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Artificial Intelligence and its Use in the Field of Education

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Abstract: ***The purpose of this study was to assess the impact of Artificial Intelligence (AI) on education. Premised on a narrative and framework for assessing AI identified from a preliminary analysis, the scope of the study was limited to the application and effects of AI in administration, instruction, and learning. A qualitative research approach, leveraging the use of literature review as a research design and approach was used and effectively facilitated the realization of the study purpose. Artificial intelligence is a field of study and the resulting innovations and developments that have culminated in computers, machines, and other artifacts having human-like intelligence characterized by cognitive abilities, learning, adaptability, and decision-making capabilities. The study ascertained that AI has extensively been adopted and used in education, particularly by education institutions, in different forms. AI initially took the form of computer and computer related technologies, transitioning to web-based and online intelligent education systems, and ultimately with the use of embedded computer systems, together with other technologies, the use of humanoid robots and web-based chatbots to perform instructors' duties and functions independently or with instructors. Using these platforms, instructors have been able to perform different administrative functions, such as reviewing and grading students' assignments more effectively and efficiently, and achieve higher quality in their teaching activities. On the other hand, because the systems leverage machine learning and adaptability, curriculum and content has been customized and personalized in line with students' needs, which has fostered uptake and retention, thereby improving learners experience and overall quality of learning.***

Keywords: Artificial intelligence, Adaptive Learning, Machine Learning, Intelligent Tutoring Systems, Algorithms, Education, Leaner

I. INTRODUCTION

Artificial Intelligence (AI) is fundamentally changing the landscape of education, offering innovative solutions to traditional challenges and opening up new avenues for learning and teaching. In its essence, AI refers to the simulation of human intelligence processes by machines, including learning, reasoning, and problem-solving. Its application in education encompasses a broad spectrum of tools and technologies aimed at enhancing the learning experience for students and improving the efficiency and effectiveness of educational processes.

The introduction of AI in education represents a paradigm shift from the one-size-fits-all approach to a more personalized and adaptive learning environment. By leveraging AI algorithms and data analytics, educational institutions can now tailor instruction to meet the individual needs, preferences, and learning styles of each student. This personalized learning approach ensures that students receive the right content, at the right time, and in the right format, maximizing their engagement and comprehension.

One of the most prominent applications of AI in education is the development of Intelligent Tutoring Systems (ITS). These systems employ AI algorithms to provide personalized tutoring and feedback to students, mimicking the role of a human tutor. ITS can assess students' knowledge, track their progress, and offer targeted interventions to address areas of weakness, thereby optimizing the learning process and promoting academic success.

Moreover, AI-powered analytics enable educators to harness the vast amounts of educational data generated in modern learning environments. By analyzing student performance, engagement patterns, and learning outcomes, educators can gain valuable insights into the effectiveness of instructional strategies and identify areas for improvement. Predictive analytics algorithms can even forecast students' future performance, allowing educators to intervene proactively and provide timely support to at-risk students.

AI also plays a pivotal role in automating administrative tasks and streamlining educational workflows. Automated grading systems can assess assignments and exams quickly and accurately, freeing up educators' time to focus on more meaningful interactions with students. Virtual assistants powered by AI technology can provide immediate support to students, answering questions and guiding them through learning materials, thereby enhancing accessibility and promoting independent learning.

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Furthermore, AI facilitates the creation of immersive learning experiences through technologies such as Virtual Reality (VR) and Augmented Reality (AR). These technologies enable students to explore virtual environments, interact with digital objects, and engage in hands-on learning activities, fostering deeper understanding and retention of concepts.

In essence, the introduction of AI in education holds immense promise for transforming the way we teach and learn. By harnessing the power of AI, educational institutions can create more personalized, adaptive, and engaging learning experiences, empowering students to reach their full potential in an increasingly digital world.

