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Evaluating the Impact of AI-Personalized Learning Systems in Higher Education; Examining how They Affect Academic Performance across Different Age Groups at Kumasi Technical University

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Abstract: ***Revolutionizing education by introducing innovative methods to enhance student experiences has birthed Artificial Intelligence (AI). This article provided an in-depth overview of AI's educative and transformative influence, particularly concentrating on learning outcomes for students of all ages at Kumasi Technical University. AI amalgamation in education has enabled modified learning experiences tailored towards each learner's unique needs. The purpose of this study sought to investigate the effects of AI-personalized learning systems on academic performance across different age groups in higher education institution. The researcher employed a quantitative research design, using a face-content verified structured questionnaire to collect data from respondents, with expert consultation. Forty-five students from Kumasi Technical University's engineering and procurement departments were selected using the convenience sampling technique. The findings provided valuable insights into the use of AI-driven personalized learning platforms in higher education. The data revealed higher adoption rates among undergraduates compared to postgraduates, and a greater likelihood of use among men than women, highlighting gender disparities and potential areas for targeted support. The predominant use of AI tools by younger students demonstrated their comfort with emerging technology, while the low participation of older students suggested potential adoption barriers. Statistical analyses (Pearson correlation;*** **(r (43) = 0.166, p = 0.265)** ***and linear regression; (*** **R^2 of 0.03), (F (1, 45) = 1.25, p = 0.265)** ***indicated that age did not significantly correlate with academic success in the context of AI use, despite extensive integration of AI learning systems in academic courses. Contrary to expectations that younger students' engagement with AI tailored***

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learning systems would positively impact their academic performance compared to those over thirty, no significant correlation between age and academic achievement was found. These findings underscore the need for further research into other factors that may influence the effectiveness of AI learning systems.

Keywords: AI-Personalized Learning Systems, Artificial Intelligence (AI), Personalized Learning.

1. INTRODUCTION

Reputable organizations and education academics, like Bransford et al. (2000), Groff (2017), O'Brien et al. (2009), OECD (2006), and Vygotsky & Cole (1978), all believe that education must be learning-centered in order for every student to reach their full potential. A pedagogical strategy known as "personalized learning" adjusts the learning process to each student's unique needs, skills, and interests. It acknowledges that no two students are the same and seeks to give each one a unique learning route (Raza, 2023). The learning-centered paradigm is the result of changes in society and industry. Because the majority of work is knowledge-based, education must embrace individual variations and foster lifelong learning skills (Lee, 2014). Ever since preliminary studies revealed that individualized instructing outperformed cluster education (Bloom, 1984; Salvin & Karweit, 1985), scientists have been looking for technology ways to provide individualized tutoring at a reasonable cost (Lee et al., 2018). Personalized learning (PL) seeks to do this by tailoring teaching, speed, techniques, and material to each individual learner's interests, needs, and objectives, according to Beese (2019), the US Department of Education (2010), and Walkington & Bernacki (2020). The uses of PL are expanding quickly as a result of advances in artificial intelligence (AI) and technology (Chen et al., 2020). According to Wawacki-Richter et al. (2019), AI-driven adaptive learning systems have arisen to give learners with tailored lesson plans, assignments, content suggestions, and automated assessments (Corbett et al., 1997; Maghsudi et al., 2021; VanLehn, 2011). The generally accepted definition of professional learning (PL) as “instruction in which the pace of learning and the instructional approach are optimized for the needs of each learner” (US Department of Education, 2010; revised in 2017) reflects Smallwood's vision. Although individualization is not emphasized in this definition, the AIEd literature frequently presents PL as a technology-facilitated, automated, and customized strategy (Lee et al., 2018; Shemshack & Spector, 2020; Tetzlaff et al., 2021). AI-powered adaptive learning systems have arisen, offering learners individualized lesson plans, assignments, content suggestions, and automated assessments (Corbett et al., 1997; Maghsudi et al., 2021; VanLehn, 2011), as noted by Wawacki-Richter et al. (2019). According to the literature on the application of AI to education (AIEd), personalized adaptive learning systems improve access to high-quality education and outperform the traditional, one-size-fits-all approach (Tetzlaff et al., 2020; Maghsudi et al., 2021; St-Hilaire et al., 2022). However, previous evaluations (Chen et al., 2020; Hinojo-Lucena et al., 2019; Zawacki-Richter et al., 2019) show that the educational underpinnings of AIEd have not been well investigated. There is still great deal to learn about how AI-personalized learning systems affect academic performance across age groups, even if their use in higher education is expanding. Although artificial intelligence (AI) tools offer personalized

