Individualised Education and Artificial Intelligence: Artificial Intelligence (AI)'s Potential to Study Personal Learning Patterns to Adapt Educational Participation

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Abstract. Technology has revolutionised education worldwide, profoundly affecting both learners and educators. Educators have shifted from stereotypical education administration to an individualised learning system that gives learners' preferences and uniqueness the required attention. The researchers conducted this study to investigate the potential of artificial intelligence in enhancing personalised learning. The researchers incorporated constructivist and self-regulating theories to substantiate the significance of the topic. An integrative literature review was conducted to achieve the study's objective and to present a framework that can guide stakeholders in implementing artificial intelligence to advance personalised education. The review revealed that artificial intelligence can facilitate improved engagement, adaptive learning, individualised predictive intervention and support, and inclusivity. The study also found that data privacy, decline in mental brilliance, and lack of AI-driven platforms are all challenges faced in the implementation and use of artificial intelligence in the education sector.

Keywords: Artificial Intelligence; Education; Learning Patterns; Personalised Education; Potential; Participation.

INTRODUCTION

Education is a collection of activities designed to foster critical and analytical reasoning, harness, and develop the innate potential of learners [1]. These processes of harnessing and developing potential have undertaken various forms and patterns over the years, undergoing refinement due to discoveries and innovations aimed at making the learning process more personal and applicable [2].

Education in all its forms (formal and informal) has often required the presence of a physical human guide to facilitate the learning process. It has long been structured in a "one-size-fits-all" model, particularly in learning institutions [3]. However, the peculiarity of learners who are supposed to be groomed and developed to solve unique problems in society requires a system that is personally applicable to their uniqueness and innate capacities [4].

Education has evolved from the traditional approach, where educators designed a single curriculum for all students to follow, to a system where developers create software and applications that support the learning and development of students' innate capacities [2]. The world is shifting towards an education system that preserves and develops students' true identities, rather than requiring them to sacrifice their authentic selves to fit in, thereby enabling greater discoveries and the expression of their genuine selves. It is enthroning a world of limitless innovations and possibilities.

Education in the present day is experiencing transmogrification through the application of information technology [5]. Artificial intelligence is making the learning process more relatable to students through software and applications designed to cater to the uniqueness of their personalities [5]. The application of artificial intelligence in education for effective learning is an emerging field in educational technology, and considerable attention has been directed towards this area over the years [6]. Many artificial intelligence algorithms and educational robots have been developed and have now become fundamental to comprehensive learning and assimilation [6]. They work in real-time, providing answers to learners' curiosities, thereby making their learning process fruitful and applicable. They act as virtual assistants to the learners, mimicking hu-

man behaviour. For example, Khanmigo, developed by Khan Academy in conjunction with OpenAI, offers writing help, tutoring, conversation for better learning, and answers to questions that are Socratic [7]. Delivering GPT-4 capabilities, they provide a personalised experience and support to learners, even in subjects such as mathematics and language learning [5]. There is also Duolingo for language learning [5]. Knewton by Wiley for tracking and analysing the learning patterns and tailoring education content to the needs of students [8]. There is Squirrel AI Adaptive learning, which is personalised, student-centred, and data analytics-driven, designed to bring cutting-edge learning to students [9]. These, and many others, have been developed to make the learning process easier, more relatable, and more applicable for students.

While in their adolescent years, children may be taught similarly in matters of learning basics, such as communication; however, it is essential to observe the different characters they display closely; this will give the tutor or guardian an idea of the best platform or educational system suitable for the child's growth and development.

Global development requires an international approach. Sound and applicable education is at the root of every sustainable development [10]. No single solution can address the myriad challenges a society may face or is likely to face; this is why educators and policymakers should appreciate the uniqueness of individuals by creating platforms and systems that develop diverse human potentials and enable people to meet various needs in society.

Unfortunately, innovation among nations and regions is varied. The application of Artificial intelligence in personal education and human development requires some level of technological advancement. The level of technological application varies significantly among nations worldwide. Hence, many educational systems are still behind– many curricula still fail to address the uniqueness of students.

The days of artificial intelligence are here, and we must appreciate and embrace it. In this study, the researchers aim to explore how artificial intelligence can enhance personal education and enable learners to engage with their time's educational opportunities, ultimately contributing to their development.

