ACADEMIA International Journal for Social Sciences
Volume 4, Issue 3, 2025 ISSN-L (Online): 3006-6638

Transforming Education: The Role of Artificial Intelligence in Personalized Learning

Husna Ali
husnaali175@gmail.com
Institute of Education & Research, Women University Mardan, KP-Pakistan

Dr. Farah Khan
drfarah@wumardan.edu.pk
Institute of Education & Research (IER), Women University Mardan, KP-Pakistan,
International Research Fellow, INTI International University, Malaysia

Dr. Maria Khan
maryak9@gmail.com
Department of Education, University of Mainwali- KP-Pakistan,
Beijing Normal University, China
Corresponding Author: * Dr. Farah Khan drfarah@wumardan.edu.pk

Received: 15-06-2025 **Revised:** 28-07-2025 **Accepted:** 15-08-2025 **Published:** 28-08-2025

ABSTRACT

The use of Artificial Intelligence (AI) in education has revolutionized personalized learning. This paper investigates the potential of AI to change the landscape of personalized learning and its applications, advantages, and limitations in delivering customized learning experiences, adapted to the pace and preferences of individual students, considering their particular learning requirements, abilities, as well as their personalized learning styles. Using AI enabled systems, educators can provide personalized learning paths, instantaneous feedback and so they are able to enhance lifelong learning in return, student engagements and resource utilization. The inclusion of AI in personalized learning additionally presents challenges such as equity and access, data quality and bias, and transparency and explainability in decision making involving AI, pointing to the importance of thoughtful, strategic integration to leverage the full potential of AI in personalized learning. However, some challenges including the limitations of data set about history as a subject, teacher training and support, and equity and access need to be resolved in order to successfully get teachers to utilize AI-based personalized learning system.

Keywords: *Artificial intelligence, Education; Personalized learning, Students learning pathways.*

INTRODUCTION

Artificial Intelligence (AI) has resulted in disruptive changes in various fields (Molnar, 2019), including a great impact in the field of personalized learning in education. By tailoring instruction to meet students' unique needs, personalization enables a more personalized educational experience in an effort to improve outcomes for students across the board. How AI is going to transform the education system by replacing the traditional style by an adaptive and personalized type of learning focusing on students' engagement, process-oriented learning, and the quality of the overall learning experience (Kaswan, Dhatterwal, & Ojha, 2024).

Personalized learning is customized instruction that meets the unique needs, abilities, and interests of each student. Individualized learning may have an effect of raising student achievement, as they can learn at their own pace and concentrate more on areas in which they need improvement. Personalized learning, a pedagogical approach in which teaching is customized for each student (National Education Association, 2015). Personalized learning puts students at the center of learning. It has multiple means of learning, so

students can access a number of different learning activities and resources in order to meet their own needs. A student that sees his learning as meaningful is already more motivated to learn (Pitler, Hubbell & Kuhn, 2015) which contributes to students' interest in learning that's meaningful for them.

Artificial intelligence (AI) has become an education game-changer, with the ability to personalize and enrich learning experiences tailored to a person's individual needs and interests at the specific time in which they need it. With intelligent-driven learning solutions, educators will be able to revolutionize learning and teaching realms, to provide an exciting and high-quality learning environment that will intrigue and inspire students themselves to succeed (Zhang, Sun & Deng, 2023). Artificial intelligence technology is a game changer in the computer era and has brought about a revolution in the field of education. AI will be an essential part of that transformation of the curriculum if we are going to build an education system that is relevant and responsive for the future. Because AI allows machines to learn and adapt, traditional school curricula can be transformed into dynamic, personalized programs that meet the specific needs of each student. Using AI to analyze data on a large scale and patterns unmistakable for educators, Instructional design, learning outcome, skills for the modern age building can take place (Renz & Vladova, 2021; Uddin et al., 2024; Khan. 2024; Rienties, Simonsen, Herodotou & Levy, 2020).

AI as a game changer AI stands as a game changer when it comes to personalized learning, and provides personalized learning for each and every student in multiple dimensions. The personalized learning potential for AI support is, more importantly, in offering real-time feedback that allows pupils to dynamically monitor and benchmark their own progress, discern missing links from their pyramid of knowledge, and personalize learning strategies to fit. This real-time feedback system not only fosters a culture of learning-improving but also enables students to take control of their own learning experience. AI has potential to help teachers and students interact effectively and efficiently via automating time-consuming tasks and providing data-driven feedback as well as personalized communication. (Baker, 2016).