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learning experiences and improved learning results, little study has been done to determine whether the age of the learners affects how effective these tools are. It is particularly uncertain if younger students who might be more tech-savvy benefit more from these systems than do older students, who can encounter distinct obstacles to technology use and learning. This discrepancy highlights the necessity for thorough research to assess the varying effects of AI-personalized learning systems on academic achievement across age groups, ultimately guiding the development of more inclusive and efficient teaching methods.
The purpose of this research is to evaluate the impact of AI-personalized learning systems in Higher Education; examining how they affect academic performance across different age groups at Kumasi Technical University.

2. RELATED WORKS

History of AI Personalized Learning Systems

The term Artificial Intelligence (AI) was initially used by John McCarthy in 1956 at the Dartmouth Artificial Intelligence Conference, where top researchers from various fields convened to explore themes such as the derivation of content from sensory inputs, the correlation between randomness and creative thinking, and other topics that advanced the notion of thinking machines. The majority of attendees anticipated the prospect of computers being able to replicate human intelligence, but their primary concern was the means and timing of this development (Michael et al., 2023). Richard D. The dissertation of Smallwood on "teachable machines" in the early 1960s provided a paradigm for individualized learning (Smallwood, 1962). According to Essa (2016), citing Smallwood (1962, pp. 2-3), these gadgets would allow students to study at their own speed, repeat content until mastery is attained, provide rapid feedback, and track their progress. Experiments that demonstrated better educational advantages in 1:1 instruction than in traditional cluster tutoring, known as the 2-sigma issue, spurred the need for customized learning (Bloom, 1984; Salvin & Karweit, 1985).

Availability and Adoption of AI Personalized Learning Systems in Higher Education

A student-centric approach to education, personalized learning recognizes and takes into account the distinctive qualities of every learner. Fundamentally, personalized learning departs from the conventional one-size-fits-all approach by customizing educational content, pacing, and assessment to meet the unique needs of each student. Personalization means that every student is evaluated and instructed separately. To this end, an artificial intelligence (AI) system can be used to evaluate a student's proficiency and choose relevant materials. For example, if a student does not perform well on a particular subject, the subject may be repeated, albeit with a different delivery method (Fatima et al., 2023). The tenets of personalized learning emphasize student agency, flexibility, and adaptability in order to create a dynamic learning environment. The foundation of personalized learning is adaptive information delivery, which is made possible in large part by AI algorithms. These algorithms dynamically modify the level of difficulty and structure of educational materials based on analysis of large datasets that include historical student performance, engagement patterns, and preferences. Artificial Intelligence (AI) prevents boredom and frustration and promotes ideal learning circumstances by continuously monitoring individual development and ensuring that learners receive content that

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corresponds with their current skill levels (Anis, 2023, Khonturaev, 2023, Tapalova & Zhiyenbayeva, 2022). The artificial intelligence system known as ChatGPT was created by Open AI and debuted in 2022 (Chen, 2020; Chokri, 2023). It is intended to speed up conversational user interactions and is based on the GPT-3.5 architecture. ChatGPT can comprehend normal language and provide responses that are human-like. The introduction of ChatGPT has had a big impact on the academic community. It has been a useful tool for academics, teachers, and students in a variety of capacities. In the academic setting, ChatGPT has been used for personalized learning in higher education. According to a U.S. poll (Welding, 2023) of college students, 43% of participants had used ChatGPT or other comparable programs, and 32% of them said they had either used or planned to employ AI technologies to complete assignments. Sixty percent of American students said that their teachers or schools had not yet explained how AI tools may be used responsibly or ethically, and over half (47%) of the students expressed concern about how AI would affect their education. By adjusting information and resources for each student, ChatGPT may offer customized learning experiences. Depending on the individual needs of the student, it can provide clarifications, answer queries, and offer further learning resources. In order to aid with literature reviews, data analysis, and hypothesis development, researchers can use ChatGPT as a virtual assistant.

