A Review to Artificial Intelligence in Education

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

The digital age has provided us with an unmatched ability to store information about single individuals, safeguarding our individual histories for generations to come. This data allows us to understand the patterns of humans' and societies' behavior, even over time. The practice of uncovering the connections between information is called datafication, and has widespread effects on the education sector. Such connections might bring up ethical issues, which call for a corresponding solution, but it also has many opportunities to personalize and govern education. (Mayer-Schönberger & Cukier, 2014)**.** The goal of this study is to show multiple ways to be educated within the context of Sustainable Development Goals (STG), which aims to improve education and lifelong learning worldwide. It aimed to help you understand the dynamics that arise when AI is introduced into educational spaces so that educational policymakers can adequately respond to challenges they may face in the future.

Complexity in allocating Artificial Intelligence (AI) recources in the developing world is comparatively underexplored. Most notably, there is immense underinvestment in technology in low-income countries. In this paper I will examine Artificial Intelligence technologies currently being used in educational systems worldwide, and how they've helped or can help students achieve learning goals. Artificial Intelligence has been around for years, but it is only recently that it has spread into the world of education, and more specifically, in the form of AI tutors (Francesc, Miguel, Axel, & Paula, 2019)**.**

For many years, all that was needed to become a tutor was some knowledge of the subject and teaching ability. This is no longer enough as technology advances at a rapid pace. Tutoring now requires computer science skills to use artificial intelligence tools to aid students' education (Sharma & Harkishan , 2020).

Artificial Intelligence and Big Data as two of the main buzzwords of the contemporary age. We should be aware that these terms are sometimes used interchangeably in news stories and articles, so words should be used carefully when writing about AI. Computer scientist John McCarthy first coined the term Artificial Intelligence (AI) in 1956 at a conference that later became known as the Dartmouth Conference (Elaine, 2011). Although AI has been in existence for quite some time, it is only very recently that this technology has found its way into the world of education. This recent introduction of AI in the education sector is growing at a much faster rate than most expected. The research and development of AI tools have exploded in recent years and moved from a mere concept to an innovation, starting to enter our everyday lives (West & Allen, 2018).

The table below clarifies how these two concepts are distinct and work with each other. Various descriptions of AI are attested to several sources, including (2006) by McCarthy and (2006) by Zhong. In this paper, we put AI in different contexts to be understood widely.

Humanly Thinking	Rationally Thinking
The new direction of computer engineering aiming to make computers think (Haugeland, 1989). Machines with minds with full functionalities and literal sense (Bellman, 1978).	The models of mental faculties are employed to study mental functions (Charniak, 1985). Analysis of the computations that enable it to be understood, reasoned, and acted upon are studied (Winston , 1992).
Acting Humanly	**Acting Rationally**
The effects of building technology devices that allow human function to be performed by machines (Kurzweil, 1990). How to make computers function much like humans, at which people excel, are currently studied (Elaine & Knight, 1991).	Computational intelligence is the study of the development of intelligent agents (David , Mackworth, & Goebel, 1998). AI is concerned with how intelligent features in artifacts act (Nils, 1998).

In addition, students are becoming more informed about AI, thus leading to more questions and concerns about the future impact of AI on education. AI has been applied in almost every field imaginable, including medicine, economics, finance, law enforcement, business, and robotics. Moreover, the current lack of skilled resources in certain areas of education has led to the introduction of AI technology to find new solutions to provide better teaching methods (Ilkka, 2018). The potential of AI, which has been explored to date, provides a serious need for its integration into education (Marr).

Russell and Peter Norvig have published this guide in their book called: Artificial Intelligence; A Modern Approach (Russel & Norvig, 2010).

Research in artificial intelligence has focused primarily on intelligence: learning, reasoning, problem-solving, perception, and using language. Data-driven AI has greatly contributed to AI's most current success, thanks to advancements specifically made since 1959 by Arthur Samuel. Machine learning is a direct approach for achieving artificial intelligence (AI). It's important to observe that you can get AI without machine learning, but it would take a great deal of time, work, and code to get that.

Section I

Using AI To Improve Learning and Equity

While Artificial Intelligence has been a part of education since its outset, education worldwide encounters various challenges when embracing new technologies in their traditional setups. Vision fields like artificial intelligence could transform education through digitally customized learning systems. Today, as technological developments explore the potential on a broad scale, the field of education is attracting innovative thinkers and sparking many new questions.

