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Replacement of humans in the classroom by artificial Intelligence: A rhetoric

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ABSTRACT

This study explores the probability of artificial intelligence (AI) being able to replace humans in the classroom. There are arguments that AI is progressively advancing and integrating with learning environments in a manner that challenges human involvement in education. Artificial intelligence is conceptualized and the findings provide insights to fill research gaps concerned with artificial and human-level intelligence comparison and productive collaboration between both aspects. Comparative research method and explorative research design are adopted to guide this study. Secondary data is utilized with the use of a systematic desk research method and content analysis is used to explain the concepts and their relationship to each other. Three research objectives are used to assess human superiority to AI, identify limitations of AI and proffer measures to encourage collaboration between human-level and artificial intelligence. The study findings identify that AI would not replace quality teaching and instructive components but become complementary to improve teaching techniques and methodology. The study concludes and further provides recommendations necessary to support the relevance of human-level intelligence and AI in education.

KEYWORDS

Artificial Intelligence; Classroom; Humans; Education.

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Introduction

Humans have witnessed fast-paced technological advancement across geo-political, socio-economic and environmental spheres globally in recent years (Pannu, 2015). This advancement has transcended into education and changed the manner of approach towards learning. One of such advancement is Artificial Intelligence (AI) which has continuously involved to adapt to human environment, interact with species and serve as an instrument for problem-solving. Artificial intelligence has advanced beyond science fiction to engage activities and yield output closely similar to human performance. In education, AIs are significant in modern learning and communication as learners can utilize mobile digital devices, gadgets and information sources (Verma, 2018). It is observable that if digital learning is not integrated in modern education, there is potential risk for such teaching methods to be obsolete and alienate learners.

With the progressive advancement of artificial intelligence, there have been suggestive debates that AIs will replace humans in the classrooms. This has been supported as teaching is gradually integrating and experimenting AI in certain learning environments to test its teaching and instructive capacity. Arguments exist that the ability for AIs to develop and redesign itself independently is threatening the human dominance. Such intelligent AI exhibit technical behaviour that is characterized by acquisition of resources or preventing its shutdown and auditability. In education, Deep Learning by AI seeks to be advanced in a manner that approach or exceed the performance of humans.

Artificial Intelligence have certain risks inclusive of being developed in a manner that compromises the actualization of educational objectives. Some AIs that are optimized for knowledge transfer are at risks of compromise and may not also incorporate social elements like motivation. There could be risk of foreign influence in national education systems and these actors may not have same educational objectives as existing national educational policies and frameworks. This may derail educational development and negatively impose foreign cultures and values on national education goals. If education is fully automated without human intervention, there is risk of excessive use of simulations for teaching purposes. This may affect the learners' chance to learn applicable real-world knowledge and skills.

Technological advancement in education has been remarkably progressive in recent years that there have been arguments that humans will be replaced. There needs to be significant identification of the relevance of human engagement, interaction and contributions in the classrooms. This study seeks to identify the gaps and disparity between artificial intelligence and human-level intelligence in providing development in education. It is important to provide theoretical and practical knowledge for educational stakeholders to bridge the gap between AIs and human

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capacity and further encourage productive collaboration for societal advancement. This article assesses if humans will plausibly be replaced by AIs in the near future. It supports arguments that AIs cannot replace humans in the classroom.

The specific research questions are:

a. What makes human intelligence more superior to artificial intelligence?
b. What are the limitations of Artificial Intelligence in replacing humans in classroom?
c. What measures can be adopted to maximize collaborative engagements between humans and artificial intelligence?

This study investigates the argument that the capability of artificial intelligence (AI) being able to replace humans in the classrooms is fictitious. Its specific objectives are to:

a. identify human characteristics that are superior to artificial intelligence.
b. examine the limitations of artificial intelligence in replacing humans in the classroom
c. proffer measures to encourage collaboration between humans and artificial intelligence.