Personalized learning is looking increasingly like a cornerstone of education today as it becomes evident that one-size-fits-all doesn't cut it anymore. This approach demands that education systems provide tailored solutions to individual students, catering to their unique needs and abilities. This represents a significant departure from traditional, teacher-centered models. However, the current state of education in many schools, particularly in developing countries, often falls short of being flexible, personalized, and focused on developing essential soft skills, with limited integration of technology (Chiappe, Wills, Uribe & Ternent de Samper, 2020).

The increasing demand for adults to continually update their skills and knowledge to stay competitive in their careers, address personal challenges, or pursue entrepreneurial ventures has sparked a growing interest in creating customized online education programs tailored to their unique needs and characteristics. In today's dynamic work environment, individuals entering the workforce are expected to demonstrate a range of skills beyond academic performance, including collaboration, negotiation, planning, and organizational abilities (Partnership for 21st Century Learning, 2019). AI-powered education enables teachers or intelligent systems to provide tailored instruction to students, catering to their unique learning needs and abilities. This individual approach acknowledges the fact that every student learns in a different way, whether it be visual, experiential, or other types of learning. Through the customization of teaching strategies and content dissemination, AI education can contribute to better outcomes and more efficient, more inclusive education. An AI-based platform from Carnegie Learning is transforming learning with a personalized experience that provides measurably more students with a brighter future. The technology adapts to the student's level of learning input, providing individual feedback, assessment support and guidance specific to their requirements (Kaswan et al., 2024). According to several researchers, the importance of human capital in the form of education, technology,

and digitization are emphasized (Idrees et al., 2021; Rivaldo & Khan, 2024; Khan et al., 2024; Khan et al., 2025; Uddin et al., 2025; Azam, 2025;). The importance of technological revolution, IT and AI cannot be belittled.

Even as personalized learning gains recognition as a practice, schools and districts looking to implement personalized learning still face significant barriers to making it work for students. The present monocausal correspondence between teaching and learning, as in the homogenized educational model, does not adequately take into consideration the varying requirements, capabilities and learning strategies used by individual students. AI technology into personalized learning (PL) has the potential to transform personalized learning but is not well understood currently. This lack of understanding is a barrier for a useful development and deployment of AI-driven personalized learning systems which could otherwise, in turn, to support student outcomes and academic achievement.

The purpose of this study is to present an overview that uses a systematic analysis of the current research on AI in personalized learning and explores the work that has been done, and the practices it adopted. The research will examine AI's role in enabling personalized learning, which may include adaptive assessment, personal learning pathways, and real-time feedback, and the influence of AI interventions on student outcomes (e.g., academic achievement, engagement, and motivation). The paper explores the ethical issues in AI for personalized learning, and gaps from research and practice and future trends that may shape the design and deployment of AI-based personalized learning systems.

This paper is organized into five sections. Part 1 introduces the study, part 2 is a review of literature on the subject, part 3 discusses the data and methodology, part 4 presents results and findings, and part 5 concludes the total study.

LITERATURE REVIEW

This section reviews and discusses the literature on AI in personalized learning and focuses on the main factors, trends, and interventions related to this topic. AI can be instrumental in personalizing learning to fit the needs of a specific student, by providing a teacher with useful information for leading the in-class work (Yuskovych-Zhukoyska, Poplavska, Diachenko, Mishenina, Topolnyk & Gurevych,2022).

Theoretical Framework

Cognitivism

The differences between information and mental processes are that while the former are probably only exogenous (that which derives from outside), mental processes cannot be exogenous only. This strategy acknowledges the importance of memory, motivation and cognitive activity such as reasoning and problem-solving to facilitate learning (Ertmer, & Newby, 2013).

Constructivism

Proposes that learners construct their own new knowledge-building on their prior understanding and prior experience. This approach considers learning to be individualized, fluid and iterative, where learners learn by directly participating through open-ended exploration and self-discovery (Chuang, 2021).

Connectivism

Connectivism defines a learning theory related to the digital age that differentiates it from traditional as well as from constructivism (by mostly bridging knowledge gaps). This theory is particularly adapted to account for complex learning processes, domain specific changes due to learning and the multiple sources of knowledge typical of modern learning environments (Goldie,2016).