Trends in Adoption and Usage Frequency of AI Personalized Learning Systems

AI-powered educational technology includes interactive tools, virtual reality, and internet platforms that go beyond the classroom. A special place has been made for artificial intelligence in education. Artificial intelligence is a field of computer science that focuses on the creation of intelligent machines that are capable of learning and solving problems. A wide range of applications, from administrative automation to individualized learning platforms, are included in the integration of AI technologies in educational settings. Artificial Intelligence (AI) has brought about a paradigm change in the field of education by making it possible to create individualized learning experiences that are tailored to each student's needs, preferences, and learning style. (Singh, 2023; Rane, Choudhary & Rane, 2023). According to Brown and Adams (2019), the adoption of AI technologies in education is fueled by advancements in machine learning algorithms and the increasing availability of digital learning platforms. Educational institutions are leveraging AI to offer more personalized and interactive learning experiences, which cater to the diverse needs of students. According to Berker (2018), artificial intelligence (AI) can be broadly divided into two domains: the weak or domain-specific, which concentrates on particular problems, and the strong or general, which has the capacity to carry out general intelligent acts. Strong AI may cause chaos and the extinction of humanity, according to researches like Stephen Hawking. Other AI researchers have suggested that when AI becomes more prevalent in education, it may eventually replace teachers. Unquestionably, artificial intelligence (AI) is permeating the classroom and the way that teachers teach. An increasing number of individuals are becoming aware of the significance of this technology in the field of education as it advances. AI has been applied extensively in the field of education and has demonstrated significant application benefits that have a significant influence on classroom management and the teaching process (Chassignol et al., 2018, Roll & Wylie, 2016).

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Effectiveness and Satisfaction of AI Personalized Learning Systems Higher Education Students

One of the most crucial aspects of AI in education is its capacity to adapt to the particular needs and learning preferences of every learner.

To personalize learning experiences, artificial intelligence (AI) systems examine enormous volumes of data, including student performance, progress, and preferences. This flexibility creates a dynamic and individualized learning environment, going beyond the conventional one-size-fits-all concept. Additionally, AI makes it easier to analyze data in real time, giving teachers' insight into students' comprehension, engagement, and problem areas. AI-powered intelligent tutoring systems provide individualized instruction based on how quickly pupils pick up new material. This not only improves the educational process but also gives teachers insightful feedback that helps them improve their teaching methods (Kabudi, Pappas & Olsen, 2021, Zhai, et al., 2021). One way artificial intelligence (AI) is used in education is to provide individualized learning. AI has altered how educators impart knowledge and how learners absorb it. In order to assist students become more proficient and efficient learners, it can create a personalized learning plan based on their needs and learning environment (Dishon, 2017) offer an immersive learning environment (H. H. S. Ip et al., 2019), and use intelligent learning tracking. Based on big data and machine learning, AI is able to thoroughly assess students' performance on tests and in daily life. It can also offer individualized teaching recommendations for students facing challenging material and issues (Bingham et al., 2016) cutting down on learning time (Quer et al., 2017) and enhancing learning effectiveness (Kong et al., 2019)

AI Personalized Learning Impact on Students' Academic Achievement of Students

Previous research (Tlili A., et al. 2023) has shown that incorporating generative AI, such ChatGPT (Ray, 2023), into college instruction can lead to better academic performance. Students can study in immersive, hands-on environments with generative AI platforms like ChatGPT (Ma et al., 2023) (Pilco et al., 2022). By simulating real-world situations, these technologies help students improve their problem-solving abilities and apply academic information in a practical setting. Artificial intelligence (AI) solutions like ChatGPT have the potential to significantly improve academic achievement by involving students in interactive learning experiences.

Artificial intelligence (AI) tools should supplement human mentoring and instruction, not replace it. Numerous prospects exist for improving academic performance through the incorporation of generative AI like ChatGPT into educational systems (Dimitriadou et al., 2023). For instance, personalized learning based on a student's special skills, interests, and learning preferences can improve motivation, engagement, and conceptual mastery (Yu, 2023). Adaptive learning algorithms facilitate mastery of important subject areas by identifying comprehension gaps and delivering tailored treatments. Additionally, AI can free teachers from the load of administrative work so they can spend more time teaching (Arunachalam et al., 2018).