Literature review

Artificial Intelligence

The term "Artificial Intelligence" was formulated in 1956 by John McCarthy who defines it as science and engineering of making machines that are intelligent (Jerry, 2016). Artificial Intelligence is viewed as the division of computer science concerned with studying and designing logical agents capable of understanding its environment, identifying patterns, executing actions capable of maximizing its chances to succeed.

AI is a continuously evolving creation as it is concerned with learning from experiences, utilize reasoning to make decisions, inference, power and respond quickly (Cheng-tek Tai, 2020). It has the ability to decide based on prioritization and manage ambiguity and complexity. The ability of machines to execute tasks by embedded programmes is described as artificial intelligence. Jacob (2016: 16) opines that the scientific goal of AI is to comprehend intelligence through developing computer programmes that express intelligent behaviour by using embedded symbolic inference and reasoning.

Artificial intelligence is concerned with simulating human intelligence in programmable machines that can imitate human actions like learning and problem-solving (Care, 2019). AI involves the development of systems with intellectual processes as reasoning, discovering meanings, learning from past meanings and generalizing. Among such artificial intelligence aspects include Computer-Aided Instructions, expert systems, robotics, natural language processing, speech understanding, sensory systems, neural computing scene recognition and computer vision.

Features of Artificial Intelligence

The limitations of basic programming languages in dealing with qualitative information reveal the relevance of AI. AIs are written differently in a manner that enables manipulation of predominantly qualitative information using declarative knowledge or assertions with truth-value independent of algorithm context (West, 2012; Cellan-Jones (2014).

Types of Artificial Intelligence

According to Hintze (2016), there are four distinctive types of Artificial Intelligence summarized as:

i. Reactive AI
ii. Limited Memory AI
iii. Theory of Mind AI
iv. Self-Aware AI

Reactive AI as defined by Johnson (2020) is programmed in a manner that provides predictable output based on inputs. This type responds to identical situations in repeated manner and time. Such include: Chess Game by IBM (Deep Blue), Spam Emails and recommendations by Netflix and Showmax.

Limited Memory AI learns from the past, builds experimental knowledge by observing actions or data (Marr, 2021). It uses historical, observational data combined with pre-programmed information for making predictions and performing complex tasks of classifications. For example, autonomous cars for adjusting oncoming car speed and direction.

Reynoso (2019) explains that Theory of Mind AI acquires capabilities to make decisions just like humans. This type of AI can acquire decision-making capabilities similar to humans. They understand and remember emotions, adjust to behaviour based on those emotions as they interact with humans. For instance, Humanoids which recognize emotions on human faces and replicate them.

As explained by Sahu (2021), Self-Aware AI is the most advanced type of AI which is aware of emotions and people's emotions. With continuous interaction, they can progressively make inferences. Despite its advancement, this has not been fully developed with hardware or algorithm for supporting its basis (Petersson, 2021).

Human Intelligence

Sternberg (2022) describes human intelligence as a mental quality that encompasses abilities to derive learning from experiences in a manner that understands abstract concepts to support situational adaptation and utilize knowledge for managing the environment. Paria (2022) explains that it is the selective combination and application of cognitive processes as learning, perception, reasoning, problem-solving and memorization.

In deriving a working theory for this study, it is necessary to identify that there are no unified theoretical explanations for the nature and evaluation of an AI theory. Artificial intelligence is largely concerned with classical logic and probability theory and this is limited as this study intends to draw comparison between AI and human intelligence within the classroom environment.

Methods

This study adopts comparative research method and exploratory research design. This design enables the researcher to gain insights for present and future investigations on human and artificial intelligence capacities (Esser & Vliegenthart, 2017). Amongst research methods as descriptive, longitudinal and observational research design, this study selects the exploratory design as studies of artificial intelligence in classrooms are gradually improving. The exploratory design provides an avenue to develop a well-grounded image of AI vs Human comparison, and provide basic details and systematic investigation concerning the variables (Dudovskiy, 2022).