The application of artificial intelligence has been ongoing for years, and numerous studies have been conducted in the field. However, the application differs among regions of the world. The study, therefore, employs an integrative literature review to critique and synthesise extant literature on artificial intelligence applications, presenting the benefits of its application and how regions lagging behind can advance their use of artificial intelligence, thereby fostering individual education [11].

Conceptual Framework. This section of the paper examines the concepts presented in the work to clarify their meanings and establish relationships, thereby enhancing the reader's and other stakeholders' understanding.

1) Artificial Intelligence. Artificial intelligence (AI) refers to the ability of computers or machines to perform tasks that humans once considered to be part of their intelligence. AI is a technological advancement where machines can operate with an intelligence created by humans (artificial intelligence). It can process and analyse data to give feedback and opinions on what is asked or fed to it, understand language, recognise patterns, and make suggestions and decisions on behalf of its users [12]. Unlike earlier technologies, which functioned like storage systems by providing only the information programmers fed into them, AI goes beyond simply serving as a search engine. It simulates data, reasoning and critiques information like a normal human would, and processes the data in response to whatever is prompted by its user [13]. The system's algorithm is modelled after the human mind. According to [14], AI is the simulation of human intelligence by machines to display certain behaviours that are unique to humans, such as reasoning, planning, learning, etc. AI refers to the ability of machines to recognise patterns and perform tasks using data and models available [15].

In all of these, it is essential to note that AI is not a monolithic technology. Different layers within the system enable it to function and produce the desired results for users [14]. There are Machine Learning (ML), Natural Language Processing (NLP), Deep Learning (DL), Computer Vision (CV), and others [12]. Machine Learning is the field in AI where machines use statistical models, operations research, neural networks, and other methods to simulate, reason, and assign meaning to the data they receive or the prompts they pro-

cess [12]. Machine Learning functions as the intelligence centre of AI, where machines simulate the data they receive through artificial intelligence. Unlike the technologies that preceded AI's arrival, AI is not programmed to deliver specific results in a predetermined manner. The machine's ability to reason ensures its nuanced responses [14].

Natural Language Processing is the field in AI that enables machines to understand, interpret, perceive, and generate human language [16]. Natural Language Processing (NLP) encompasses various techniques that will allow machines to translate texts, recognise voices, and perform other forms of human language understanding and processing [17]. The methods in NLP include text processing and preprocessing, syntax and parsing, semantic analysis, information extraction, text classification, speech processing, language generation, and dialogue systems, among others [17].

Deep learning is another subfield in AI that utilises neural networks to manage large volumes or multilayers of data, extracting meanings and making decisions [18].

With all these and other capabilities, AI functions to serve users in real-time, processing data, responding to queries, and providing feedback as though a human assistant is at work; this has also been incorporated into educational technologies, and over the years, the learning process for students has become easier, more relatable, and more applicable [19].

2) Individualised Education. Individualised education is a learning approach where the instructional materials or curricula are designed to suit the individual uniqueness and potential of each student [20]. This type of education prioritises and recognises the different capabilities of individuals, which have hitherto remained dormant and untapped. The designers did not create the system to supplant them but to provide an avenue for their expression and development.

Over the years, educational curricula have been designed in a "one-size-fits-all" model [3] that does not prioritise the innate capabilities of learners (individualised education). This situation has negatively impacted society because graduates perform or contribute below their actual capacities when educators and institutions fail to recognise and nurture their strengths. With individualised education, also known as personal education, educators develop the innate capabilities of learners to enable them to contribute positively to society.

The need for individualised education becomes glaring when educators focus on developing learners rather than adhering to an established system. Proper education is one that first creates the person learning, bringing out the true self and deploying inner capacities. With learners coming from varying backgrounds, diverse potentials, different learning paces and strengths, the need for a system that is tailored to suit the peculiarities of learners cannot be overemphasised [20]. Post-industrial education, which incorporates AI into the learning process, favours individualised education, allowing learners to satisfy their curiosity, move at their own pace, and ultimately build upon their innate potential.

Theoretical Framework. The study draws on several theories, and embedding them provides a broader and more tenable perspective on the topic and the findings.