Humanism

It is a learning style based on each learner's interests, goals, and passions, unlocking their full potential. This is an approach that revolves around intrinsic motivation, and pushes learners to think for themselves and take control of their learning, rather than to do what is expected of them, or to learn because there is a reward (or the opposite) in it for them (Sharp, 2012).

Applications of AI in Personalized Learning

The use of AI in education involves more than just developing learning resources and tools and is comprised of a wide range of innovations. For tailoring AI mediated learning, scholars can investigate different answers such as mobile learning, educational gaming, social networking-based cooperative learning, MOOCs (massive open online courses), and augmented reality etc., alongside several others (Hamal, Alaoui & Lu, 2022., Del, Oyarvide & Reyes, 2023).

Adaptive learning systems

One of the most noteworthy tasks of AI in education is adaptive learning. These AI-aided systems can dynamically match the difficulty level of instructional content to a student's performance in real time now. This adaptive method aims for students to work at their sweet spot, not too easy, not too hard (Ritter et al 2017).

(AI)-powered intelligent tutoring systems (ITS)

The use of intelligent tutoring systems (ITS) based on artificial intelligence (AI) has transformed the perception of student learning and provided them with personalized individual support. These systems integrate AI algorithms to provide students real-time feedback and guidance, mimicking the experience of working with a human tutor. As a result, with instant feedback, individualized learning is offered by personalized ITS by integrating AI that can result in better student performance, in most cases for students who do not have means to a human tutor or personalized learning. (VanLehn, 2011).

Automated Grading and Feedback

Grading with AI automation Grading tools using AI are transforming the process of assessment by automating the grading process for assignments, quizzes, and exams and giving students instant feedback. This does not only save teachers a lot of time, but can make them concentrate on the more human side of teaching, i.e. advising students. Using AI-supported grading systems allows faculty to spend more time in the high touch, high quality activities known to foster deeper learning, creativity, and critical thinking, and thus, more effective and engaging teaching (Warschauer, 2020).

Natural language processing

The language learning experiences are also greatly enriched by AI-driven Natural Language Processing (NLP) tools. These are also tools based on machine learning algorithms which assess student's language skills to uncover improvement areas. Personalized language practice and feedback. Students learn to improve their language skills faster with personalized feedback and suggestions for improvement, thanks to NLP therapy tools. Such tools can provide some automation to grading and feedback, allowing teachers to concentrate on more hands-on human elements of teaching. NLP tools supported by AI will allow teachers to provide leveraged timely, specific feedback to language learners as the latter build their own language proficiency and achieve their academic success (Heilman, 2017).

Benefits of AI in Personalized Learning

Improved Student Outcomes

AI-enhanced personalized learning platforms that use machine learning models have been demonstrated to significantly improve the outcomes of students, such as academic success and reducing achievement gaps (Ritter, Anderson, Koedinger & Corbett, 2017).

Real Time Feed-back and Continuous Improvement

Feedback in common school or professional teaching settings was often time consuming to the instructor, because he had to review assignments and exams manually. This delay could hinder the learning process, causing students to lose momentum or forget crucial information. However, with the integration of AI-powered systems, students can now receive instantaneous feedback on their assignments. By automating tasks such as grading and administrative work, AI systems enable educators to devote more time and energy to interacting with students, ultimately enhancing the learning experience (Yuskovych-Zhukovska, Poplavska, Diachenko, Mishenina, Topolnyk & Gurevych 2022; Roberts, 2023).

Personalized Recommendation and Targeted Support

AI-powered systems can provide personalized recommendations and targeted support to students, helping them overcome learning challenges and gaps. By analyzing student performance patterns, AI systems can suggest customized resources, such as video tutorials, interactive exercises, and one-on-one tutoring, to support individual learning needs (Pan, Wang & Wang, 2023).

Life-Long Learning

AI systems can facilitate lifelong learning by offering tailored and adaptive learning experiences that enable individuals to learn at their own speed and focus on their unique knowledge gaps and goals (Ally Perris, 2022). In today's rapidly evolving world, lifelong learning has become essential for success. The pursuit of knowledge is no longer confined to traditional classroom settings, but has evolved into a personalized, adaptive, and ongoing process that continues throughout one's life. As recognized by UNESCO (2022), the traditional distinction between a period of learning and a period of application is no longer relevant, as learning is now a continuous and integral part of every stage of life.