It guides the study in generating new ideas on AI and human impact in classrooms by providing existent representation of classroom learning (Willard, 2022). These adopted research methods provide opportunities for the definition of terms concerning artificial intelligence including clarifications on existing concepts on human intelligence and classroom learning.

Instrument of Data Collection

Data is collected through secondary sources which includes relevant books, journals, newspapers, institutional publications, videos, graphical presentations, magazines, websites, blogs, unpublished theses and official documents of carefully selected organizations.

Instrument of Data Analysis

This study adopts the technique of content analysis which involves two classifications namely; conceptual content analysis and relational content analysis. This guides the study in the identification of patterns and determination of central themes focused on human intelligence being superior to artificial intelligence.

Validity and reliability of instrument

As Mohajan (2017) posits that validity and reliability tests the dependability of research methods, this study adopts logical content validity to enable the adequate and effective measurement of artificial and human intelligence capabilities in the classroom environment. Internal reliability is used to facilitate the individual testing of variables concerning artificial intelligence and human Intelligence and identify reliable indicators of their relevance within the classroom environment.

Results

There has been technological advancement that promotes AI to allow increased coordination and integration between humans and technology through the production of Human-Aware AI. Despite such, AIs remain unconscious beings or used as special-purpose to support humans in specific and complex tasks.

According to Scolari, Seidl-Rathkopf & Kastner (2015), the human brain has depth and layers that are far more sophisticated and complex which cannot be matched by AI despite AI's software and hardware infrastructure. Fan et. al. (2020) explains that AI stems from brain science also known as neuroscience which views how information is processed for making decisions and interacting with the environment. The Hebbian learning identifies that a synapse between two neurons is strengthened by highly correlated input and output side of the synapse. This explains the dynamism of biological neural systems which lays the foundation for single-layer and multi-layer artificial network.

Comparatively, this study outlines the prominence of human intelligence as compared to artificial intelligence.

Research Objective One: Identification of human characteristics that are superior to Artificial Intelligence

Despite the prevalence on artificial intelligence in the educational environment, human-level intelligence possesses certain characteristics that are superior to technology success. These are expressed below:

Motivation and Inspiration

The capacity of Artificial Intelligence in motivating is limited and majorly flawed with its technique of rewards and penalty. The reward and penalty techniques of accolades, praise, smiles, gifts, awards and clapping can be totally ignored by AI without social consequences. In designing adaptive learning systems, there are difficulties in optimizing goals as they may be conflictual which may require trade-offs and substitutions (Bostrom, 2014). For instance, an AI learning system with intentions to teach complex knowledge in quick real-time may not achieve this if the learners have slow retention capacity. This inhibits an exciting experience for learners. It is evident that the teacher helps in developing the creative thinking skills of learners and prepare them to face future challenges. Tasks may become more tedious and mundane as they are taken over by machines, but it is the teacher that possesses flexibility and can readily solve problems in reflective and robust ways to increase creative thinking skills in a supportive learning environment. This offers feedback that guides a student in taking the next step in a new scenario. If test questions in AI systems are very easy, students would not learn as quick as expected because they would hardly gain new knowledge. If learning questions are difficult, it could demotivate learners and this consequently leads to a decline in student performance.

AIs adopt a systemic monotonous teaching style which restrains teaching in a differentiated manner that is inspirational or motivational manner and consequently limits classroom learning (Cortes et. al., 2015). This can be exemplified through concept teachings about social reality like terrorism, gender inequality, domestic abuse, rape, harassment or bullying as AIs may not be able to teach such with passion. Human teachers stir curiosity and prompt learners to widen their scope of thinking from different knowledge-discipline perspectives and understand what is known and knowable in their world. They show that there is no limit to learning and knowledge by revealing the future to learners for global inspiration, aspiration and opportunities. AIs monotonous character may find it difficult to adjust to the dynamic behaviour of students especially those who require special care, attention and learning. This raises questions like how will autistic students or students with speech impediment be able to learn without special attention?