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3. METHODOLOGY

Premises with a post-positivist foundation state that the study is more in line with statistical methods. Such hypotheses include a deterministic viewpoint, which holds that causes directly impact results, and a reductionist strategy, which divides concepts for simpler analysis. Numeric depictions of patterns, attitudes, and correlations between elements could be acquired by using a descriptive survey approach to collect data directly from a sample of the population. Given that empirical research requires a representative statistical sample, there is an increasing demand for an effective method of determining sample size. To fill the void in the literature, Krejcie & Morgan (1970) created a table for determining sample size for a particular population for easy reference. By employing the Krejcie and Morgan table, the investigator arrived at a sample size of forty-five and he employed that figure for his analysis. The researcher included 37 men, 7 women, and 1 missing individual in his analysis. Convenience sampling was used to select students at Kumasi Technical University studying engineering and procurement. A structured questionnaire with thirteen items divided into four sections was used to collect the data. They included; Demography, Usage of AI Personalized Learning Systems, Academic Achievement and Perceived Impact of AI Personalized Learning Systems on academic success. Face validity was employed to confirm the reliability and consistency of the questionnaire. Face validity involves assessing whether the items seem relevant and appropriate to respondents and experts in the field. Pearson Correlation and Linear Regression analysis were used to examine the relationship between academic accomplishment and AI Personalized Learning systems. As required by study ethics, all participants' informed consent, confidentiality, and anonymity were respected.

4. RESULTS AND DISCUSSIONS

The survey revealed that 14% of respondents were women and 74% were men. According to a study on students' attitudes and use of AI chatbots in higher education across different genders, academic levels, and fields of study (Christian et al., 2024), men were more likely to use AI personalized learning systems. Among academic levels, postgraduate students had the lowest usage at 4%, while undergraduates had the highest at 72%. The age group of 20-24 years made up the largest proportion of respondents at 78%, while only 1% were over 30 years old. Half of the respondents (25 respondents) reported that AI personalized learning systems were present in all their courses, whereas 4% (2 respondents) indicated that no such systems were available. The findings show that a significant proportion of participants 45.8% said that utilizing AI-powered tailored learning solutions in the classroom enhanced their academic performance. This demonstrates how the ability of AI to adapt educational materials to each student's needs and learning preferences may improve student outcomes. However, 41.7% of respondents claimed that their performance remained mostly unchanged as a result of adopting AI technology. According to this research, while AI can help many students learn better, it might not have a major impact on every student's performance. The success of AI systems may vary depending on user differences in learning preferences, engagement levels, and the specific design of the AI tools used. Surprisingly, a smaller subset 12.5% said they performed worse in classrooms using personalized learning systems driven by AI. A substantial majority 59.2%