Informing Teacher Practice

Personalized learning using artificial intelligence (AI) can support those students who need it most. AIs can process colossal amounts of data to make individual programs for students according to their capabilities and needs (Yuskovych-Zhukoyska, Poplavska, Diachenko, Mishenina, Topolnyk & Gurevych, 2022). This personalized method of instruction supports students who fail to connect with more traditional ways of teaching, offering valuable insights for teachers looking for ways to teach better and support students more effectively.

Optimize Resources

AI in education helps students get personalized resources to address their knowledge gaps, which can reduce classroom time and training costs. AI takes care of the report generation and analysis of metrics, which means instructors can dedicate themselves to creating great educational content. By leveraging AI to manage large datasets, educators can devote more time to high-value activities that enhance the learning experience (Burgos 2020).

DATA AND METHODOLOGY

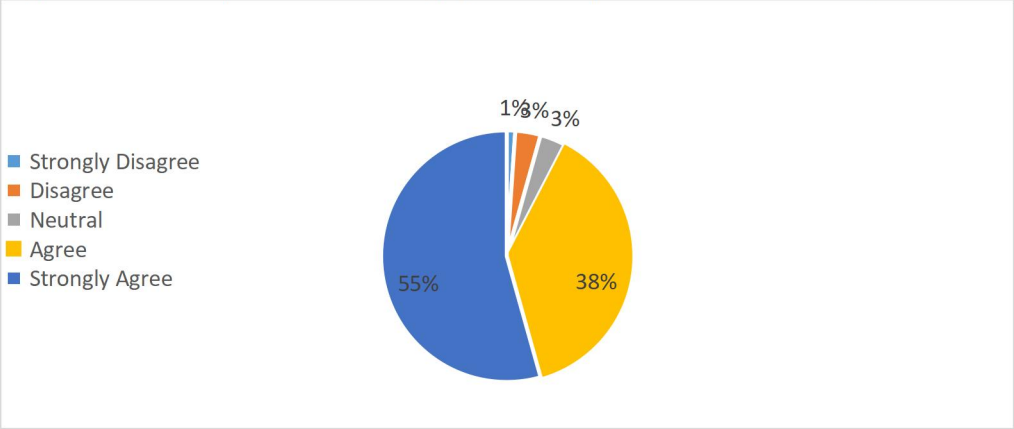
This study employed a quantitative research design, using a questionnaire to collect data. The target population consisted of university students, and a sample size of 100 participants was selected using simple random sampling. A five-point Likert scale questionnaire was used. The questionnaire consisted of 5 questions. Data analysis was performed using SPSS software, and descriptive statistics were used to summarize the data. Measures were taken to ensure the validity and reliability of the data, including pilot testing the questionnaire and using Cronbach's alpha to assess reliability.

RESULTS AND FINDINGS

In Figure 1 based on the results of questionnaire data was collected that 55% of students strongly agreed, 38 % agreed, 3% neutral, 3% disagreed and 1% strongly disagreed about the effectiveness of AI powered learning systems in learning.

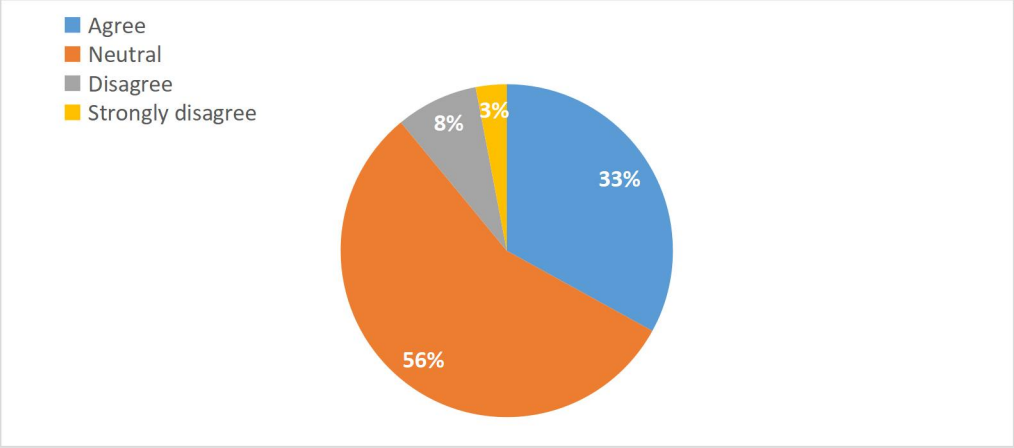
In Figure 2 based on the results of questionnaire data was collected that 33% of students are agreed, 56% neutral, 8% disagreed and 3% strongly disagreed that AI powered adaptive learning systems can help students learn at their own pace.

