are provided with the specific resources they need in order to fill their knowledge gaps which means less time needs to be spent in the classroom cutting costs on training hours. In addition, employees do not have to do the time-consuming tasks of reports and metrics analysis and are able to completely focus on creating high-quality learning materials. By means of AI, Big Data are taken care of which means that employees can invest their time in more valuable activities [7].

Figure 1 shows personalized learning in action with its various components and actors.
4. Big Data analytics for personalized learning

For AI to be the most efficient, it needs to receive and process data on a regular basis. Just like a human learner, AI needs data to become more intelligent. Thus, the more time AI spends on the learning platform consuming data, the greater the benefits will be [8].

A lot of variables need to be applied to AI so that it is better prepared to assist in personalized learning and completing tasks through the use of a wide range of data. There are some AI systems that are able to make tasks on their own once they know the objectives for the data they have processed [9].

Many techniques that are used for processing student data are limited because they are not focused on an individual student and follow that same one-size-fits-all pattern in order to predict student performance and engagement and detect students who might have issues with the content of the curriculum. In order to overcome this limitation, it is necessary to have access to far larger amounts of data which will result in improving the predictive capabilities of AI. Large datasets are obtained from courses within an institution and from other institutions [10].

The auto-tagging capabilities of AI largely depend on regular data consumption for them to be more effective and useful to learners over time. The purpose of auto-tagging is to make sense of different keywords within the content in order to create a set of tags that will help in searching and categorizing without having to accomplish this manually. The AI system updates these tags if the content is updated [11].

5. Summarizing personalized learning

Based on the findings in this paper, we can conclude that personalized learning is all about giving more control to students over their learning activities. It provides students with great opportunities to manage the process of their learning [12].

- Students can influence the way their learning is going with the help of AI and do not have to depend on some pre-determined pathways [12].
- AI collects and processes data to find any gaps in a student’s knowledge and based on this information it constructs a learning path that constantly changes to suit the student’s needs [12].
- The learning platform is not enhanced by AI but it becomes responsive to the needs of a student [12].

6. Opposing views

It is important to point out that there are also educators who do not have much faith in personalized learning. Some of them even claim that this system cannot be called personalized learning. According to them, it is just a piece of software that is used for assessment and delivering content. This software referred to as AI just decides which assignments the student is supposed to get. Human intervention is available when needed but most of the learning is managed by the AI system. The opponents also do not buy into the argument that the role of a human teacher can be reduced because this system is not as deep and flexible for personalization as many claim it to be. The reason behind this phenomenon being discussed so much these days is that the idea of students learning in front of their computers in different locations is popular during this period of social distancing [13].

All in all, they do not believe that these technologies are able to accomplish much in terms of the personalization of education. They claim there are far better ways to personalize education without involving these technologies and reducing the role of the teacher. For example, they suggest breaking the school day into two parts. One part of the day is dedicated to teaching, the other part is for interacting with individual students. In addition, the number of students in the classroom must exceed fifteen as this will be a good opportunity for teachers to know their students better. Each student would have a chance to personally contact the teacher who would have more time to interact with that student on a one-on-one basis. This way, teachers would have sufficient time to understand the strong and weak points of their students [14].
Thus, this is one of the ways, they believe, would personalize education without having to resort to these technologies that have not yet been proven effective, and having to get rid of the central role of a human teacher in education.

7. Conclusion
There are a lot of technologies these days that are going to revolutionize education according to many claims, and it is becoming increasingly difficult to decide what works and what does not. The fact that some technology works in one area does not necessarily mean it is going to be effective in other areas. However, AI and Big Data analytics might prove to be effective if implemented correctly but it is important to point out than handing most of the responsibilities of the human over to AI is probably not the solution to most of the problems of education that many think it is. Up to this point, there have not been any major studies proving or disproving the effectiveness of these technologies. AI has been proven to be better than humans in some areas but it remains to be seen if that applies to other areas as well including education. Ideally, there should probably be a balance between the use of these technologies and activities that should only be performed by humans.

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