ARTÍCULO DE REFLEXIÓN

Integración de la inteligencia artificial en la educación: desafíos y perspectivas

Integration of Artificial Intelligence in Education: Challenges and Prospects

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Resumen

El documento aborda los desafíos y las perspectivas de integrar la inteligencia artificial (IA) en la educación. El análisis se basa en los hallazgos de las dos fases del Proyecto de Investigación de la Red de Investigación Educativa 2004-2008 (Educational Research Network for West and Central Africa) sobre la integración de las TIC en educación. Este proyecto fue llevado a cabo por equipos de investigación de África Occidental y Central con colaboración científica de la Universidad de Montreal. Los resultados de la investigación de este estudio transnacional podrían servir como base para integrar la IA en la educación.

Palabras clave: integración, inteligencia artificial, educación, desafíos, perspectivas

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Abstract

The paper addresses the challenges and prospects of integrating artificial intelligence (AI) in education. The analysis is based on the findings from the two phases of the 2004-2008 ERNWACA (Educational Research Network for West and Central Africa) research project on ICT integration in education. This project was carried out by research teams from West and Central Africa with scientific collaboration from the University of Montreal. The research findings from this transnational study could serve as a foundation for integrating AI in education.

Keywords: integration, artificial intelligence, education, challenges, prospects

Introduction

Officially, the birth of artificial intelligence (AI)[2] dates to the 1950s. For a long time, AI remained in the realm of science fiction. It was primarily the entertainment industry that opened the door to the possibilities AI offers to revolutionize the world and our way of life. However, it must be said that since the beginning of mankind, legends, myths, and heroic epics have been told about supernatural forces and men and women with superpowers.

Today, AI is poised to become a major technological revolution that has already begun to permeate the most important fields of activity, such as industry, trade, transport, infrastructure, health, agriculture, entertainment, and more.

Therefore, there is a need to integrate AI into the educational system to connect school to life and the job market.

[2] University of Washington (2006). The history of Artificial Intelligence. https://courses.cs.washington.edu/courses/csep590/06au/projects/history-ai.pdf

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The following quote underlines the importance of AI in relation to the global economy:

> The last few years have seen several innovations and advancements that have previously been solely in the realm of science fiction slowly transform into reality. Experts regard artificial intelligence as a factor of production, which has the potential to introduce new sources of growth and change the way work is done across industries. This PWC article[3] predicts that AI could potentially contribute $15.7 trillion to the global economy by 2035. China and the United States are primed to benefit the most from the coming AI boom, accounting for nearly 70% of the global impact.

1. What is Artificial Intelligence?

. Among many other definitions, the following quote provides an easy understanding of the term "artificial intelligence":

. "Artificial intelligence is the science of making machines that can think like humans. It can do things that are considered 'smart.' AI technology can process large amounts of data in ways unlike humans. The goal for AI is to be able to do things such as recognize patterns, make decisions, and judge like humans.

. Machines today can learn from experience, adapt to new inputs, and even perform human-like tasks with help from artificial intelligence (AI). Examples of artificial intelligence today, from chess-playing computers to self-driving cars, are heavily based on deep learning and natural language processing.

. Strong AI, also known as general AI, refers to AI systems that possess human-level intelligence or even surpass human intelligence across a wide range of tasks. Strong AI would be capable of understanding, reasoning, learning, and applying knowledge to solve complex problems in a manner like human cognition. However, the development of strong AI is still largely theoretical and has not been achieved to date"[4].

[3] PWC article: https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf
[4] What is artificial intelligence in simple words? https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-artificial-intelligence

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2. ICT integration in Education in West and Central Africa

To address the potential issues of integrating artificial intelligence (AI) in education, this paper will base its analysis on the transnational research on the integration of information and communication technology in education (ICTE) conducted by the Educational Research Network for West and Central Africa (ERNWACA). The background for this project was the lack of research on the impact of ICTE in Africa, unlike in industrialized countries.

Nowadays, the integration of ICTE has become an unavoidable phenomenon in the education sector, promoting access to information and knowledge, building capacity, improving school management, and stimulating collaboration between schools, families, and society. In the African context, new technologies constitute powerful cognitive tools offering alternative solutions to the many problems and challenges of education in Africa. However, such educational innovation is generally accompanied by a series of constraints that research can help identify. Because African education systems evolve in situations characterized by constraints mainly linked to the absence of an incentive policy for the use of ICT, a deficient technological environment, and relatively high costs, the use of ICT in schools must overcome many obstacles.