This section highlights how AI can be used to improve learning and equity. I address two key areas: personalization through AI (pedagogical scale), and management information systems (systemic scale). Structuring and maximizing the use of data is not a straightforward process. Data analysis techniques are used to leverage big data technologies like statistical analysis and machine learning algorithms. Subject matter experts also employ visual tools to communicate data analysis results with those who must use the results. These software programs for data analytics will help reveal learning and training patterns, predict future circumstances, or recommend optimal solutions based on our available resources.

Solving complex problems is an essential part of developing AI solutions. Powerful libraries help us, including natural language processing, translation, and game theory. We can, for example, develop avatars that simulate the behavior of a learning teacher or a learning assistant in the form of an avatar. Seeing the bright possibilities of the future, we can imagine a civilization full of AI solutions that might help us overcome different challenges in learning and analytics.

Promoting Personalization and Better Learning Outcome with AI

A few important research studies have helped develop ways artificial intelligence may enhance students learning and interact with management systems in recent years. Sustainable Development Goal 4 (SDG 4), which aims at ensuring equitable quality education and wants to guarantee equal educational opportunities throughout life, employs AI system to guarantee equal opportunity to acquire knowledge. This AI provides a platform for marginalized individuals and communities, individuals with disabilities, refugees, those who are homeless, and those who live in isolation with the opportunity to learn pertinent courses. So, in this way, it enables inclusiveness and universal access. AI can enhance the development of collaborative learning, which has become one of the most popular facets of computer-supported learning. The noteworthy characteristic of computer-supported collaborative learning is that it is available anyplace and at any time, even in forensic sciences, where scholars are not in the same place.

AI techniques like machine learning and shallow text processing to monitor online asynchronous discussions play a large role in computer-supported collaborative learning. AI systems classified and analyzed the qualities of discussions in these groups, thus yielding feedback for teachers about how to engage learner interest and enabling the learners to extend their learning through engagement.

The Computer Assisted Learning (CAL) field implements applications for helping students' learning strategies through AI and digital technology (Janda, Mattheos, Lyon, & Attström, 2001). AI can track individual students' learning strategies and tendencies, areas for improvement that have an increased learning load and cost to address, and learning preferences.

Intelligent Tutoring Systems use algorithms to offer students more selective assistance while evaluating different content paths. Intelligent Tutoring Systems displays all the newest technological developments in educational learning for developing economies (Nye, 2015).

Concerning analyzing the number of times teachers invest in grading papers, artificial intelligence is currently being used to grade multiple-choice tests, essays, and other types of assignments. AI not only assesses tests but is also used to evaluate individual assignments. Now that these opportunities are beginning to emerge in developed countries, various businesses are testing new applications for countless applications.

Learning Equality is an organization and an initiative originating with the Kahn Academy that utilizes an open-source platform to provide education worldwide. Learn Equality developed the Kolibri educational platform and toolkit to provide lower-resource communities with e-learning tools.

With challenges for palatable philanthropic purposes, other nonprofit programs are designed to incite innovation. The $15 million Global Learning XPRIZE challenges motivate developers worldwide to create open-source programs that empower children in developing countries to become educated (XPrize).

Carnegie Mellon University specialists created the machine learning program with robot tutors using voice recognition and partly data-driven algorithms (XPrize).

And finally, these new "first-generation AI initiatives in educational institutions in developing countries" result from private enterprise, while those who come hand-in-hand with societal authorities provide a good perspective.

How Predictive Data Analysis Is Helpful to Education Department Management Information Systems (EMIS) And the Evolution to Learning Management Systems (LMS).

An Education Management Information System goes by various names, including EMIS. The system's objective is to store, process, analyze, and disseminate the information needed for educational planning and management. An EMIS is primarily used by education directors, policymakers, and managers at various levels and for the generation of national statistics. Big Data-Driven Decision Making (DDDM) which involves making decisions that are backed up by hard data rather than making decisions that are intuitive or based on observation alone, is a central component of many schools and district reforms due to federal and state accountability policies. And with huge data from the EMIS system, AI platforms can make empirical evaluations to enhance the educational experience.