Figure 1: Can AI powered learning systems help learn more effectively?



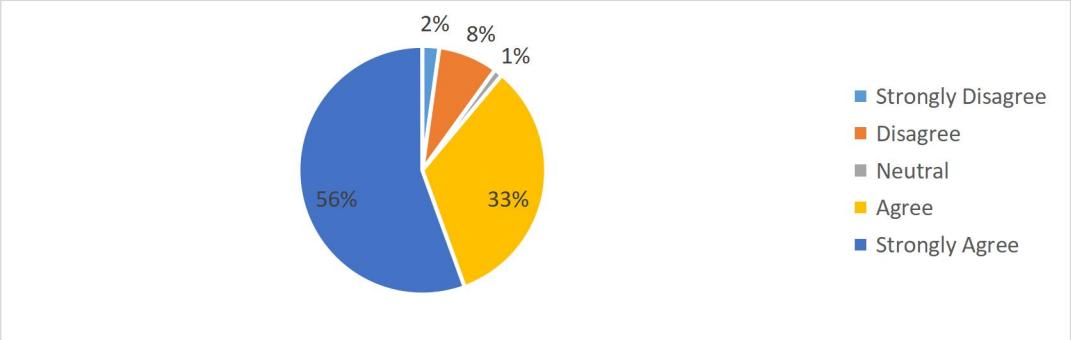
Source: Own work

Figure 2: AI powered adaptive learning systems can help students learn at their own pace



Source: Own work

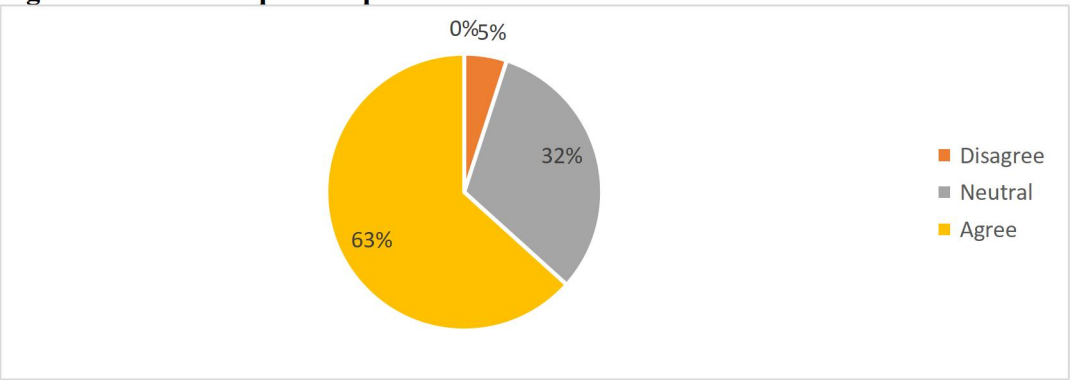
Figure 3: Does AI can facilitate personalized learning by adapting to individual students' needs and abilities?



Source: Own work

In figure 3 based on the results of questionnaire data was collected that 56% of students strongly agreed, 33 % agreed, 1% neutral, 8% disagreed and 2% strongly disagreed that AI can facilitate personalized learning by adapting to individual students' needs and abilities.

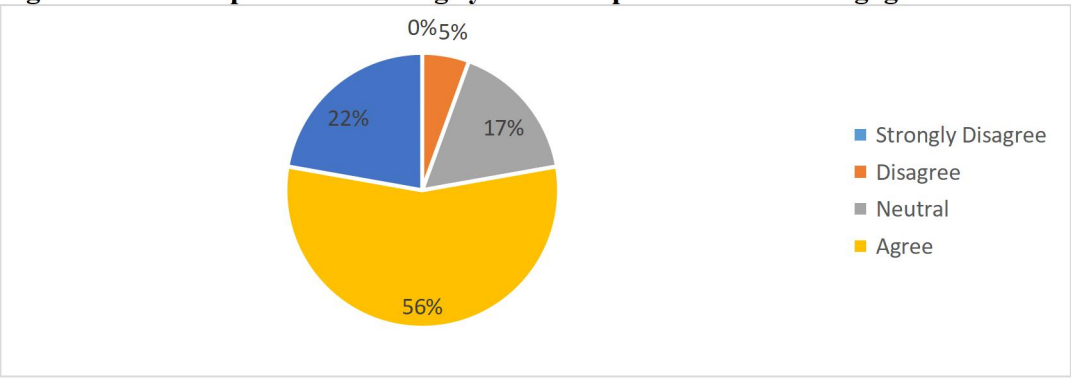
Figure 4: Can AI help develop skills that are relevant to the modern workforce?