At its April 2002 meeting, the Bureau of African Ministers of the Association for the Development of Education in Africa (ADEA) placed the use of ICT for educational purposes at the top of its priorities. The widening digital divide between Africa and other regions of the globe represented a significant concern for the ADEA, which stressed that African countries should participate in the global ICT revolution due to its capacity to foster rapid evolutions of professional patterns in the new global market.

The ADEA placed particular emphasis on the potential of ICT (computers and the Internet) to meet the many challenges facing education in Africa and pointed out that paradoxically, only a few research works were undertaken in this area. The World Bank also indicated in 2002 that there is a significant lack of research on ICT in Africa, both in terms of the efficiency of

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ICT in schools and the possible impact on improving the quality of education. In Sub-Saharan Africa, the lack of teaching materials and the shortage of teachers constitute major obstacles to the quality of education.

Five major challenges to the integration of ICT in education were identified by the ADEA:

. Defining and setting measurable objectives for the ICT sector and applications in education.
. Establishing an adequate institutional structure to design and manage a country-wide project or policy aimed at developing education using ICT.
. Acquiring and maintaining the necessary technical and pedagogical expertise in ICT for education.
. Introducing partnership mechanisms for cost sharing between the state, donors, and civil society actors to ensure that all stakeholders actively contribute to and participate in policy development, implementation, and review.
. Addressing the challenges posed by constantly changing technological and socio-economic environments.

Subsequently, a sub-regional ministerial meeting on the theme: “Integration of Information and Communication Technologies (ICT) in Education in West Africa: Issues and challenges” was held in Abuja, Nigeria, from July 26 to 30, 2004.

2.1 ERNWACA Transnational Research on ICTE

In the framework of these reflections and statements from the ADEA and the World Bank, ERNWACA and the University of Montreal (Canada) jointly launched a large-scale transnational study called “Integration of Information and Communication Technologies (ICT) in Education in West and Central Africa: study of pioneer schools” after the 2003 inception phase. This project, financially supported by the International Development Research Centre (IDRC), aimed to explore the integration of ICT in schools across West and Central Africa.

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The selected countries for the project were Benin, Cameroon, Ghana, Mali, and Senegal. The general objective of the research was to "better understand, in the context of African countries, the conditions that are likely to promote the successful integration of ICT in schools to contribute significantly to the quality and development of education".

The specific objectives were to:

. Determine the conditions of access to ICT and the processes that promote their successful integration at school.
. Identify educational approaches adapted to the use of ICT in the African context.
. Evaluate the impact of ICT integration.
. Identify important factors contributing to the sustainability of ICT integration in schools.

This research was the first of its kind in Sub-Saharan Africa, extending over five years (2003-2008) and carried out in two phases (2004-2005 and 2006-2008) by 30 ERNWACA researchers formed into national teams. It aimed at political decision-makers, administrative authorities, and school partners.

Quantitative data were collected from approximately 66,000 students and 3,000 teachers from 36 selected primary and secondary schools (Benin: 4 schools, Cameroon: 8 schools, Ghana: 8 schools, Mali: 8 schools, Senegal: 8 schools). The results indicated that the total number of computers in the 36 schools was 1,200, with 50% connected to the Internet. At the student level, 47% had one or more email addresses, and 51.8% often used the Internet at school. Furthermore, 54% of students thought that computers and the Internet made it easier to complete schoolwork, and 77% said it was important to use ICT at school. All trainers and students using ICT affirmed that they would no longer be able to work effectively without these new technologies.

The second phase, from 2006 to 2008, focused on research-action-training involving four African countries (Cameroon, Ghana, Mali, Senegal). This project evolved into the Pan-

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African Research Agenda on the Pedagogical Integration of ICT (PanAf), which recorded two phases from 2008 to 2012 and included twelve African countries (Cameroon, Central African Republic, Congo, Ivory Coast, Ghana, Kenya, Mali, Mozambique, Senegal, South Africa, The Gambia, and Uganda). The objectives were to improve the quality of teaching and learning through:

. The collection of new data from educational institutions.
. Knowledge sharing.
. Training opportunities for the involved stakeholders.