Humans possess the ability to incite curiosity and feed this curiosity in the learning environment. For teaching to be viewed as effective, it must focus on the 'why?' and 'how?' more than 'what?' with the aim of igniting creative imagination and linking the minds and hearts of learners.

Emotional Intelligence and Empathy

The limited ability of AI to be emotionally intelligent is a drawback to AI instructors as it has difficulty in processing students' learning inabilities thus leading to learning frustration, sadness and other human difficult emotions. According to Kaplan & Haenlein (2019), the correlation of empathy is to reduce the damaging effect of repeated stress and further has implications for achievement both intellectually and socially. In a learning environment, empathy gives a professional relationship that connects personally which could sometimes involve gesticulation and dramatization during learning periods and class activities. This brings appeal among learners and makes them enjoy natural experiences to understand the taught concepts.

Educational systems like those in Europe determine learning difficulty and subject choice by learners level and year (Strout, 2020). This connotes that a student is only admitted to a particular level or year based on their attainment of minimum performance requirement of selected subjects or courses. For example, a student must have proficiency in both mathematics and at least a foreign language with the same difficulty level in the Netherlands. AI mainly allows certifications per subject rather than collective certifications in all selected subjects (Månsson & Haake, 2018). This focuses on providing signaling and information insights about students' performance.

AIs advancement is yet to fully grasp the quality of empathy or become fully developed to have the same sense of engagement as humans. This causes difficulty for learners to interact and engage with digital instructors as compared with human facilitators. AI generated data can mainly inform about students' performance in learning systems as analytical dashboards (Le Cun et. al., 2015). These analytical dashboards mainly provide visualization for students' performance progress overtime with data designs as charts and create predictive modelling (Reed et. al., 2015). These descriptive statistics can mainly provide information or links through observational data in a predictive model of students' performance. However, the AI is not intelligent enough to provide vital presentation of the emotional factors that affect student performance and empathically resolved them (Kirkpatrick et. al., 2017).

Relational Method of Teaching and Learning

Humans possess an exclusive classroom advantage which is the ability to view learners, mentees and students for who they are, which is their innate personality, who they can be through their ambitious aim and the relationship between personality and ambition (Van & Jelicic, 2019). Humans also have the remarkable ability to build and maintain relationships whether positive or negative between tutors or instructors and learners. Humans form symbiotic and

synergistic ecosystem that helps in the mutual advancement of knowledge and perceptions evolving in naturally gifted ways (Bharti, 2022). Relationship building and management is a critical aspect of learning and engagement in the educational environment and it is sometimes difficult.

Machines may only support or enhance relationships in the classroom but may not directly build or engage relationships. AIs deep-learning involves input of several parameters that may show certain aspects that may not be traceable or understandable (Nick & Yudkowsky, 2014). There are sometimes conflictual goals between designing adaptive learning and its optimization which can affect the learning process.

Subjection of Problem Solving to Realistic Phenomena

Human intelligence is significantly relatable to experience and adaptive learning that has little to no dependence on pre-fed data as required by AI (Periera et. al., 2012). Humans have special ability to logically reason and understand while applying acquired knowledge in learning and experience. This makes humans make rational decision as they understand 'cause' and 'effect' which is used to solve problems in a holistic approach which AIs are unable to perform (Graves et. al., 2016). Humans understand what progress is and can identify where and how to intervene when need arises in order to avoid pitfalls. This helps learners to take risks and go through them to enhance their level of maturity.

Despite AIs smart advancement to human performance, there are strong arguments against its ability to implement intuition-based decisions in new manners (Jeong et. al., 2019: 472). For instance, students can ask challenging questions in classrooms that can inspire instructors to make cross-connections with reality, uniquely explain with valid examples and discuss the topic reasonably in a productive and engaging manner.