1) The Constructivist Learning Theory. The constructivist theory applies to the study, as it is closely related to education. The theory holds that learners or individuals construct their understanding of the real world through experience and reflection [21]. The theory proposes a learning process where the student is actively involved, rather than being passive. It explains that learners create their knowledge by reconciling their new experiences with what they previously knew [22]. This knowledge reconciliation process involves two key activities: assimilation and accommodation [21]. When learners encounter new knowledge, they compare it with what they already know, using their prior knowledge as a foundation for understanding. If the comparison produces a positive result – meaning the new knowledge aligns with and advances the existing one – they accept it (accommodation). This process clearly shows that the student is the primary creator of his understanding [21].

According to [22], in constructivist learning settings, educators are prepared to ensure that all learners have the opportunity to learn and develop in their unique ways; this means constructivist pedagogy transcends the usual way of transmitting knowledge from teachers to learners. The educator ensures that learners receive the knowledge and support they need to learn and grow at their own pace, within their strengths, and utilise the provided tools to create

their knowledge and understanding of the world [22].

The constructivist theory complements individualised education. The theory recognises that learners create their knowledge through experiences and reflections. A student produces valid and trustworthy knowledge when they follow the scientific process of knowledge creation in their unique way. The role and potential of artificial intelligence in this process are substantial. AI is now like a human assistant, modelled to reason and process data, and provide feedback to users. It is simulated in such a way that, with the right prompts, the learner can operate the AI to give responses tailored to their level and pattern of reasoning; this is equivalent to creating what the students need to learn in a constructivist setting. AI, with its complex and nuanced framework, can attend to all learners uniquely, enabling them to construct their knowledge in a personalised manner.

2) Self-Regulated Learning (SRL) Theory. The self-regulated learning theory is another that is compatible and also emphasises the potential and role of AI in individualised education [23]. Introduced by [24], the theory holds that learners are not passive in the knowledge acquisition process, but are actively involved. According to [23], it is centred on three pillars of the learning process: metacognition, motivation, and strategic action. By metacognition, the theory holds that learners are aware of their areas of strength and challenge and diplomatically leverage their strengths while working to overcome the obstacles. Motivation in the process emphasises that the learners are willing and ready to attempt challenging tasks, exert the required effort, and believe they will succeed with consistency and persistence [23]. Strategic learners possess a repertoire of strategies that they can employ at various times and in diverse situations to achieve their goals. They are flexible and ready to bend at necessary points in the learning process to accommodate emerging knowledge that broadens their mental horizon.

There are many contributions to the development of the theory, and most of the models recognise the cyclical process or different phases involved in the learning process. Learners engage in or undergo the phases of guiding and preserving their thoughts and actions throughout the learning process, from the beginning to the end 25].

The role of AI in learning, as seen through the lens of self-regulated learning theory, is particularly highlighted by its flexibility. AI is flexible enough to adapt to the unique and diverse phases in the process. AI is not programmed to supply fixed answers – it provides nuanced feedback and views on a topic. Its potential in supporting students' metacognition – the drive (motivation) for the student to challenge themself and explore alternative perspective on a matter of discourse through different strategies is enormous and attainable with AI.

Education is a collection of activities designed to develop critical and analytical reasoning in people [1]. A significant part of the process concerns individual (personal) education; this means giving priority to the development of particular individuals within a system is germane. The two theories explored above have reinforced the individualistic paradigm involved in the process, and educational institutions and systems would benefit from considering this when setting out.

METHOD

Research Design. The focus of this study is to explore how the incorporation of artificial intelligence into contemporary learning can enhance students' education. As such, the paper adopts an integrative literature review to comprehensively examine and synthesise the dynamics of AI incorporation into personal education. The study demonstrates that educators and researchers can effectively utilise AI technologies in education to benefit learners, as evidenced by an integrative literature review. This approach can reveal how AI has been beneficial to users in the past, as well as the challenges involved in the process. An integrative literature review extends beyond the traditional haphazard literature review and is sometimes similar to a systematic review, but differs in that it aims to provide new insights or establish a new framework in a specific area of study [26]. The study, therefore, reviews recent peer-reviewed literature relevant to the topic to draw insights and demonstrate how artificial intelligence can enhance personalised education.

Search Strategy. To achieve the study's objective of examining the potential of artificial intelligence to enhance personal learning patterns and adapt educational participation, the researchers conducted an integrative literature review from 2016 to 2025 to gain insight into the topic. The

chosen period is designed to ensure that the knowledge extracted and synthesised from the review is novel and applicable to readers and stakeholders.