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said they were appreciative of the enhanced personalization provided by AI technology. Prejudice and justice were raised by 12.2% of respondents, who emphasized the risk that AI systems might exacerbate already-existing inequalities or create new ones. This is a severe problem because, if uncontrolled, biases from society might be present in the data used to train AI systems. Moreover, data privacy and ethics were raised as issues by 28.6% of those polled. Serious privacy problems arise from the huge data collection and analysis of school records by AI systems. Pearson correlation analysis was used to examine the relationship between age and academic performance in AI Personalized learning systems, revealing a weak, non-significant correlation ($r(43) = 0.166$, $p = 0.265$). A linear regression analysis was conducted to predict academic success rates based on age when AI learning systems were used, showing a non-significant result with an R^2 of 0.03 ($F(1, 45) = 1.25$, $p = 0.265$). The regression model explained 3% of the variance in the dependent variable, ($R^2 = 0.03$). The model was not statistically significant. The analysis's conclusions imply that, when AI learning systems are applied, there is no discernible correlation between academic achievement and age. This suggests that, regardless of the students' ages, AI-powered personalized learning systems do not seem to improve academic performance. Other aspects that might affect how well AI learning systems work to improve academic achievements could be investigated in more detail. The results of the study offer an insightful overview of the state of affairs with regard to the application of AI-powered personalized learning systems in higher education. Men (74%) outnumbered women (14%), according to the respondents' gender distribution. This is consistent with other research showing that men are more likely than women to use technology, particularly artificial intelligence (AI) systems (Christian et al., 2024). This gender gap may indicate that more focused outreach or assistance is needed to promote higher female involvement in the use of AI learning technologies. There is a clear difference between undergraduate and graduate students based on the academic level statistics. This data suggests a considerable disparity in the adoption of AI learning systems, with undergraduates accounting for 72% of system users compared to postgraduates' 4%. There could be a number of reasons for this, such as the fact that postgraduate and undergraduate students have distinct expectations and learning requirements. AI personalized learning systems may be especially helpful for fundamental learning and support for undergraduates, who are frequently just starting their academic careers. On the other hand, postgraduate students might be more involved in coursework that is specialized or research-focused, where traditional teaching strategies or cutting-edge research instruments might be more common. Given that 78% of respondents were between the ages of 20 and 24, and only 1% were above 30, the age distribution of the respondents indicates that most users of AI systems are relatively young. Younger students may be more at ease and familiar with developing technology, which may explain this demographic trend and contribute to their better engagement with AI learning systems. On the other hand, the low participation of senior students may indicate adoption hurdles or different learning preferences among experienced students. The investigation clarifies if AI-powered personalized learning systems are used in the courses. The fact that 50% of respondents said that these kinds of technologies were offered in every course they took shows how deeply AI tools have been incorporated into the educational setting. To guarantee greater access and use, it is possible to bridge the gaps in AI deployment, as stated by the 4% of respondents who said they were unavailable. The results of the statistical analysis, including Pearson correlation and

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linear regression, shed light on the association between student success in AI-assisted courses and age. The findings of the Pearson correlation study indicate that, in the context of AI learning systems, age has no discernible impact on academic achievement, with a weak and non-significant link (r (43) = 0.166, p = 0.265). In keeping with this, the results of the linear regression analysis (R^2 = 0.03, F (1, 45) = 1.25, p = 0.265) are non-significant. Contrary to the earlier findings indicating the younger generation employed AI tailored learning systems more than those over thirty, which should have had a comparable favorable impact on their academic work, there is no relevant association between age and academic accomplishment. These results suggest that AI tailored learning systems do not significantly improve academic performance across age groups based on available data confirming an article which contributed to the mounting body of evidence suggesting, in the realm of human-computer interaction, age is an inappropriate metric for differentiating between people especially in the area of task retrieval. (Crabb et al., 2016) This could imply that other elements, including the AI system's quality, student participation, or the particular learning environment, may be more important in deciding how effective these systems are.

5. CONCLUSION

To sum up, the survey results and the studies that followed provide valuable information about the application of AI-powered personalized learning systems in higher education. Men are more likely than women to use these systems, and undergraduates have greater adoption rates than postgraduates. These gender differences highlight different degrees of participation and possible areas for focused support. The limited participation of older students underscores potential adoption constraints, while the preponderance of younger students using AI tools shows their comfort level with emerging technologies. Age does not significantly correlate with academic success in the context of AI use, according to statistical analyses (Pearson correlation and linear regression), despite the fact that AI learning systems are widely available in academic courses. This implies that AI systems do not currently show a discernible effect on improving academic performance in various age groups. These results highlight the need for additional investigation into other variables that may affect how successful AI learning systems are. Examining these systems' unique characteristics, the educational environments in which they are used, and different demographic variables may offer more insights on how to best utilize AI tools to enhance student learning. Through tackling these facets, educators and technologists can gain a deeper comprehension and augment the function of AI in bolstering various student populations and propelling academic success.

6. REFERENCES

1. J. Bingham, J. F. Pane, E. D. Steiner, and L. S. Hamilton, ―Ahead of the Curve: Implementation (MOOCs), ‖ IEEE Trans. Learn. Technol., vol. 12, no. 4, pp. 503–515, 2019, doi 10.1016/j.procs.2018.08.23310.1109/tlt.2018.2878700.10.1177/0895904816637688.