II. NATURE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is conventionally heavily associated with computers. However, it is evident, from a review of the various articles, particularly within the context of the education sector, that while computers may have formed the basis the development of artificial intelligence, there is a gravitation away from the computer alone, the hardware and software, or the equipment, as being artificial intelligence. Embedded computers, sensors, and other emerging technologies have facilitated the transfer of artificial intelligence to machines and other items, such as buildings and robots. Indeed, Chassignol *et al.* provides a two-faceted definition and description of AI. They define AI as a field and a theory. As a field of study, they define AI as a study area in computer science whose pursuits are aimed at solving different cognitive problems commonly associated with the human intelligence, such as learning, problem solving, and pattern recognition, and subsequently adapting. As a theory, Chassignol *et al.* defined AI as a theoretical framework guiding the development and use of computer systems with the capabilities of human beings, more particularly, intelligence and the ability to perform tasks that require human intelligence, including visual perception, speech recognition, decision-making, and translation between languages.

III. PURPOSE OF THE STUDY

It is certain that as long as information technology is applied or used, it will have an impact on education in various ways. This study aims to evaluate how various forms of AI use in education have affected or had an impact on various aspects of education. The study will specifically look at how AI has impacted the fields of education administration and management, teaching, and learning.

The study's goal is to determine whether artificial intelligence (AI) has increased instructional and learning effectiveness in general and has made administrative duties in education more effective and efficient.

Numerous stakeholders in the education system will gain from this study. It will add to the expanding body of research on the various ways that artificial intelligence (AI) has impacted education, as well as the theory, knowledge, and empirical data that support these claims.

By encouraging evidence-based decision-making and management and leadership practices in the sector, it will help academics, professionals, and policy makers, including administrators, management, and leadership of educational institutions and the education sector. The results will complement those of other studies and guide government policies and initiatives meant to promote the beneficial application of information technology, especially artificial intelligence (AI), in the field of education. For instance, having knowledge of how AI affects the education sector and having assessed the precise nature of such effects, policies and programs that support the positive effects of AI on education while reducing any potential negative repercussions.

IV. TECHNICAL ASPECTS OF AI IN EDUCATION

AI-aided education includes intelligent education, innovative virtual learning, and data analysis and prediction. Major scenarios of AI in education and key technologies supporting are listed in fig 1. Note that AI-enable education is playing a more important role as learning requirements promotes. Intelligent education systems provide timely and personalized instruction and feedback for both instructors and learners. They are designed to improve learning value and efficiency by multiple computing technologies, especially machine learning related technologies, which are closely related to statistics model and cognitive learning theory.

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Scenarios of AI education	AI-related techniques
Assessment of students and schools	Adaptive learning method and personalized learning approach, academic analytics
Grading and evaluation of paper and exams	Image recognition, computer-vision, prediction system
Personalized intelligent teaching	Data mining or Bayesin knowledge interference, intelligent teaching systems, learning analytics
Smart school	Face recognition, speech recognition, virtual labs, A/R, V/R, hearing and sensing technologies
Online and mobile remote education	Edge computing, virtual personalized assistants, real-time analysis

Fig 1

V. ARTIFICIAL INTELLIGENCE IN CURRENT EDUCATION

Artificial Intelligence (AI) is playing an increasingly significant role in current education systems, transforming various aspects of teaching, learning, and administrative processes. Here are some ways AI is being utilized in education today:

1) **Personalized Learning:** AI-powered adaptive learning platforms assess individual student progress and adjust the content and pace of instruction accordingly. This personalized approach helps address each student's unique learning needs and challenges.
2) **Intelligent Tutoring Systems (ITS):** ITS use AI algorithms to provide personalized tutoring and feedback to students, simulating the role of a human tutor. These systems can offer tailored assistance in various subjects, helping students grasp difficult concepts more effectively.
3) **Educational Data Analysis:** AI and machine learning techniques are employed to analyze vast amounts of educational data, such as student performance metrics, attendance records, and learning patterns. This data-driven approach enables educators to gain insights into student progress, identify areas for improvement, and make informed decisions about instructional strategies.
4) **Automated Grading and Assessment:** AI systems are increasingly being used to automate the grading and assessment of assignments, quizzes, and exams. By leveraging natural language processing (NLP) and machine learning algorithms, these systems can provide timely and objective feedback to students while reducing the workload for educators.
5) **Virtual Classrooms and Remote Learning:** AI-powered virtual classroom platforms facilitate remote learning by providing interactive tools for online instruction, collaboration, and assessment. These platforms often incorporate AI features such as chatbots, virtual assistants, and automated transcription to enhance the online learning experience.
6) **Content Recommendation and Curation:** AI algorithms analyze student preferences, learning styles, and performance data to recommend personalized educational content, including textbooks, articles, videos, and interactive modules. This content curation helps students discover relevant resources that align with their interests and learning objectives.
7) **Natural Language Processing (NLP) Applications:** NLP technologies enable the development of AI-powered language learning platforms, intelligent tutoring systems, and educational chatbots that interact with students in natural language. These applications facilitate language acquisition, comprehension, and communication skills development.
8) **AI Ethics and Education:** There is a growing emphasis on incorporating discussions about ethical considerations related to AI into educational curricula. Educators are integrating topics such as data privacy, algorithmic bias, and digital citizenship into their lessons to promote responsible AI use and critical thinking skills among students.