The researchers accessed peer-reviewed articles through electronic databases, including Google Scholar, ScienceDirect, JSTOR, Web of Science, and Emerald Insight, and used them for the review. With a focus on artificial intelligence and personal education (education), words such as "Individualised Education" or "Personal Education" And "Artificial Intelligence" or "AI technology": "Potential" or Role" to find studies that are relevant and closely related to the topic under consideration.

Inclusion and Exclusion Criteria. Even though the researchers specified the type of articles needed for the study, the database's algorithm may suggest others that do not meet the expected specificity. To avoid redundancy, the researchers excluded irrelevant articles using the following criteria.

Time frame: For the sake of novelty, the researchers excluded articles whose works, even if related, fell outside the specified period (2016-2025) and included those published within the time frame.

Languages: Although workers in other languages may possess extensive knowledge, due to the targeted locations for which the work is done, only work in English was included.

Types of studies: All works that contribute novel and applicable knowledge, including quantitative, qualitative, mixed, theoretical, and other studies, are included to provide a nuanced view of the topic.

Area of focus: All works reviewed and included for the study addressed the topic.

Method of Literature Synthesis. This study aims to explore how educators and researchers can leverage the potential of AI to enhance personal education. As such, the study employs thematic analysis to identify themes and sub-themes, exploring the possibility of AI in strengthening personal education. The researchers developed the themes by intuitively reviewing the articles [27], exploring and elucidating how AI can cater to individual learning patterns and enhance students' educational experiences.

RESULTS AND DISCUSSIONS

This section of the study presents the findings on how AI can enhance individualised education among learners.

1) What is the Potential of Artificial Intelligence to Enhance Individualised Learning?

1.1) AI Potential for Adaptive Learning: According to [28], AI has the potential to tailor the learning process to meet the demands and study patterns of students. Additionally, [28] presented case studies in which educational institutions incorporated AI to foster learning, and they reported success when adopting AI-powered platforms to enhance adaptive learning, yielding positive results. The learning process is made adaptive through AI, as it provides real-time assistance in diverse ways, tailored to the learners at their own pace [29]. A plethora of studies (qualitative and quantitative) testifies to AI's ability to make the learning process adaptive and personalised.

1.2) Improved Engagement and Curated Feedback: The application of AI in learning has also been found to have increased the engagement level of learners. In a study by [30], which reviewed 45 articles on the effectiveness of AI in education, one area identified was increased learner engagement. Again, [31] in using a mixed-method research approach to assess the efficacy of AI applications in enhancing personal education, found that they led to improved engagement and academic performance among learners. The work of AI is felt in diverse ways, even in education. Still, the report of [32] corroborates the findings of other works on the potential of artificial intelligence to improve learners' engagement.

1.3) Individualised Predictive Intervention and Support: Another potential of AI in enhancing individualised learning is the ability to predict the risk of learners performing poorly and provide timely support tailored to different learners. According to the findings in [33], AI tools implemented for advancing individualised learning were practical and helpful, to the point of predicting at-risk students and providing necessary support early, even for those struggling with their studies. In another study by [34], Researchers found that AI's predictive analysis effectively identifies at-risk students and provides support to advance individualised and personal education. Just as [35], the potential of AI through predictive analysis and time support to enhance in-

dividualised learning is another point that has a plethora of works covering and testing it.

1.4) Accessibility and Inclusivity in Diversity: Despite the neurodiverse learning challenges faced by students, AI tools have the potential to include all in the solutions provided for their betterment. Learners from diverse cultures and native languages worldwide can benefit from AI, which has the potential to cater to their needs and overcome many of the barriers they face. In testing the application of AI in education in Rwanda (Africa), [36] found that AI tools personalise instruction based on the competence level of individual learners, allowing educators to provide individually tailored guidance; this reveals how the system includes all, regardless of personal diversity. [37] researched the impact of AI in advancing inclusivity in education and found that AI has made it possible for more to participate in education globally, overcoming barriers to access. Similarly, [38] reviewed the inclusivity of different individuals with diverse abilities and disabilities in education through AI and found that AI can enable individuals with various disabilities to participate in education, even in impoverished areas, and overcome learning obstacles. In [39], the potential of AI to create a system that includes all persons with different disabilities to participate in education was still found to be positive.

