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Intellectual Development Versus Artificial Intelligence (Ai) and Impacts on Education

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Abstract

The paper highlighted on the concept of Intellectual Development as it is one of the Idealist aims of education which focus on all things that are of more lasting value-eternal and directed towards the search for true ideas. As ascertained by Plato that 'truth' or 'perfect ideas' can be found only in 'philosophic wisdom' which can only be attained through intellectual development. Piaget's theory of Intellectual Development' was also discussed in the paper, as he believed that everyone must pass through an invariant sequence of four qualitatively distinct stages. Lastly discussed the greatest undoing of Idealism like Industrialisation, Globalisation and Technological Advancement, in which the development of science has brought technology to what is now called Artificial Intelligence (AI) and this in turn has helped man put more emphasis on the material wellbeing as opposed by the idealist aspect of life.

Key words: Intellectual Development, Artifical Intelligence, Education, Science, Tsechnology

Introduction

Humans have been using machines to augment our capabilities for a long time, so it's only natural that we have come to a point where we are looking to replicate our cognitive processes in some of those machines. Human beings are rational a view often attributed to Aristotle and a major component of rationality is the ability to reason a task for cognitive scientists is accordingly to analyze what inferences are rational, how mental processes make these inferences, and how these processes are implemented in the brain. Scientific attempts to answer these questions go back to the

origins of experimental psychology in the 19th century. Since then, cognitive scientists have established three robust facts about human reasoning. First, individuals with no training in logic are able to make logical deductions, and they can do so about materials remote from daily life. Indeed, many people enjoy pure deduction, as shown by the world-wide popularity of Sudoku problems. Second, large differences in the ability to reason occur from one individual to another, and they correlate with measures of academic achievement, serving as proxies for measures of intelligence. Third, almost all sorts of reasoning, from 2D spatial inferences to reasoning based on sentential connectives, such as if and or, are computationally intractable. As the number of distinct elementary propositions in inferences increases, reasoning soon demands a processing capacity exceeding any finite computational device, no matter how large, including the human brain.

Until about 30 years ago, the consensus in psychology was that our ability to reason depends on a tacit mental logic, consisting of formal rules of inference akin to those in a logical calculus. This view has more recent adherents. However, the aim of this article is to describe an alternative theory and some of the evidence corroborating it. To set the scene, it outlines accounts based on mental logic and sketches the difficulties that they ran into, leading to the development of the alternative theory. Unlike mental logic, it predicts that systematic errors in reasoning should occur, and the article describes some of these frailties in our reasoning. Yet, human beings do have the seeds of rationality within them—the development of mathematics, science, and even logic itself, would have been impossible otherwise; and as the article shows, some of the strengths of human reasoning surpass our current ability to understand them. Piaget has been labeled an interactionist as well as a constructivist. His interest in cognitive development came from his training in the natural sciences and his interest in epistemology. Piaget was very interested in knowledge and how children come to know their world. He developed his cognitive theory by actually observing children (some of whom were his own children). Using a standard question or set of questions as a starting point, he followed the child's train of thought and allowed the questioning to be flexible. Piaget believed that children's spontaneous comments provided valuable clues to understanding their thinking. He was not interested in a right or wrong answer, but rather what forms of logic and reasoning the child used (Singer, 2011). After many years of observation, Piaget concluded that intellectual development is the result of the interaction of hereditary and environmental factors. As the child develops and constantly interacts with the world around him, knowledge is invented and reinvented. His theory of intellectual development is strongly grounded in the biological sciences. He saw cognitive growth as an extension of biological growth and as being governed by the same laws and principles (London, 2010). He argued that intellectual development controlled every other aspect of development - emotional, social, and moral.