Overall, AI is reshaping the landscape of education by offering innovative solutions to enhance teaching effectiveness, improve learning outcomes, and foster a more personalized and adaptive learning environment. As technology continues to evolve, the integration of AI into education is expected to become even more pervasive and transformative.

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VI. TECHNICAL ASPECTS OF AI IN EDUCATION

The technical aspects of AI in education cover a broad range of applications and technologies aimed at enhancing teaching, learning, and administrative processes within educational institutions. Here are some key areas: Technical Aspects of Ai in Education

1) **Adaptive Learning Systems**: AI-powered adaptive learning platforms use algorithms to personalize learning experiences based on individual student needs, preferences, and learning styles. These systems analyze data on student performance to deliver customized content, recommendations, and feedback.
2) **Intelligent Tutoring Systems (ITS)**: ITS utilize AI techniques such as natural language processing and machine learning to simulate one-on-one tutoring experiences. These systems provide personalized instruction, assess student understanding, and adapt instructional strategies in real-time based on student responses.
3) **Automated Grading and Assessment**: AI algorithms can automate the grading of assignments, quizzes, and exams, saving teachers time and providing students with immediate feedback. Natural language processing techniques enable AI systems to analyze and evaluate written responses, essays, and other open-ended questions.
4) **Virtual Assistants and Chatbots**: AI-powered virtual assistants and chatbots can enhance student support services by providing instant responses to inquiries related to course information, schedules, assignments, and general academic guidance. These systems use natural language understanding and generation to communicate with students in a conversational manner.
5) **Data Analytics and Predictive Modeling**: AI algorithms analyze large volumes of educational data, including student performance, attendance, engagement, and demographics, to identify patterns, trends, and predictors of academic success or risk. Predictive modeling techniques can help educators intervene early to support struggling students and improve overall outcomes.
6) **Natural Language Processing (NLP)**: NLP technologies enable AI systems to understand, interpret, and generate human language. In education, NLP is used for various applications such as automated essay scoring, language translation, text summarization, and sentiment analysis of student feedback.
7) **Virtual Reality (VR) and Augmented Reality (AR)**: AI-powered VR and AR applications offer immersive learning experiences that simulate real-world environments and scenarios. These technologies can be used to teach complex concepts, enhance student engagement, and facilitate experiential learning in subjects like science, engineering, and history.
8) **Personalized Recommender Systems**: AI-driven recommender systems analyze student data and preferences to suggest relevant educational resources, such as articles, videos, textbooks, and online courses. These systems help students discover new content aligned with their interests and learning goals.
9) **Emotion Recognition and Affective Computing**: AI technologies capable of detecting and analyzing human emotions can be used to gauge student engagement, motivation, and well-being. Emotion-aware learning systems can adapt instructional strategies and provide personalized support based on students' emotional states.
10) **Ethical and Privacy Considerations**: As AI becomes more integrated into educational settings, it's essential to address ethical and privacy concerns related to data security, algorithmic bias, transparency, and fairness. Educators and policymakers must ensure that AI technologies in education are deployed responsibly and ethically to promote equity and safeguard student privacy rights.