Numerous studies across various regions demonstrate the impact of AI in enhancing individualised learning and creating opportunities for personal education and participation. AI enables virtual tutoring and real-time feedback [40] and integrates teaching models for optimisation and retrieval [41]. The impact and wave of AI are significant and tangible. A great level of progress has been recorded over the years [42]. It is, however, challenging that, with the progress recorded so far, the application of AI in education around the globe is not uniform; this partly accounts for the disparity in the educational levels among regions worldwide in the 21st century [43].

2) Framework for Incorporating AI to Enhance Individualised Learning

Enhancing individualised learning through AI requires a framework that can effectively guide learners. This framework will become effective and productive when it is aligned with the Universal Design for Learning (UDL) [44]. The section provides a framework for aligning AI with UDL that caters to the diverse needs of learners. According to [45], the UDL framework provides equal learning opportunities regardless of background or disabilities, promotes inclusivity, and ultimately supports individualised learning, which AI can enhance. To facilitate individualised education, UDL relies on three principles that define the framework [44].

2.1) Principle of Means of Engagement: This principle addresses the purpose (why) of the whole process. Its focus is on the motivation, interests, preferences, and other aspects of the learners. The strategies under this principle in installing the framework are authenticity and relevance, collaboration and community, and self-regulation and autonomy [46]. The engagement principle emphasises that learning activities must be authentic and relevant to the age, race, gender, disabilities, and background of learners [46]. In terms of collaboration and community, the principle holds that learners should be encouraged to relate with their peers, who are learners with the same or similar interests [46]. Self-regulation and autonomy are key strategies within the framework for sustaining the entire process. Activities such as problem- or project-based learning, collaborative learning, personally relevant project design, and self and peer evaluation [46] are the main drivers of this principle.

2.2) Principle of Representation: This principle deals with the "what" in the framework. In what the students are learning, a good level of perception is essential. AI is a novel individualised learning strategy, and as such, it must be represented with modalities that make it easy for the learners to perceive (visualisation, simulation) [46]. In addition, the learning process must be conducted using symbols and languages that are unique and relatable to individual students [46], and this is where machine learning in AI is genuinely needed. The knowledge attained must be comprehensible and not miss a connection with existing knowledge [45].

2.3) Principle of Action and Expression: Here, the concern of “how” is addressed. The principle is mainly concerned with how AI learning will be incorporated to foster individualised learning, as well as the physical actions and expressions required for the execution of AI literacy. Developing artefacts using AI tools, AI project documentation, AI unplugged activities, authentic assessments, and other strategies [46] are all ap-

proaches that can be employed to actualise this principle.

Educators can enhance individualised learning by understanding the individual preferences and qualities of students. Using the framework above, they can build a sound system complemented by AI to advance personalised learning among students [45].

3) Challenges of AI Application to Enhance Individualised Learning. Despite the numerous benefits of AI in advancing individualised learning, there are challenges encountered that are impeding the greater success of the technology. The section reviews the different challenges identified over time.

3.1) Lack of AI-driven Learning Platforms: One of the drawbacks of implementing AI to enhance personalised education is the lack of platforms that support the successful operation of AI in certain regions around the globe [47]. This disparity in development between regions has led to differences in the level of AI application in various places.

3.2) Diminish critical and analytical abilities: While AI has the potential to enhance personal education, over-reliance on the technology can lead to a state of mental fatigue [48]. The application of AI ought not to induce a state of cognitive decline; instead, it should enhance activities of mental brilliance.

3.3) Challenge of Data Privacy: When incorporating AI to foster individualised learning, using tools like ChatGPT requires users to provide personal information, which poses a risk as people's privacy is exposed [49].

Other challenges to incorporating AI include systemic bias and discrimination. The potential of AI in advancing individualised education is numerous; however, the above difficulties have impeded its applicability and successful operations in different regions.

CONCLUSIONS

In conclusion, the study focused on the potential of artificial intelligence in facilitating individualised learning. The constructivist and self-regulating theories, which accentuate personal education and development, were incorporated to substantiate the relevance of the topic, particularly in the 21st century. The literature review shows that artificial intelligence can enhance individualised learning to match the preferences and unique qualities of different learners. Inclusivity and other potentials are attainable through artificial intelligence in personalised education. However, these potentials are not without drawbacks. Including ethical challenges, the process of artificial intelligence incorporation is fraught with drawbacks.

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