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https://journal.hmjournals.com/index.php/JAIMLNN
DOI: https://doi.org/10.55529/jaimlnn.45.19.29

2. Anis, M. (2023). Leveraging Artificial Intelligence for Inclusive English Language Teaching: Strategies and Implications for Learner Diversity. Journal of Multi-disciplinary Educational Research, 12(6).
3. Arunachalam A.S., Velmurugan T. Analyzing student performance using evolutionary artificial neural network algorithm. Int. J. Eng. Technol. 2018;7(2.26):67–73. doi: 10.14419/ijet.v7i2.26.12537.
4. Beese, E. B. (2019). A process perspective on research and design issues in educational personalization. Theory and Research in Education, 17(3), 253–279. https://doi.org/10.1177/1477878519893963
5. Bloom, B. S. (1984). The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring. Educational Researcher, 13(6), 4–16. https://doi.org/10.3102/0013189X013006004
6. Bloom, B. S. (1984). The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring. Educational Researcher, 13(6), 4–16. https://doi.org/10.3102/0013189X013006004
7. Bransford, J., National Research Council (U.S.), & National Research Council (U.S.) (Eds.). (2000). How people learn: Brain, mind, experience, and school (Expanded ed). National Academy Press.
8. Brown, J., & Adams, R. (2019). Gender differences in technology adoption. Journal of Educational Technology, 15(3), 123-134.
9. Challenges in Personalized Learning School Models, ‖ Educ. Policy, vol. 32, no. 3, pp. 454–489, 2016, doi:
10. Chen, L.; Chen, P.; Lin, Z. Artificial Intelligence in Education: A Review. IEEE Access 8, 75264–75278, 2020.
11. Chen, X., Xie, H., Zou, D., & Hwang, G.-J. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education. Computers and Education: Artificial Intelligence, 1, 100002.
12. https://doi.org/10.1016/j.caeai.2020.100002
13. Chokri Kooli, Research on the ethical challenges associated with the use of Chatbots in education and research was already underway. Sustainability 15(7), 5614, 2023; https://doi.org/10.3390/su15075614.)
14. Christian Stöhr, Amy Wanyu Ou, Hans Malmström, Perceptions and usage of AI chatbots among students in higher education across genders, academic levels and fields of study, Computers and Education: Artificial Intelligence, Volume 7, 2024, 100259, ISSN 2666-920X,https://doi.org/10.1016/j.caeai.2024.100259.
15. Corbett, A. T., Koedinger, K. R., & Anderson, J. R. (1997). Intelligent Tutoring Systems. In M. G. Helander, T.
16. Corbett, A. T., Koedinger, K. R., & Anderson, J. R. (1997). Intelligent Tutoring Systems. In M. G. Helander, T.K. Landauer, & P. V. Prabhu (Eds.), Handbook of Human-Computer Interaction (Second Edition) (pp. 849–874). North-Holland. https://doi.org/10.1016/B978-044481862-1.50103-5
17. Crabb, Michael, and Vicki L. Hanson. "An analysis of age, technology usage, and cognitive characteristics within information retrieval tasks." ACM Transactions on Accessible Computing (TACCESS) 8.3 (2016): 1-26.

Journal of Artificial Intelligence, Machine Learning and Neural Network
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https://journal.hmjournals.com/index.php/JAIMLNN
DOI: https://doi.org/10.55529/jaimlnn.45.19.29