Research Objective 2: Limitations of Artificial Intelligence' Capacity to replace Humans in Classroom

Repetitive Method of Learning

The accuracy and operational ability of AI spurred by its high-speed execution makes it streamlined to monotonous tasks. These qualities also limit AIs ability to rationalize and perform sensitive tasks as humans can execute. AIs in education are developed in models of adaptive learning systems which are optimized for learning processes and these models are either Expert-based, Student-based and Instruction-based (Lundberg & Lee, 2017; Lelei & McCalla, 2018).

Artificial Intelligence learning systems are quite static in aiding learners' development. For example, a student is proficient in mathematics but experience specific difficulty to algebra. The AI could consistently generate several learning exercises on algebra in a bid to improve resolve the learner's difficulty (Herodotou et. al., 2017; Davies et. al., 2021). However, the student is questioned on all topics during tests and he/she may encounter difficulties as the learner had limited practices for other non-algebra topics like geometry and calculus.

Limitations on Learning Flexibility and Creativity

One of the major problems of AI algorithms is its limited capacity to reveal the meaningfulness of learning to students. The prefrontal cortex in the human brain is responsible for working as it remembers past data to perform inferential tasks and complicated reasoning (Hochbaum et. al., 2014). AIs cannot flexibly develop the life of students as human teachers take more cognizance of understanding and meaning. Humans have expertise in creatively educating with passion that facilitate the building of relationships that impact students. Humans consistently undertake increasing innovative tasks.

AIs adopt natural learning processing in assessing texts that are written based on the type of content and style of writing (Balfour, 2013). This type of automation is developed and trained in a manner that is based on previous assessed texts. Then, the adopted methods of machine learning are been utilized to determine the extent to which new texts would correspond or contain with texts that created the AI model. This process is achieved within a patterned framework and this inhibits creativity as such AI would require improved algorithms to adopt such changes.

Complexity in Identifying Concepts

AI require the crunching of millions of data and images to identify concepts or image based on presented features whereas humans are capable of grasping such concepts by their understanding of symbolism (Deepa & Aruna, 2011).

According to Paninski & Cunningham (2018), humans develop AI to operate in the following manner: Hypothesize, Data generation, supervised modeling, identifying patterns through attribute interrogation, conjecture and proving theorems. This is identified in the diagram below:

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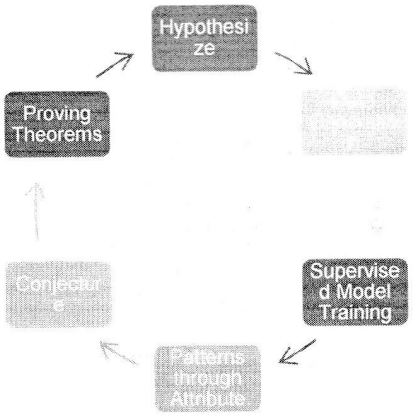

Figure 1. Flowchart of Artificial Intelligence Programming for Identification of Concepts (Field, 2022)

This process is important to attain accuracy of learned functions and applied attribution techniques. At conjecture stage, if there are errors or concerns due to the alteration of sampling distributions, data is regenerated or hypothesis reformulated.

Humans can adapt easily in learning complex concepts by consistent learning through interaction by means of classroom culture and people in the learning environment. Although AI has simplified several tasks in multiple ways by the development of several task-execution algorithms, there has been several epic failures such as:

i. Autonomous Self-driving Uber car accident killing pedestrians;
ii. AI-led IBM Watson Supercomputer incorrect and unsafe cancer treatment; and
iii. AI-enabled facial recognition bias for skin-tones or skin alterations.

Static Classroom Management and Student Care

Artificial Intelligence in classroom management, has been unable to properly enforce decisions or influence actions of learners in terms of discipline. Humans have the superiority of properly executing academic, social and emotional classroom management in the learning environment. For example, AIs do not possess efficient skills to prevent issues as loitering, noise-making and learning disagreements which affect learning. The development of AI can mainly support specific classroom management activities as classroom monitoring. For instance, China, France, Switzerland and certain European countries use cameras and surveillance AIs to monitor learners and obtain real-time feedback to teachers (Connor, 2018). This feedback is used to address students' behaviour and classroom actions occurring in the presence and absence of teachers, instructors, trainers and instructors.