Stages of Intellectual Development

Piaget may be best known for his stages of cognitive development. Piaget discovered that children think and reason differently at different periods in their lives. He believed that

everyone passed through an invariant sequence of four qualitatively distinct stages. Invariant means that a person cannot skip stages or reorder them. Although every normal child passes through the stages in exactly the same order, there is some variability in the ages at which children attain each stage. The four stages are: sensorimotor - birth to 2 years; preoperational - 2 years to 7 years; concrete operational - 7 years to 11 years; and formal operational (abstract thinking) - 11 years and up. Each stage has major cognitive tasks which must be accomplished. In the sensorimotor stage, the mental structures are mainly concerned with the mastery of concrete objects. The mastery of symbols takes place in the preoperational stage. In the concrete stage, children learn mastery of classes, relations, and numbers and how to reason. The last stage deals with the mastery of thought (Evans, 2022).

A central component of Piaget's developmental theory of learning and thinking is that both involve the participation of the learner. Knowledge is not merely transmitted verbally but must be constructed and reconstructed by the learner. Piaget asserted that for a child to know and construct knowledge of the world, the child must act on objects and it is this action which provides knowledge of those objects; the mind organizes reality and acts upon it. The learner must be active; he is not a vessel to be filled with facts. Piaget's approach to learning is a readiness approach. Readiness approaches in developmental psychology emphasize that children cannot learn something until maturation gives them certain prerequisites (Brainerd, 2000). The ability to learn any cognitive content is always related to their stage of intellectual development. Children who are at a certain stage cannot be taught the concepts of a higher stage.

Intellectual growth involves three fundamental processes: assimilation, accommodation, and equilibration. Assimilation involves the incorporation of new events into preexisting cognitive structures. Accommodation means existing structures change to accommodate to the new information. This dual process, assimilation-accommodation, enables the child to form schema. Equilibration involves the person striking a balance between himself and the environment, between assimilation and accommodation. When a child experiences a new event, disequilibrium sets in until he is able to assimilate and accommodate the new information and thus attain equilibrium. There are many types of equilibrium between assimilation and accommodation that vary with the levels of development and the problems to be solved. For Piaget, equilibration is the major factor in explaining why some children advance more quickly in the development of logical intelligence than do others (Lavatelli, 2010).

A Piagetian-inspired curricula emphasizes a learner-centered educational philosophy. Piaget espoused active discovery learning environments in our schools. Intelligence grows through the twin processes of assimilation and accommodation; therefore, experiences should be planned to allow opportunities for assimilation and accommodation. Children need to explore, to manipulate, to experiment, to question, and to search out answers for themselves - activity is essential. However, this does not mean that children should be allowed to do whatever they want. So what is the role of the teacher? Teachers should be able to assess the child's present

cognitive level; their strengths and weaknesses. Instruction should be individualized as much as possible and children should have opportunities to communicate with one another, to argue and debate issues. He saw teachers as facilitators of knowledge - they are there to guide and stimulate the students. Allow children to make mistakes and learn from them. Learning is much more meaningful if the child is allowed to experiment on his own rather than listening to the teacher lecture. The teacher should present students with materials and situations and occasions that allow them to discover new learning. In his book To Understand Is to Invent Piaget said the basic principle of active methods can be expressed as follows: "to understand is to discover, or reconstruct by rediscovery, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition". In active learning, the teacher must have confidence in the child's ability to learn on his own.

History of Artificial Intelligence

Multiple definitions of AI exist, but the one that captures the essence of AI is: "Artificial Intelligence encompasses a collection of sciences, theories, and techniques, including mathematical logic, statistics, probabilities, computational neurobiology, and computer science. Its objective is to replicate the cognitive abilities exhibited by human beings." The roots of AI can be traced back to the Second World War when computers began undertaking complex tasks that were once the exclusive domain of human operators. This marked the inception of a tenuous link to human intelligence. However, the AI of that era was vastly different from the sophisticated systems we witness today. Despite advancements during that time, these early AI tasks remained far removed from achieving human-like intelligence in its strictest sense. Following are some milestones in the history of AI which defines the journey from the AI generation to till date development.

Maturation of Artificial Intelligence (1943-1952)

The first work which is now recognized as AI was done by Warren McCulloch and Walter pits in 1943. They proposed a model of artificial neurons. In 1949**:** Donald Hebb demonstrated an updating rule for modifying the connection strength between neurons. His rule is now called Hebbian learning. In 1950**:** The Alan Turing who was an English mathematician and pioneered Machine learning in 1950. Alan Turing publishes "Computing Machinery and Intelligence" in which he proposed a test. The test can check the machine's ability to exhibit intelligent behavior equivalent to human intelligence, called a Turing test. The Turing test is a central, to build a computer that can sufficiently imitate a human to the point where a suspicious judge cannot tell the difference between human and machine.