18. Dimitriadou E., Lanitis A. A critical evaluation, challenges, and future perspectives of using artificial intelligence and emerging technologies in smart classrooms. Smart Learn. Environ. 2023;10(1) doi: 10.1186/s40561-023-00231-3.
19. Empowered by AI Technologies,‖ IEEE Trans. Intell. Transp. Syst., vol. 20, no. 10, pp. 3765–3770, 2019, Educ., vol. 26, no. 2, pp. 582–599, 2016, doi: 10.1007/s40593-016-0110-3.
20. Fatima Ezzahraa EL Habti, Mohamed Chrayah, Abdelhamid Bouzidi, Hanae Aoulad Ali, Noura Aknin, "Building a Sustainable E-Learning Ecosystem : Strategies for Long-Term Success", 2023 XIII International Conference on Virtual Campus (JICV), pp.1-5, 2023. doi: 10.1109/tits.2019.2940856
21. G. Dishon, ―New data, old tensions: Big data, personalized learning, and the challenges of progressive education,‖ Theory Res. Educ., vol. 15, no. 3, pp. 272–289, 2017, doi: 10.1177/1477878517735233.
22. G. Quer, E. D. Muse, N. Nikzad, E. J. Topol, and S. R. Steinhubl, ―Augmenting diagnostic vision with AI,‖ Lancet (London, England), vol. 390, no. 10091, p. 221, Jul. 2017, doi: 10.1016/S0140-6736(17)31764-6.
23. H. H. S. Ip et al., ―Design and Evaluate Immersive Learning Experience for Massive Open Online Courses
24. Roll and R. Wylie, ―Evolution and Revolution in Artificial Intelligence in Education, ‖ Int. J. Artif. Intell.
25. K. Landauer, & P. V. Prabhu (Eds.), Handbook of Human-Computer Interaction (Second Edition) (pp. 84874). North-Holland. https://doi.org/10.1016/B978-044481862-1.50103-5
26. Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. Computers and Education: Artificial Intelligence, 2, 100017.
27. Khonturaev, S. I. (2023). The Evolution of Artificial Intelligence: A Comprehensive Exploration For Higher Education. Best Journal of Innovation in Science, Research and Development, 2(11), 700-706.
28. Lee, D. (2014). How to Personalize Learning in K-12 Schools: Five Essential Design Features. Educational Technology, 54(3), 12–17.
29. Leelawong, K., & Biswas, G. (2008). Designing Learning by Teaching Agents: The Betty's Brain System. International Journal of Artificial Intelligence in Education, 18(3), 181–208.
30. M. Chassignol, A. Khoroshavin, A. Klimova, and A. Bilyatdinova, Artificial Intelligence trends in education: a narrative overview, ‖ Procedia Comput. Sci., vol. 136, pp. 16–24, 2018, doi:
31. Ma X., Huo Y. Are users willing to embrace ChatGPT? Exploring the factors on the acceptance of chatbots from the perspective of AIDUA framework. Technol. Soc. 2023; 75(28) doi: 10.1016/j.techsoc.2023.102362.
32. Maghsudi, S., LAN, A., Xu, J., & van der Schaar, M. (2021). Personalized Education in the Artificial Intelligence Era: What to Expect Next. IEEE Signal Processing Magazine, 38(3), 37–50. https://doi.org/10.1109/MSP.2021.3055032

Journal of Artificial Intelligence, Machine Learning and Neural Network
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https://journal.hmjournals.com/index.php/JAIMLNN
DOI: https://doi.org/10.55529/jaimlnn.45.19.29

33. Maghsudi, S., LAN, A., Xu, J., & van der Schaar, M. (2021). Personalized Education in the Artificial Intelligence Era: What to Expect Next. IEEE Signal Processing Magazine, 38(3), 37–50. https://doi.org/10.1109/MSP.2021.3055032
34. Michael Atarah, Nsoh, A, Adablanu, Selorm, 2023/02/01, Artificial Intelligence In Education: Trends, Opportunities And Pitfalls For Institutes Of Higher Education In Ghana, Vl - 12, DO - 10.47760/ijcsmc.2023.v12i02.004, JO - International Journal of Computer Science and Mobile Computing, ER
35. O'Brien, J. G., Millis, B. J., & Cohen, M. W. (2009). The Course Syllabus: A Learning-Centered Approach. John Wiley & Sons.
36. OECD. (2006). Personalising Education. OECD.
37. https://doi.org/10.1787/9789264036604-en OECD.
38. Rane, N., Choudhary, S., & Rane, J. (2023). Education 4.0 and 5.0: Integrating Artificial Intelligence (AI) for personalized and adaptive learning. Available at SSRN 4638365.
39. Ray P.P. ChatGPT: a comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. Internet Things Cyber-Physical Syst. 2023; 3(March):121–154. Doi: 10.1016/j.iotcps.2023.04.003. S. Berker, a Combinatorial Argument against Practical Reasons for Belief, ‖ Anal. Philos., vol. 59, p. 42770, 2018.