An excellently designed and well-functioning EMIS allows teachers throughout all educational levels to locate useful info about managing and administrating an education system, developing customized and cost-effective ways and policies, monitoring and evaluating educational results, and more (Wako, 2003). In places where data is comprehensive, up-to-date, regularly aggregated, and disaggregated, AI-enhanced EMIS would more accurately analyze the data and then generate data dashboards either at the school or national levels.

EMIS's potential for creating predictive algorithms will increase as development continues. Up to now, this area of EMIS development is relatively new, yet many countries around the world, both developed and developing, are restructuring of EMIS from a school-based aggregated administrative data management system into an integrative and dynamic learning management system that can effectively support real-time decision-making in every area of education sector management.

In the United Arab Emirates, for example the Ministry for Education has implemented a platform that provides analytics for the nation's educational institutes totaling more than 1.2 million students (UIS, 2018).

This data analytics system collects various quantitative data on the curriculum, teachers' professional development, learning resources, financing, logistics, operations, performance reports, teachers, students, and parents, along with scores from internationally recognized assessments such as PISA and TIMSS (Leading Countries of the World). The Ministry of Education in the United Arab Emirates has a data analytics section focused on developing machine learning algorithms to develop strategic studies on the country's education system (Morgan, 2020).

Other countries like Kenya are also working to utilize AI for Source of Funds Enhancement purposes. For instance, iMlango is an educational technology learning tool provided by a partnership of private and public sector organizations. They also use the sQuid attendance management system to monitor daily student attendance, which facilitates quick and easy tracking, real-time data reporting, and high reliability and insight into complex student data patterns. Class and school attendances are tracked and reported with the help of analytics, which educators and a field team then use. sQuid helped develop an interactive learning platform for teachers and students, enabling access to interactive curricular content in multiple formats.

In education, UNICEF seeks innovations focused on improving learning outcomes for the most marginalized children. As part of this effort, UNICEF recently launched the Innovations in Education initiative to scan, test, and share knowledge about promising education interventions that are being designed or are underway worldwide. The university mapping part of UNICEF Innovation is researching the potential of deep learning (DL) algorithms in cooperation with academic institutions and private companies. Their studies indicate that DL algorithms are valuable enough to recognize schools by satellite imaging, consequently making unmapped schools noticeable (Bourne, 2014).

Data for Development; The Inter-American Development Bank-financed a study called "Big Data for public policy in education: The Chilean case (OECD, 2016)." These data are utilized to investigate Chilean education policy and government policy on substance abuse at the University of Chile. The researchers used an algorithm to create an accurate map of schools, local access, student test scores, and dropout predictions by mapping out the geographical distances between those factors. Using 127 different characteristics of student residences and where they went to school, the researchers could design an algorithm to create a "geography of educational opportunities."

Section II

Challenges and Policy Implication of AI in Education

This section presents the main challenges facing the implementation of AI in education, including the fulfillment of the Sustainable Development Goal 4 (SDG4), namely, rising new opportunities for AI to improve learning and the anticipated attitude of students and future employees of implementing AI in general.

Ensuring Inclusion and Equity in AI In Education

Artificial intelligence (AI) has limitless potentialities, many outlined in this paper, but it can also be a challenge to use, especially with closed or insufficient AI devices distributed to disadvantaged populations. In the same way, there's a further divide between the conventional use of informative data and the new use of Big Data that allows informed decisions to be launched (Hilbert, 2015).

Equity and inclusion should be organizational values when designing policies for AI in education. Policy-makers should also consult inclusion and equity questions when developing their policies, such as:

What are infrastructure conditions urgent in developing countries to make AI in education possible? What have we learned from previous experiences to build sustainable and equitable conditions to digital rights in terms of Internet access? How can AI serve the education provided to disadvantaged groups and populations? How can we engage communities themselves in building the AI-supported education they need or want? How can faster access to digital technologies in poor nations help close the gap between rich and poor students of the world's educational landscape? What are the best practices for AI use in females to shrink gender gaps?

Researchers have identified significant barriers to adopting AI-based education supplies in various areas of the world. They include infrastructure constraints, energy management, global Internet connectivity, data analysis, economic conditions, students' basic ICT skills, language, and culturally appropriate content (Nye, 2015). Extensively reviewing big data implementation in rural areas reveals that lack of basic infrastructure creates a digital divide regarding access to data-driven knowledge for informed decision-making (Hilbert, 2015).