The first phase (2004-2005) of ERNWACA transnational research identified the major challenges to ICTE in the five countries:

. Absence or weakness of a sectoral ICT policy.
. Insufficient public funding.
. Inequities between schools in urban and rural areas.
. Inequalities in access to ICT (boys/girls; teachers).
. Lack of ICT training for teachers.
. High costs of electricity, maintenance, and renewal of equipment.
. School selection was based on four fundamental criteria defining an ICT pioneer school.
. Students and teachers have access to computers.
. Didactic or educational use of ICT is made.
. There is leadership in the integration of ICT at school (director, policy, teaching team).
. ICTs are tools of communication, information research, production, and management.

Additional criteria ensured objectivity, diversity, and transparency in the selection of schools: the status of the school (public/private), the geographical area (urban/rural), the size (small/large), and if possible, a school consisting only of girls.

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By examining the ERNWACA study on ICTE, we can gain insights into the potential challenges and strategies for integrating AI in education, ensuring it contributes positively to the quality and development of education in similar contexts.

The conditions of a Successful Integration of ICTE

The ERNWACA study highlighted the fact that three essential factors must be taken into account in order to successfully integrate information and communication technologies in education, notably:

. The commitment of the various school stakeholders.
. The access to and the use of ICT at school.
. The partnership focused on the development and sustainability of ICT at school.

2.2 The commitment of the various school stakeholders

Generally, ICTs have been integrated in the selected pioneer schools from an individual awareness of the different promoters and/or heads of schools on the importance of ICTs to improve the quality of education.

The study has shown that it is not necessarily the schools where there are the greatest number of computers that are the most efficient, but those where the commitment to ICT is the highest on the part of the different school stakeholders. Thus, one of the major conditions for the successful integration of ICTE is the commitment of the various school stakeholders (school managers, teachers, students, parents) in favor of the integration of ICTs. However, this commitment can only be realized if there are clearly defined policies (national and sectoral) relating to ICT, with a view to promoting the development and sustainability of new technologies. In Cameroon for example, the integration and generalization of ICTE was the subject of a strong message from the President of the Republic in his address of February 10, 2001 to the Cameroonian youth. The impact of the presidential message gave the signal for

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the acceleration of the process of introducing ICTE in secondary schools and teacher training institutions. In 2003, official programs were given to Cameroonian secondary schools while teacher training schools began to offer computer training sessions.

2.3 Access and Use of ICT at School

It is important to guarantee an equal and fair access to ICT tools to all female and male students, as well as to the entire teaching staff (teachers in all disciplines). It is also necessary to ensure the mastery of ICT by all those involved in education, particularly by students and teachers (the initial and continuing training of teachers in ICT is an essential factor), as well as the provision of computer and multimedia resources required by the school. Furthermore, the effective and targeted integration of new technologies into educational systems, the design, development and dissemination of educational products are all essential measures to take to successfully integrate ICTs at school. In this regard, it is essential to give establishments the possibility of facilitating access to computer equipment as well as to the Internet connection thanks to affordable costs or preferential connection rates, as is the case in Senegal with the establishment of the special line (LS) guaranteeing a reduction of up to 75% in connection rates for educational institutions.

2.4 Partnership focused on the Development and sustainability of ICT at School

The partnership focused on the development and sustainability of ICT at school should help in the process of integrating ICTE, by helping States in the acquisition, management and maintenance of computer equipment and contributing to the training of teachers in the field of ICT.

A school in which ICT is sustainably and successfully integrated is an educational institution with a committed school administration convinced of the positive contribution of new technologies to improve the quality of teaching and learning. In this regard, the school administration must put in place an adequate logistical and educational system capable of

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ensuring quality training for its students who are themselves capable of producing educational content reflecting the value of their knowledge.

3. Role of Research-Action-Training in the Successful Integration of ICTE

ERNWACA action-research-training was designed and implemented with the main objective to contribute to the development and strengthening of policies and strategies for the integration of ICTE in West and Central Africa through the improvement of teacher training and their teaching practices.

The objectives were the following:

. To identify and evaluate current teaching practices integrating ICT.
. To develop, test and validate educational strategies and tools allowing more effective integration of ICT into teachers' practices.
. To propose reforms to teacher training programs considering the integration of ICT into their teaching practices.
. To produce and distribute a guide on effective teaching practices integrating ICT into their teaching practices.