A. AI Education Model

The learner model in an AI learning system is essential to enhancing autonomous learning capacities. It is developed using learner behavior data that is produced during the learning process. To evaluate students' learning capacities, analysis of their thinking and talents is done. To ascertain learners' mastery of the material, knowledge analysis is then mapped. Learner modeling creates links between learning outcomes and a range of elements, such as resources, learning materials, and instructional strategies . A knowledge model creates a map of the knowledge structure that includes specific learning components, such as expert knowledge, guidelines for common mistakes that students make, and misunderstandings . By fusing the learner and knowledge field models, the teaching model establishes the conditions for accessing the knowledge field, allowing teachers to customize their lesson plans and methods. As learning progresses, students are more inclined to behave well.

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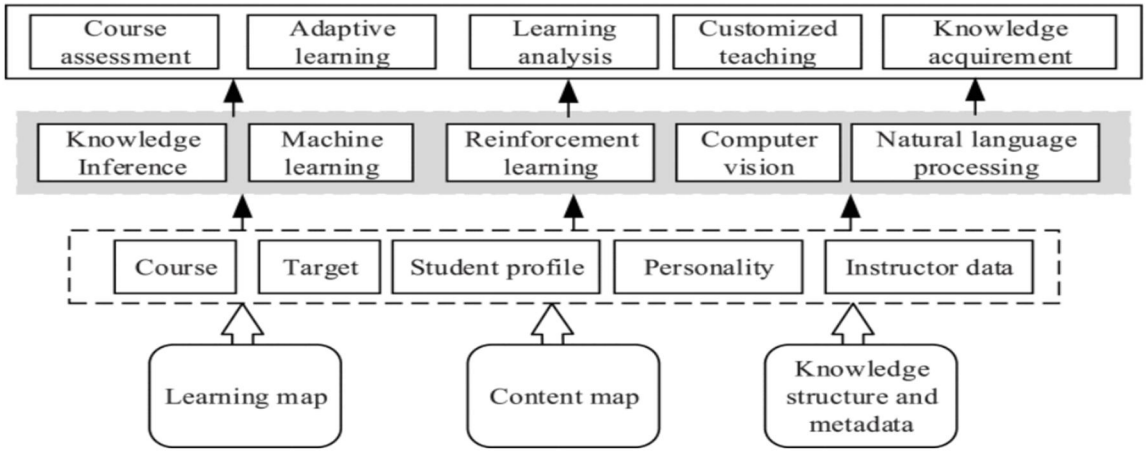


Fig 2

B. Intelligent Education Technologies

Data mining, learning analytics, and machine learning are all closely connected educational technologies. Two communities have emerged around educational data mining and learning analytics as of right now. They share goals and methods and gain from a range of fields, such as data mining, machine learning, data modeling, and statistical psychometrics [41]. Large-scale test results and learning content management systems are the main areas of focus for learning analytics. The field of intelligent tutoring systems, which focuses on very small-scale cognition, is where data mining first emerged.

VII. CHALLENGES AND OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT

Artificial Intelligence is a booming technological domain capable of altering every aspect of our social interactions. In education, AI has begun producing new teaching and learning solutions that are now undergoing testing in different contexts. AI requires advanced infrastructures and an ecosystem of thriving innovators, but what about the urgencies of developing countries? Will they have to wait for the “luxury” of AI? Or should AI be a priority to tackle as soon as possible to reduce the digital and social divide?These are some of the questions guiding this document. In this regard, this urgent discussion should be taken up with a clear picture of what is happening and what can be done. This document gathers examples of how AI has been introduced in education worldwide, particularly in developing countries. It also sows the seeds of debates and discussions in the context of the 2019 Mobile Learning Week and beyond, as part of the multiple ways to accomplish Sustainable Development Goal 4, which targets education. The first section of this document analyses how AI can be used to improve learning outcomes. It presents examples of how AI technology can help education systems use data to improve educational equity and quality in the developing world. The section is divided into two topics that address pedagogical and system-wide solutions:i) AI to promote personalisation and better learning outcomes, exploring how AI can favour access to education, collaborative environments and intelligent tutoring systems to support teachers. We briefly introduce cases from countries such as China, Uruguay, Brazil, South Africa and Kenya as examples experimental solutions conceived from public policies, philanthropic and private organisations. ii) Data analytics in Education Management Information Systems (EMIS). Here we present opportunities for improving a state’s capacity to manage large-scale educational systems by increasing data from schools and learning, presenting cases from United Arab Emirates, Kenya, Bhutan, Kyrgyzstan and Chile. The second section “Preparing learners to thrive in an AI-saturated future” explores the different means by which governments and educational institutions are rethinking and reworking educational programmes to prepare learners for the increasing presence of AI in all aspects of human activity. Based on examples from different contexts, the section is also divided into two main parts: i) “A new curriculum for a digital and AI powered world” elaborates further on the importance of advancing in digital competency frameworks for teachers and students. Some current initiatives are presented such as the “Global Framework to Measure Digital Literacy” and “ICT Competencies and Standards from the Pedagogical Dimension”.