To solve these problems, various strategies have to be implemented. First, it is essential to define the internet as a human right and create multiple international alliances to create infrastructure in the poorest sectors of the developing world (Mutoni, 2017). The work carried out by the United Nations Broadband Commission is an example of one such policy.

Preparing teachers for AI-powered education and preparing AI to understand education

AI applications for teaching and learning or system management have yet to see widespread adoption in the education sector, even though the educational technology industry produces new technologies. Their central issue with the lack of uptake is due to new products ignoring the current challenges teachers face. They fail to thoroughly assess newly established methods of organizing teaching that depart from mainstream methods without even conducting substantial studies validating those claims (Luckin, Holmes, Griffiths, & Forcier, 2016).

For the record, some countries have already taken action that supports the efforts of the EdTech industry to expand innovative research and development (teachers and education institutions) while intensifying their efforts to qualify and address their demands (education professionals). Furthermore, they explore ways in

which AI can contribute to richer, more evidence-based policies and programs. Considering the growing number of AI applications utilized in the academic sector, expert teachers are a vital portion of incorporating effective educational metrics. If teachers are equipped to operate effectively with such technologies, they will need to strengthen their competencies, including understanding new technologies (Luckin, Holmes, Griffiths, & Forcier, 2016).

Developing Quality and Inclusive Data Systems

Data provides the basis for the diverse functions of intelligent algorithms. No matter how developed, Artificial Intelligence can't do well without the required data. Because of this, a data-rich environment is a necessary condition for AI-enabled computing systems. However, data availability is just the first condition.

Any artificial intelligence application is only as good as its source (data). After all, wrong data will lead to wrong predictions from machine learning algorithms utilized by those AI systems. Indeed, predictive algorithms can yield correct and complete predictions only when the data they are dealing with is accurate and complete.

The educational data can be a challenge to gather efficiently, some countries have as yet not solved this problem. The UNESCO Institute for Statistics (UIS) indicates that many obstacles stand in the way of collecting and using the information on educational data (UIS, 2018). Educational data should be open and usable at the school level.

An EMIS should generate analyses that are fine-grained enough to help administrators and educators understand the problems that are central to learning and teaching in the classroom. The system also must have the capability to group and analyze statistics to evaluate trends that can inform policy formation. It should be noted, however, that technologies like those used for collecting data are getting better and better, but their costs may be prohibitively expensive for the world's poorest and developing countries.

Therefore, it's vital to evaluate the quality of such education data and analyze its cost against the potential benefits. While many governments can come up with huge quantities of education data, many nations are currently unable to do so. Various efforts to solve this problem have failed, even those centered on acquiring more sophisticated data reporting capabilities rather than in the dysfunctional processes that led to the availability, incompleteness, and inefficiency of raw data (Hilbert, 2015).

This difficulty means that strong institutional and organizational structures are a critical precondition for the success of any data-dependent technology, including AI technology. Therefore, institutional capability development is among the most critical investments, especially for countries that do not possess sufficiently strong pre-existing data infrastructure.

Conclusion

Countries are becoming increasingly reliant upon big data for teaching purposes. Because of the mass quantities of educational data available, they are devising new techniques to produce more personalized learning experiences that meet students' unique academic needs.

Due to the ethical implications of collecting and using data from students, policy frameworks regarding the use of artificial intelligence in educational environments must address those ethical concenrns. The entire educational community must clearly define how student data are being used and be explicitly based on the consent of the parents to students' data being collected.

Education institutions are actively updating their curriculums to confirm that learners are getting the skills required for a rapidly evolving future workplace, with changes occurring across the board in every instructional division, from childhood to continuing education. Contemporary AI technologies are having a substantial impact on education systems.

Consequently, the need to transform educational programming to make use of prediction algorithms of artificial intelligence ought to be a continual and essential procedure. Indeed, there are many examples of the positive and negative effects of AI in different areas of human education and activity, as indicated by the examples provided in this article.

All said, we are in the beginning of an organized and holistic approach for AI in education. This can lead to creating a well-organized policy plan for AI in education. Hence, it is paramount that the AI industry collaborates with other sectors when beginning the development of a framework.

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