The application of such technological functions does not necessarily improve learners' attention in classroom or their participation in classroom activities. It is arguable that if improvements occur among students, it is based on certain effects described as Panopticon as conceptualized by Jeremy Bentham. Bentham describes Panopticon as a custodial or surrounded social enclave that enforces social control in which its prisoners or subjects begin to feel the presence of constant supervision or watch (Olah & Schubert, 2017). In Liang Jun's field research outcome (2018), he noted the reactions of Chinese students who revealed that they were unable to be distracted in classrooms because of installed cameras as they felt being watched by "mysterious eyes".

Humans have the cultural and intuitive sensitivity to read with smiles and change the mood in the classroom environment. AIs have limited interactive capacity to intentionally manage classroom mood and distortion which is necessary for emotional communication. There are ongoing researches in Germany and Canada to create AIs that can be integrated as augmented reality to enable AIs to prioritize specific activities to enhance students' performance in classroom activities (Nehra, 2015).

Research Objective 3: Measures to maximize collaboration between humans and artificial intelligence

Transference

In new or emerging situations, AIs experience difficulty in performing efficiently as they can mainly aid task-execution for humans but not reliably transfer learning to new circumstances. However, there are evolving technological developments to use robotics for the creation of didactic learning methods. These robots are currently under development in order to be characterized with the ability to teach new information and skills to learners (Grace et. al., 2018).

As humans interact, they are faced with several experience-based encounters and this enables them to derive unique lessons that may not be easily transferable. AIs require deep learning which involves classifying patterns using neural networks and machines can only follow series of encoded statements. Teachable robots would be able to provide "multiple" to "infinite" explanations on a specific AI-learned concepts (Piech et. al., 2015). This method of robotic teaching is derived from the protégé effect which assumes that students are most likely to learn quickly by understanding learning materials and resources individually and then explaining to their peers or other students (Chase et. al., 2009). In such simulations, students would be able to receive practical instructions within their learning environments, assimilate at their own pace and be inclined to learn without damaging their self-esteem.

As AI do not possess required intelligence to provide response to evolving circumstances like arguments among students. There is need to converge similar problem-solving approaches between human-level and artificial intelligence (Cornelius & Klaveren, 2018). In education, AI can be used appropriately in assessing and transferring skills and knowledge by informing teachers and instructors about students' performance and accomplishments.

Social Reality and Necessity for Teamwork

As the learning environment transforms, it is necessary to gauge learning needs in terms of knowledge and skill levels (Letouzé & Pentland, 2018). This can be done through teamwork engagements and exercises. This teamwork exists through social interactions between students, learners, teachers, instructors, tutors, administrators, mentors, guardians, coaches and parents.

Teachers create and develop scenarios and situations that can facilitate collaboration and cooperation among learners. This encourages learning and assimilating lessons that are applicable to their daily lives. These patterns and learning mechanisms are limited in Artificial Intelligence (AI) learning. However, AIs can also be used for the selective process in classifying learners and students based on their individual strengths and weaknesses.

Students learn in social environments by observing and imitating the behaviour of others as they feel the need to have meaningful connections and experience the sense of belonging. Artificial Intelligence has little to zero of such connections with learners as studies also indicate that AI reflect some prejudices which they were created to solve (Harari, 2018). In order to avoid these technological risks, the High-Level Expert Group on AI of the European Union made a publication in 2019 titled Ethics Guideline for Trustworthy AI (Nature News, 2020). The Group suggest that the development of AI systems must be cognizant on being explainable, accountable and unbiased with emphasis that AI respects all applicable laws and regulations, ethical principles and values. Also, AI should be robust to consider its social environment and become robust in its reliability, fairness, trustworthiness and adaptable (Von der Leyen, 2020).