The birth of Artificial Intelligence (1952-1956)

An Allen Newell and Herbert A. Simon created the "first artificial intelligence program "Which was named as "Logic Theorist". This program had proved 38 of 52 Mathematics

theorems, and find new and more elegant proofs for some theorems. In 1956**:** The word "Artificial Intelligence" first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field. At that time high-level computer languages such as FORTRAN, LISP, or COBOL were invented. And the enthusiasm for AI was very high at that time.

The golden years-Early enthusiasm (1956-1974)

The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chat bot in 1966, which was named as ELIZA. In **1972:** The first intelligent humanoid robot was built in Japan which was named as WABOT-1.

The first AI winter (1974-1980)

The duration between years 1974 to 1980 was the first AI winter duration. AI winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for AI researches. During AI winters, an interest of publicity on artificial intelligence was decreased.

A boom of AI (1980-1987)

After AI winter duration, AI came back with "Expert System". Expert systems were programmed that emulate the decision-making ability of a human expert. In the Year 1980, the first national conference of the American Association of Artificial Intelligence was held at Stanford University.

The second AI winter (1987-1993)

The duration between the years 1987 to 1993 was the second AI Winter duration. Again Investors and government stopped in funding for AI research as due to high cost but not efficient result. The expert system such as XCON was very cost effective.

The emergence of intelligent agents (1993-2011)

In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov, became the first computer to beat a world chess champion. In 2002**:** for the first time, AI entered the home in the form of Roomba, a vacuum cleaner. In 2006**:** AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

Deep learning, big data and artificial general intelligence (2011-present)

Now AI has developed to a remarkable level. The concept of Deep learning, big data, and data science are now trending like a boom. Nowadays companies like Google, Facebook, IBM, and Amazon are working with AI and creating amazing devices. The future of Artificial Intelligence is inspiring and will come with high intelligence. AI is gradually becoming seamlessly integrated into almost every aspect of our routines. Whether we embrace it or not,

AI adoption is accelerating rapidly. Even in instances where it operates discreetly, AI influences our experiences targeting web advertisements on social media, predicting behaviour on gambling websites, enabling facial recognition in security systems, and facilitating support and advice through chatbots. The pervasive nature of AI underscores its transformative impact on diverse aspects of modern life.

The Use of Artificial Intelligence in Education

The followings are some of the uses of Artificial Intelligence in education in Nigeria, Thus:-

Personalized Learning

AI brings benefits and opportunities to education by facilitating personalization of learning, providing instant feedback and improving efficiency in the assessment process. Thus, learning management systems can use artificial intelligence to provide personalized recommendations, automatic feedback and monitor student progress. Thus, students can access relevant materials and resources according to their individual needs. Virtual reality can also help students encourage collaboration and teamwork, and tools like social media can be used to connect students with their peers and instructors. Artificial intelligence adapt the learning process to the individual needs of students. By collecting and analyzing data about student/student progress and performance, AI can identify weaknesses and automatically adapt content and teaching methods to support individual performance improvement. Thus, a personalized and more effective learning experience can be ensured.

Improved teachers and students efficiency

From personalizing learning to instant feedback and automated assessment, AI can improve the teaching and learning process, providing a more efficient and effective experience for students and teachers. However, it is important to strike a balance between technology and the human aspects of education. Educators and students must understand, evaluate, and familiarize themselves with the uses of generative AI tools and consider their potential impacts on academic integrity. This involves recognizing when and how AI is used, assessing the reliability and validity of AI-generated outputs, and understanding the ethical and social implications of AI applications (Akgun & Greenhow, 2021). Moreover, the application of AI in education brings questions about educational equity and access to the fore. Systemic biases in AI algorithms and data can perpetuate inequities, making it crucial to address these biases effectively (Adams, 2022).