Source: Own work

In figure 4 based on the results of questionnaire data was obtained that 63% of students agreed, 32% neutral, 5% disagreed about the development of skills through AI that can help in the modern workforce.

Figure 5: Does AI powered learning systems can promote student engagement and motivation?



Source: Own work

In figure 5 based on the results of questionnaire data was collected that 22% of students strongly agreed, 56 % agreed, 17% neutral, 5% disagreed about the engagement and motivation of students with the help of AI.

CONCLUSION

AI has the potential to play a significant role in personalized learning by providing real-time feedback, and adapting instruction. The role of AI in personalized learning is transformative. The findings suggest that AI-powered learning systems can be effective in enhancing the learning experience. 90% of respondents are agree that AI-powered learning systems can help learn more effectively, facilitate personalized learning, and promote student engagement and motivation. A significant number of respondents believe that AI-powered adaptive learning systems can help students learn at their own pace. The findings also indicate that there is room for improvement in terms of developing skills relevant to the modern workforce. The results indicate AI-enhanced has a strong effect on personalized learning. With the development of AI, its inclusion in education systems has changed the paradigm of how teaching and learning have been learnt, education becomes more inclusive and adaptable to the varied needs of all students.

SUGGESTIONS AND RECOMMENDATIONS

- Policy and decision-makers may consider applying AI empowered personalized learnings systems on conventional educational frameworks to improve students' learning process and outcomes.
- Teachers should be trained and supported to effectively incorporate personalized learning systems using AI into their teaching.
- Equity and Access Educators and policy leaders must attend to issues of equity and access to ensure that all students, irrespective of zip code or school district, have access to AI-driven personalized learning systems.
- Policymakers must invest in and create incentives for AI-enabled personalized learning systems, including research and development, teacher training, and funding for adoptions.

REFERENCES

Ally, M., & Perris, K. (2022). Artificial intelligence in the fourth industrial revolution to educate for sustainable development. *Canadian Journal of Learning and Technology, 48* (4), 1-20. DOI: https://doi.org/10.21432/cjlt28287

Azam Khan, M., Zahir, S., Othman, N. S., & Awan, A. M., (2025). Exploring the synergies between natural resources, technological innovation, and fiscal and monetary policies for promoting environmental sustainability in ASEAN countries. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-025-06263-8

Baker, R. S. (2016). Stupid tutoring systems, intelligent humans. *International Journal of Artificial Intelligence in Education, 26*(2), 349-364.

Burgos D (2020) Radical Solutions and Learning Analytics: Personalized Learning and Teaching through Big Data (London: Springer Nature) 27-8.

Chiappe, A., Wills, A. E., Uribe, I., & Ternent de Samper, A. (2020). 21st-century education or the awakening of the sleeping beauties: A systematic literature review. *EKS*, 21, 1-15.

Chuang, S. (2021). The applications of constructivist learning theory and social learning theory on adult continuous development. *Performance Improvement, 60*(3), 6-14.

Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, and constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 26*(2), 43-71.

Goldie, J. G. S. (2016). Connectivism: A knowledge learning theory for the digital age? *Medical Teacher, 38*(10), 1064-1069.

Idrees, M., Khan, F., & Fauzee. M.S.O. (2021). Analysis of the Effect of Government Expenditures on School Enrollment in Pakistan. Responsible Education, Learning and Teaching in Emerging Economies, 3(1), 27-35

Hamal, O., El Faddouli, N.-E., Alaoui Harouni, M. H., & Lu, J. (2022). Artificial intelligent in education. *Sustainability*, *14*(5), 1–11.

Heilman, M. (2017). Automatic scoring of short answers. *Journal of Educational Data Mining, 9*(1), 1-25.

Kaswan, K. S., Dhatterwal, J. S., & Ojha, R. P. (2024). AI in personalized learning. Advances in Technological Innovations in Higher Education. (1-25).