Discussion

The comparison between human and artificial intelligence has been one of the most debatable subjects based on concerns such as ethics, explainability, constraints and impact (Dong et. al., 2020). Scholars as Korteling, van de Boer-Visschedijk, Blankedaal, Boonekamp and Eikelboom present notions to provide the possible forms of general intelligence, similarities and differences between AI and human intelligence, and the multiple impacts of AI on education in recent years. Several arguments emphasize that despite AI enhancement, they remain unconscious machines that require further intelligence development within their cognitive systems (Komal, 2014).

Based on the findings, it is identifiable that AI will not replace good teachers, relevant teaching methodology and instructive concepts. Rather, Artificial Intelligence will serve as a great aid for teachers to improve their teaching techniques thus serving as a tool for teachers, instructors, tutors, learners and students. Most AIs utilized in educational environment are developed to automate didactic activities. These includes the following:

i. Selecting teaching and learning materials;
ii. Review of tests or automated questioning activities; and
iii. Provision of constructive feedback based on the learners' performance.

These activities are done through adaptive learning systems, automated AI models and intelligent tutoring systems. Teachers, instructors and mentors are not only to transfer knowledge but influence students to learn norms, values and ethics that improve their social competence and teamwork abilities (Delcker, 2018).

The findings indicate that human users of AI especially teachers and instructors can make the decision to either use or ignore the provided information by AI. Teachers and Instructors have the autonomy to determine the class activities, select the learners, learning time, learning materials and instruction type. Additionally, AI interacts with its users in a manner that choices can be made to provide insights about the performance of students (Iyer, 2021). This depends on how information is presented and the knowledge of humans in interpreting such information.

Artificial Intelligence will reduce the burdens on teacher and further give them insights to develop learners' abilities and help them grow. It can be noted that most AIs are subject-specific and this is mainly used to transfer knowledge on specific subjects or topics or competence (Letouzé, 2012). There is need for the development of cross-curricular AIs in a manner that considers the entirety of an individual student performance in all subjects and personalize the entire curriculum.

As AI is gradually evolving and here to stay, its developers must be encompassing in features that make them beneficial, lucid, uphold value and be accountable. There is need to create a balance between use of technology, real books and hands-on learning in the classroom environment. AI can support education in the classrooms and further facilitate the integration of new educational styles.

Artificial Intelligence could serve as a tool for teachers but cannot replace them in the classroom. Several requirements have been recommended for AI development which includes human intervention or supervision, security, accuracy and privacy. Efficient data infrastructure should be created to ensure optimal performance for educational development. This data infrastructure must totally eliminate all forms of bias and stimulate multi-disciplinary approaches to educational development.

Conclusion and Recommendations

From the findings, it is concluded that Artificial Intelligence will not replace teachers but could be an aid for good teachers to improve their teaching techniques. It can be identified that there is probability that humans may increasingly become dependent on AI. The digital knowledge and skills of teachers, instructors, mentors and educationists must be increased and enhanced. These skills must go beyond computer handling but also include specific data skills both didactic and pedagogical that are necessary for the interpretation of AI output. This knowledge must include high-level statistics and general machine learning algorithms. As such, there must be increased responsibility to encourage blended learning between human intelligence and machine learning models.

Algorithms and data used for developing AI should be accessible without bias of gender, age, race or other characteristics in a manner that is traceable and understandable by human intelligence. AI systems should be subjected to auditing to enforce that its negative impacts are properly acknowledged and reported to enable immediate corrections to facilitate improvements. Future AI should encompass detailed responsibility for actions, encourage transparency, subjected to auditability, developed for incorruptibility and predictable in a manner that does not manipulate humans and the society.

This research is limited by the inaccessibility to data metrics and algorithms of AI applications to critically assess or compare their capacity to match human intelligence. Such data would require credible legal permissions for the intellectual property rights (IPR) of AI technological companies.

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