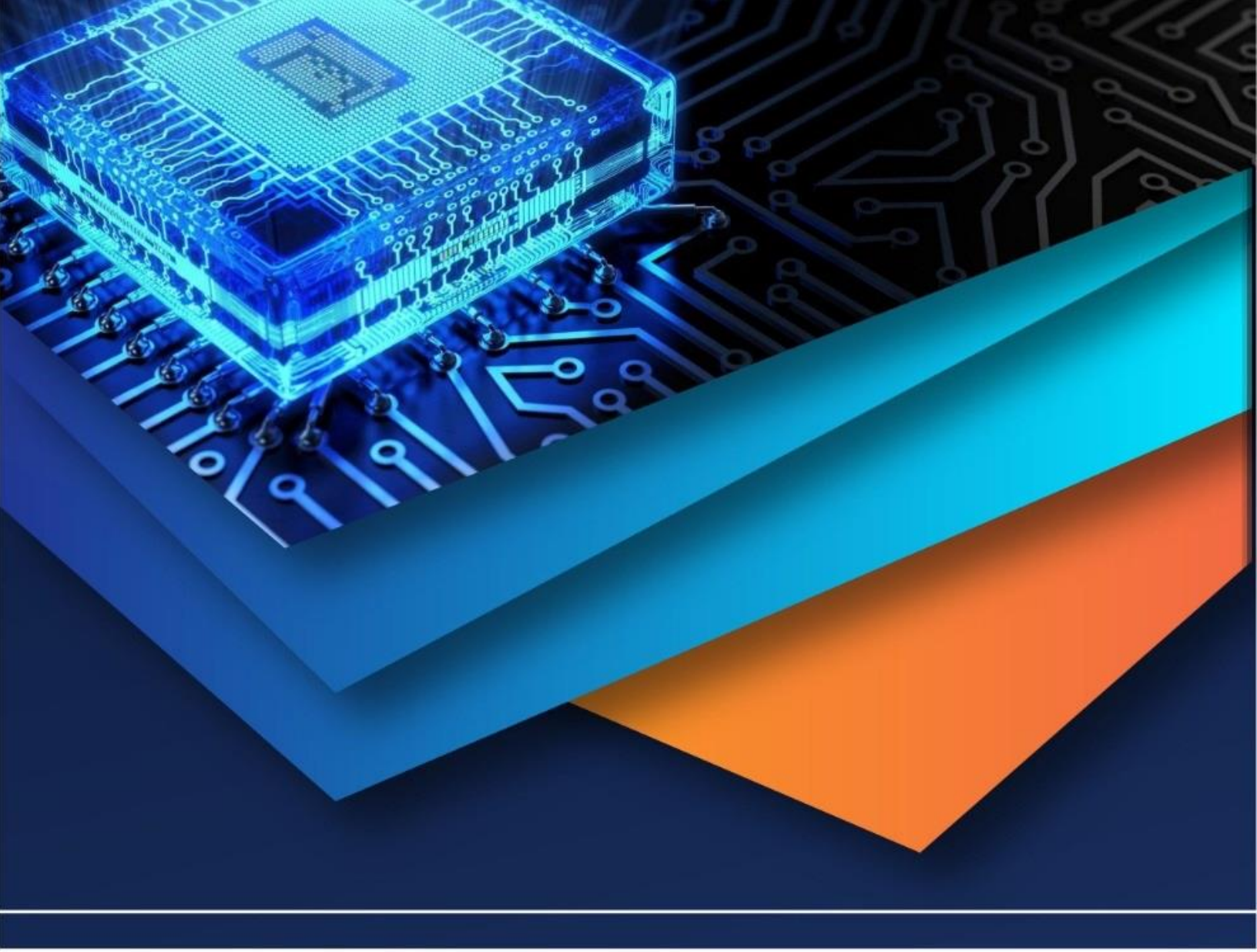
The discussion of the curricular dimension is broadened to include new experiences for developing computational thinking in schools with examples from the European Union, United Kingdom, Estonia, Argentina, Singapore and Malaysia.ii) The second part is more focused on strengthening AI capacities through post-basic education and training. How can each country prepare the conditions for an AI-powered world? Here we present some of the most advanced cases from developed countries who are generating comprehensive plans to tackle this question, namely France, South Korea and China. We also present some cases from the technical and vocational education and training sector and some opportunities from non-formal and informal learning scenarios.The last section addresses the challenges and policy implications that should be part of the global and local conversations regarding the possibilities and risks of introducing AI in education and preparing students for an AI-powered context. Six challenges are presented: The first challenge lies in developing a comprehensive view of public policy on AI for sustainable development. The complexity of the technological conditions needed to advance in this field require the alignment of multiple factors and institutions. Public policies have to work in partnership at international and national levels to create an ecosystem of AI that serves sustainable development. The second challenge is to ensure inclusion and equity for AI in education. The least developed countries are at risk of suffering new technological, economic and social divides with the development of AI. Some main obstacles such as basic technological infrastructure must be faced to establish the basic conditions for implementing new strategies that take advantage of AI to improve learning.The third challenge is to prepare teachers for an AI-powered education while preparing AI to understand education, though this must nevertheless be a two-way road: teachers must learn new digital skills to use AI in a pedagogical and meaningful way and AI developers must learn how teachers work and create solutions that are sustainable in real-life environments. The fourth challenge is to develop quality and inclusive data systems. If we are headed towards the datafication of education, the quality of data should be our chief concern. It´s essential to develop state capabilities to improve data collection and systematisation. AI developments should be an opportunity to increase the importance of data in educational system management.The fifth challenge is to make research on AI in education significant. While it can be reasonably expected that research on AI in education will increase in the coming years, it is nevertheless worth recalling the difficulties that the education sector has had in taking stock of educational research in a significant way both for practice and policy-making.The sixth challenge deals with ethics and transparency in data collection, use and dissemination. AI opens many ethical concerns regarding access to education system, recommendations to individual students, personal data concentration, liability, impact on work, data privacy and ownership of data feeding algorithms. AI regulation will thus require public discussion on ethics, accountability, transparency and security.The document ends with an open invitation to create new discussions around the uses, possibilities and risks of AI in education for sustainable development.