Enhanced Creativity

According to Manyika (2017) emphasize that good teachers will continue to exist in the future, teaching classes designed to boost students' affective intelligence, creativity, and communication. Artificial intelligence and automation will actually make 'people more human.' Haseski (2019) briefly states that artificial intelligence in education make learning

more individual, provide effective learning experiences, enable students to discover their talents, improve their creativity and reduce teachers' workload.

Provide Inclusive Education

Artificial intelligence can provide access to appropriate and better learning opportunities for excluded people and communities, people with disabilities, refugees, people out of school, and those living in isolated communities. Research shows how effective individually tailored approaches can be presented with the support of artificial intelligence techniques and intelligent learning environments (Mohammed & Watson, 2019).

Provided Supportive Assistants

The uses Chat bot and virtual assistants which are based on intelligent systems and can offer round-the-clock availability, address queries, and offer valuable feedback. AI also enables enhanced engagement and motivation of students by providing tools such as gamification of learning or interactive content. It enables students to be more engaged and motivated (Zhang and Aslan, 2021). AI can also reduce the cost borne by educational institutes as it removes unnecessary work and automates processes which reduce the resource requirements (Adlawan, 2024; Tahiru, 2021). The reduced cost thus can be transferred to other stakeholders such as students. Overall, we can argue that AI use in the education field has benefits for learners, tutors, and educational institutes in terms of flexibility, increased learning, a focus on more important tasks, and increased efficiency.

Artificial Intelligence versus Piaget's Intellectual Development

Cognitive development is a major aspect of human development, and both genetic and environmental factors heavily influence it. Key domains of cognitive development include attention, memory, language skills, logical reasoning, and problem-solving. Piaget's theory of Intellectual development suggests that children move through four different stages of intellectual development which reflect the increasing sophistication of children's thought. Each child goes through the stages in the same order (but not all at the same rate), and child development is determined by biological maturation and interaction with the environment Although no stage can be missed out, there are individual differences in the rate at which children progress through stages, and some individuals may never attain the later stages. Piaget did not claim that a particular stage was reached at a certain age – although descriptions of the stages often include an indication of the age at which the average child would reach each stage. Proposes discrete stages of development, marked by qualitative differences, rather than a gradual increase in the number and complexity of behaviors, concepts, ideas, etc. He disagreed with the idea that intelligence was a fixed trait, and regarded cognitive development as a process that occurs due to biological maturation and interaction with the environment. Children's ability to understand, think about, and solve problems in the world develops in a stop-start, discontinuous manner (rather than gradual changes over time).

Piaget focuses on cognitive development and how children construct knowledge. He proposed universal cognitive stages relatively independent of culture. Piaget sees cognitive conflict (disequilibrium) as a driver for learning. Piaget's theory primarily covers childhood to adolescence. Piaget emphasizes how children learn and understand the world. Based on the above highlight one would conclude that Cognitive development is how a person's ability to think, learn, remember, problem-solve, and make decisions changes over time. This includes the growth and maturation of the brain, as well as the acquisition and refinement of various mental skills and abilities.

The attributes of AI can be described as its abilities and characteristics that enable AI to be much more than just a computer but permit and enable AI to learn, comprehend, and adapt to its surroundings. All these advents were realized based on the human ability to think, and make decision to changes over time as focused by Piaget's cognitive development. The ability of AI to make choices is crucial to many sectors. AI makes use of data analysis as well as pattern recognition in order to come up with accurate and informed decisions. AI systems analyze huge quantities of information, evaluate the potential outcomes and make choices that are usually more precise and objective than human judgment. In the field of healthcare, AI helps doctors make the right decisions regarding patient care, beginning with the diagnosis and ending with treatment plans in the context of complex medical information

With regard to Artificial neural networks, which allow machines to process information, identify patterns and make predictions or decisions based on them. Reasoning is another crucial aspect of Artificial Intelligence. Intelligent systems are able to use available information to make logical decisions and solve complex problems. They can use rules and algorithms to analyze data, extract relevant information and generate desired results or solutions.