Khan, F., & Fauzee. M.SO. (2025). A Review study on the Strategic Importance of Human Capital Through Education in Driving Socio-Economic Development. Innovare Journal of Education, 13(3) (20-25

Khan, F., Sarwar, G., Azam, M., Noor, S., & Rehman, Z., (2024a). Assessing the link between environmental quality and life expectancy in developing nations: an empirical analysis for sustainable development. International Social Science Journal. https://doi.org/10.1111/issj.12553

Khan, M. A., Khan, M.A, & Tariq, M., (2025). Do digitalization and innovation accelerate productivity? a comparative analysis of four Asian countries. Lahore Journal of Economics, 29 (2), 91–120. https://doi.org/10.35536/lje.2024.v29.i2.a4

Khan, F., Uddin, I., Don, Y.B. & Awan, A. M., (2024b). Does women's education play a role in sustainable environment in Pakistan? A quantitative approach. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-024-05479-4 (Springer, Impact Factor= 4.7)

Khan, F., Zahir, S., Rahman, H.U., Raza, A., & Noor, S, (2024c). Exploring the role of ICT and education in reducing environmental degradation among Asian countries, Natural Resources Forum, https://onlinelibrary.wiley.com/doi/full/10.1111/1477-8947.12548 (Willey, Impact Factor= 3.3)

Farah Khan, Khan, M.A. & Rahman, H.U. (2024). Perusing sustainable development through education: evidence from Malaysia, Indonesia and Pakistan. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-024-05441-4

National Education Association. (2015). personalized learning: A study of implementation and effectiveness.

Pan, M., Wang, J., & Wang, J. (2023). Application of artificial intelligence in education: Opportunities, challenges, and suggestions. 13th International Conference on Information Technology in Medicine and Education (ITME) 623-627.

Partnership for 21st Century Learning. (2019). Framework for 21st century learning definitions. Available at: https://www.battelleforkids.org/insights/p21-resources/

Pitler, H., Hubbell, E. R., & Kuhn, M. (2015). Using technology with classroom instruction that works. ASCD.

Renz, A., & Vladova, G. (2021). Reinvigorating the Discourse on Human-Centered Artificial Intelligence in Educational Technologies. 11(5), 24-36

Rienties, B., Simonsen, H. K., Herodotou, C., & Levy, J. (2020). Defining the Boundaries between Artificial Intelligence in Education, Computer-Supported Collaborative Learning, Educational Data Mining, and Learning Analytics: A Need for Coherence. 5, 1–5.

Ritter, S., Anderson, J. R., Koedinger, K. R., & Corbett, A. (2017). Cognitive tutors: Lessons learned. *Journal of the Learning Sciences, 26*(3), 377-411.

Rivaldo, H., Khan, F., (2025). The causes of low female literacy rates in developing African and Asian countries: the role of government in driving change. Innovare Journal of Education, 13(4), 1-10

Sharp, A. (2012). Humanistic approaches to learning. In Springer (Ed.), Humanistic approaches to learning. 1469-1471.

Uddin, I., Azam Khan, M., & Tariq, M., (2025). Machine Learning Insights on Inclusive Growth Determinants in Pakistan: Examining the Role of Remittances and Renewable Energy in Achieving SDG-8. Asia-Pacific Financial Markets. https://doi.org/10.1007/s10690-025-09548-0

Uddin, I., Azam, M. K., Tariq, M., Khan, Farah, & Malik, Z.K., (2024). Revisiting the determinants of life expectancy in Asia-Exploring the role of institutional quality, financial development, and environmental degradation. Environment, Development and Sustainability, 26: 11289–11309

UNESCO. (2022). making lifelong learning a reality: a handbook. UNESCO Biblioteca Digital. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000381857

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist, 46*(4), 197-221.

Warschauer, M. (2020). The digital divide and AI in education. *Journal of Educational Computing Research, 56*(4), 419-433.

Yuskovych-Zhukovska, V., Poplavska, T., Diachenko, O., Mishenina, T., Topolnyk, Y., & Gurevych, R. (2022). Application of artificial intelligence in education. Problems and opportunities for sustainable development. *Brain. Broad Research in Artificial Intelligence and Neuroscience, 13*(1), 339-356.

Zhang, X., Sun, J., & Deng, Y. (2023). Design and application of intelligent classroom for English language and literature based on artificial intelligence technology. *Applied Artificial Intelligence,* 37, 1–9.