VIII. CONCLUSION

This study's goal was to evaluate how artificial intelligence is affecting schooling. Utilizing a literature review as a research design and methodology, a qualitative research study was conducted. In order to help achieve the goal of the study, professional publications, conference reports, and journal articles were found and employed in an analysis. Artificial intelligence (AI) has developed and is being used in a variety of industries thanks to research and developments sparked by the development and use of computers and computer-related technology. The development and application of artificial intelligence (AI) have been particularly aided by the advancement of personal computers and subsequent innovations that have increased their processing and computing power as well as their ability to be embedded or integrated into a variety of devices, machinery, and platforms. It has been demonstrated to have a significant effect on the industries it penetrates. The education industry has widely adopted and utilized AI, especially in the educational institutions that were the subject of this study. The analysis's main objective was to determine how artificial intelligence (AI) has affected the administrative, instructional, and learning aspects of education. It also sought to determine the implications of AI's application.

Computers and computer-related systems were the first forms of artificial intelligence (AI) in education. Later, web-based and online learning platforms emerged. Robots can now be used as independent instructors or cobots, or humanoid robots, to assist teachers. Moreover, chatbots can be programmed to mimic teaching roles. This is made possible by embedded systems. Richer or higher-quality instruction has been produced as a result of the usage of various platforms and technologies, which have enabled or enhanced teacher effectiveness and efficiency. In a similar vein, AI has enhanced the educational experiences of students by making it possible to tailor and customize course materials to each student's requirements and skills. All things considered, artificial intelligence (AI) has significantly impacted the field of education, especially the areas of administration, instruction, and learning

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