Problem solving is the essential skill of artificial intelligence that uses intelligent systems to approach and solve various problems, be they mathematical, logical or related to information processing. They can use specific algorithms and methods to find optimal solutions or make decisions based on the objectives and constraints involved. But putting in mind AI is not human and can perform faster and better than human with less or minimal mistakes.

Artificial Intelligence ignored all the four sequential stages of Piaget theory of learning which he proposed that every human must followed the stages of cognitive development but now a days with the advent of science and technology a machine can performed better than humans. Artificial Intelligence ignored influence of maturation disequilibrium, all these factors that influenced individual to learn it was ignored by machine and performed better than humans

Challenges of Artificial Intelligence in the Education Field

The followings are some of the challenges faced by Artificial Intelligence in the field of educational practice in Nigeria. They are as:-

Inadequate preparedness.

A relevant challenge is the inadequate preparedness of tutors and educational institutes in general (Awofiranye, 2024). Implementing AI requires training a large number of tutors and educational managers to use the system which may not be an easier task. The educational system in Nigeria is not up to date to accommodate such change and thus it remains a challenge.

Privacy and Security Concerns

The collection and analysis of large amounts of personal data from students could pose a risk if it falls into the wrong hands. Institutions must ensure that they are taking appropriate measures to protect students' privacy and prevent data breaches. Because students must interact with the AI-based system which can limit their privacy through aspects such as facial recognition and recommender system (Akgun and Greenhow, 2022). Student privacy can also be compromised if data captured by AI-based education systems lands in the wrong hands such as hackers. Therefore, the privacy of users of AI-based education systems remains a challenge.

Cost

AI systems can be expensive to implement and maintain, which can be a challenge for educational institutions that are already facing budget constraints. Institutions must carefully consider the costs and benefits of implementing AI systems in their classrooms. Provision of the initial outlays for software and cloud support is very costly for educational systems. Not only the costs for continuous employee training are expensive but also ongoing training of the AI system would be costly.

Potential Bias

Another relevant issue is inclusion and ease of accessibility (Awofiranye, 2024). This is because many individuals do not have equal access to technology which can create a disadvantageous position for such individuals. For example, many students in developing countries do not have access to a smartphone or internet connection which can put them in a disadvantageous position compared to those who have such facilities. Besides the socio-economic status of students, geographical location can also be a factor in access to AI-based education.

Ethical Considerations

There are certain challenges related to AI in education. One of the key challenges for AI in education is related to ethics. The ethical issues that can arise while using AI in education are the issues of transparency, fairness, privacy, morality, and removal of bias (Garrett, Beard, and Fiesler, 2020)

Transparency and fairness

AI systems must be transparent, with clear explanations of how they make decisions and why. This can help build trust with students and ensure that they understand the technology. AI-based education systems must be fair, ensuring that all students are treated equally and not discriminated against based on their race, gender, or other factors.

Dehumanization

A big challenge related to the use of AI in education is dehumanize the learning experience (Luan, Geczy, Lai, Gobert, Yang, Ogata, and Tsai, 2020). A decreased dependence on teachers is a challenge since AI despite its capacity cannot replace the need for human teachers. We put this argument since the teacher's role is important not only for education but also for shaping the students' careers. Therefore, AI brings a challenge as a decreased dependence on teachers means a decreased focus on students' moral and personality development (Chiu, Xia, Zhou, Chai, and Cheng, 2023). Another challenge is the inability of students to explore their full potential. This is because if students start depending too much on AI-based education, it will limit their critical abilities including thinking, logic, and memory which is a big drawback. In other words, students will be depending too much on machines which can hinder their learning and making full use of their potential.

Conclusion

In conclusion, Piaget espoused active discovery learning environments in our schools. Intelligence grows through the twin processes of assimilation and accommodation; therefore, experiences should be planned to allow opportunities for assimilation and accommodation. Children need to explore, to manipulate, to experiment, to question, and to search out answers for themselves - activity is essential. And based on the active discovery learning which give birth to Artificial Intelligence that ignored all the four sequential stages of Piaget theory of learning which he proposed that every human must followed the stages of cognitive development but with the advent of science and technology a machine can performed better than humans. This evidently shows the great work of Idealist on human intellectual development.

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