4. xThe Integration of Artificial Intelligence (AI) in Education: Challenges and Prospects

How can artificial intelligence be successfully integrated in Education?

Based on ERNWACA research work, it can be stated that the following eight (8) conditions can be considered:

. The decision to integrate AI must be taken at the highest political level (Presidency of the Republic) and involve all ministries, as well as the National Assembly, International Education partner organizations, etc.) based on internationally recognized research on the

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subject to address the issues about the educational innovation.

. All stakeholders in the education system (school and university administrators, teachers, pupils and students, parents, private sector) must be informed and involved in decision-making. This will allow to get a wide consensus regarding the initiative.

. Substantial budgets must be allocated to research into the issues, advantages and potential disadvantages of AI in the education system.

. Pioneer schools in the field of AI integration must be identified or created in order to make them objects of study.

. Legislation must be taken to legislate on the integration of AI in education.

. Provide the Ministry in charge of scientific research with a budget for research on the integration of AI in Education.

. Initial and continuing training on the integration of AI in Education should be provided.

. Laws must be passed and decisions made to ensure equity between different geographic areas, establishments and learners in terms of AI training.

However, it should be noted that the big difference between the integration of ICT and that of AI in the education system is that for ICTs the attention is more focused on their use with the aim of improving the quality of teaching and training. Only a minimal part of the activities was dedicated to capacity building in creativity.

On the other hand, artificial intelligence is mainly based on the capacity for innovation and creation of learners, which involves the design and implementation of much more complex methodologies.

Regarding the integration of artificial intelligence in Education, ethics and professional conduct must be considered. Many researchers have already warned of the potential abuses of artificial intelligence and the dangers that this could cause for humanity.

The audience for this educational project is young and has a very fertile mind fueled by the Internet, social networks, video games and science fiction films. Thus, it is extremely

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important to take all appropriate measures to ensure the mental health of the target groups concerned. While the integration of ICT in education has concerned young children from kindergarten, it is necessary to conduct studies to determine the age from which this integration should be made for students.

Artificial intelligence is an essential step since it is part of the evolution of the world and there is the need to link school to life. As we have seen, the primary purpose of artificial intelligence is to design and manufacture machines capable of thinking like humans and doing things considered intelligent.

In our so-called “developing countries”, artificial intelligence can contribute to progress in vital areas such as industry, commerce, transport, health, agriculture, infrastructure, education, and significantly reduce the burden of hard human work and promote decent work.

The integration of artificial intelligence in education can enable the emergence of geniuses capable of carrying out these innovations. Prudence dictates however, that ethics and deontology are also taught and observed, so that artificial intelligence can be developed in school and university spaces as an instrument for promoting inclusive development and peace.

Furthermore, the questions that many people are asking are the following: how far will artificial intelligence go? Will the machine end up dominating man? Will the advent of artificial intelligence lead to a decline in human intelligence, now subject to the dictates of the machine? Should we expect a “Frankenstein effect” where the monster takes control over its creator? Is it possible that one day a robot could be created with an intelligence allowing him of thinking for itself and making decisions autonomously? Where will this lead us?

The major audience for this educational project is composed of young adults, teenagers, or even sometimes young children. This audience has generally a very fertile mind fueled by the Internet, social networks, video games and science fiction films. Consequently, it is extremely important to make all necessary arrangements to ensure their mental health and their security,

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for instance through parental control or permission, trough the fight against cybercrime, trough detection of fake news and fraudulent applications etc.

For these reasons, decision makers should take this matter into account: while the integration of ICT in education can involve young children from kindergarten, it is necessary to conduct studies to determine the age from which the integration of artificial intelligence should start into the educational system.

Conclusions

Without a shadow of a doubt, we can state that the efficient and effective integration of artificial intelligence (AI) in education can contribute to the emergence of young new talents capable of positively changing the world. Schools where information and communication technologies (ICTs) have been successfully integrated are more capable of successfully integrating AI.

It is also of paramount importance to conduct quality research to address challenges that could hinder the integration of AI in education. In this regard, it has been proven that transnational research and the synergy of research teams are very effective. Finally, the decision to integrate AI must follow a process involving all stakeholders at the national and local levels, because innovations, especially in the field of education, often face resistance to change.

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