Emerging Role of AI in Education 5.0: New Paradigms in Education

Akhilesh Balaji*[1] and Karishma Desai[2] and Shweta Loonkar[3]

[1]Merryland International School, Abu Dhabi, akhileshbalaji2008@gmail.com

[2]S.P Jain Global School of Management, Mumbai, India karishmamihirdesai@gmail.com

[3]MPSTME, NMIMS University, Mumbai, India, shwetaloonkar@gmail.com

Abstract:

Purpose: This literature review examines the impact of AI on the development of Education 5.0, a new, revolutionary educational system that prioritizes human-centered learning through Industry 5.0 technologies. This study identifies key challenges, including readiness gaps among faculty for disruptive technology adaptation, the impact of AI on faculty roles, and the impact of AI on pedagogical innovations in the classroom. The findings aim to provide valuable information to educational institutions, technologists, and policymakers, enabling them to address gaps and inform policies related to Education 5.0, ultimately facilitating its development into a more reliable, equitable, and sustainable model for students and educators.

Methodology: Using the PRISMA modeling methodology, we analyzed how AI-driven pedagogical innovations, such as NLP, ML, ITS, LLMs, and Generative AI, enable dynamic adaptation to individual learning patterns, thereby fostering creativity and critical thinking. The research papers cited for this review are exclusively in peer-reviewed sources from Scopus, Web of Science (WoS), and IEEE, ensuring academic rigor, while statistical data is drawn from credible industry reports such as McKinsey, Deloitte, Statista, and Financial Express.

Results: The findings reveal that AI is redefining the role of the faculty, enabling personalized learning at a large scale. The review also identifies that while AI shows promise in enhancing educational access and equity, the lack of infrastructure, training, and long-term impact assessments poses significant challenges for the global adoption of this technology. The study also maps Education 5.0's alignment with the UN SDGs, specifically SDGs 4 (Development of High-quality Education), 8 (Economic Development), and 10 (Reduction in Inequalities).

Conclusion: The review concludes that while AI presents significant opportunities to enhance educational access, equity, and quality, it also introduces considerable challenges. These must be addressed through targeted policymaking, infrastructure development, and the training of educators. The findings provide invaluable information for educational institutions, technologists, and policymakers to close existing gaps and guide the evolution of Education 5.0 into a more sustainable, inclusive, and reliable model.

Keywords: AI, Education 5.0, Higher Education, Personalized Learning, SDGs, AI Ethics in Education

V. Agarwal et al. (eds.), *Proceedings of the Global Innovation and Technology Summit "AAROHAN 3.0"_Engineering Track (GITS-EAS 2025)*, Advances in Engineering Research 295,
https://doi.org/10.2991/978-94-6239-644-9_8

I. Introduction

The system of formal education has been introduced and used to turn students into responsible citizens since the Ancient Greeks around 4 BCE. Since the Greeks, the education system has undergone various transformations across cultures, countries, and continents. This transformation can largely be summed up into five distinct ages (Kalaichelvan, R et al., 2023).

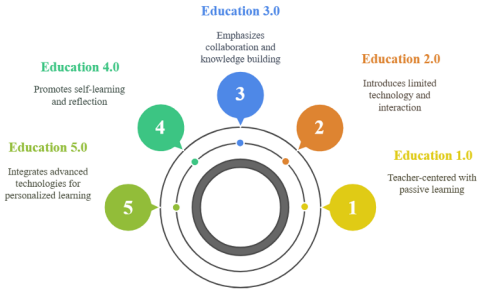

Figure 1. Evolution of Education from 1.0 to 5.0

As per Figure 1, Education 1.0, also known as "essentialist education," is an education method where the teacher is at the center and students are just recipients of knowledge. It is founded on the 3Rs: receive, response, and regurgitation. The student receives knowledge, responds to the learning methods they have learned, and regurgitates what they know from the instructions. Technology is completely forbidden in the classroom (Huk T., 2021). Education 2.0, also known as "Classroom 2.0," is a method of education that improves upon 1.0 by enabling more communication in the classroom and introducing technology in the classroom. However, this interactivity is limited to physical classroom setting. The technology used is only for sharing learning resources, like the use of broadcasting media such as television and radio. Projectors are also used in the class for rendering learning materials via slides (Khan, N. D. R., 2025). Education 3.0 greatly expands on the improvement in 2.0 by fully integrating technology in the classroom. The 3Cs of Communication, Connection, and Collaboration are more emphasized. The focus on individualized, technology-driven learning and creativity (Dr. A. Shaji George et al., 2025). Education 4.0 is an updated system that promotes self-learning and conceptual understanding based on constructivist principles for student learning and teaching. It is a system where self-reflection and understanding of one's learning process are encouraged. Education 4.0 is also the first time that personalized learning started to take shape (Jhonattan Miranda et al., 2021).

However, the COVID pandemic has highlighted new issues related to traditional educational methods. The sudden shift to distance learning has worsened existing discrepancies in education. Before the lockdown, many teachers had little to no knowledge of online teaching pedagogy. As a result, the pandemic has widened gaps between learners, leading to increased inequality (Stanistreet, P., et al., 2020). Therefore, the need for a personalized learning environment and the integration of AI has driven the concept of the fifth revolution in education, commonly called Education 5.0 (Shabir Ahmad et al., 2023). Education 5.0 is a groundbreaking educational system that aims to deliver the highest quality education for each student and better accommodate both gifted learners and students with disabilities using disruptive technologies like AI (Shabir Ahmad et al., 2023). Figure 2 summarizes the five main principles of this new system.

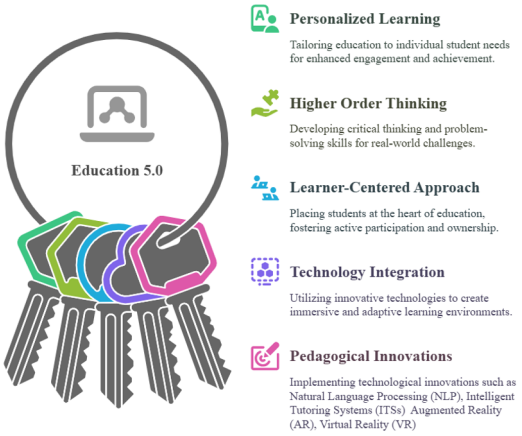

Figure 2. Principles of Education 5.0

There are five basic principles of the system as shown in Figure 2. Personalized Learning (PL) is described as an approach that puts the student at the forefront, aiming to tailor the instructions to each student's needs and past experiences. Although the idea has been envisioned before, having been introduced in Education 4.0, PL used to be viewed as difficult to implement in classrooms for educators and institutions (Lee, D., et al., 2018). However, in the post-COVID world, the growing popularity of digital technologies in educational settings has opened new opportunities for widespread use of personalized learning (Zhang, X., et al., 2018). Technology-supported personalized learning (TSPL) is one of the key pedagogical innovations utilizing PL. According to Schmid, R., et al. (2022), TSPL has been proven to enhance cognitive engagement among students, as it allows for better accommodation of individual needs compared to traditional methods. NLP (Natural Language Processing) is used in generative AI programs such as ChatGPT, Deep AI, Bing AI, Mathbot, and others. These systems leverage machine learning algorithms to analyze and assess students' learning levels based on responses from practice tests, assignments, or other sources, and they deliver tailored feedback in real-time (Smyrnaiou, Z., et al., 2023). AR and VR technologies create entirely new environments that offer students fully immersive experiences. These technologies use computer-generated simulations to create environments that may resemble or be completely different from the real world (S. K. Jagatheesaperumal et al., 2024).

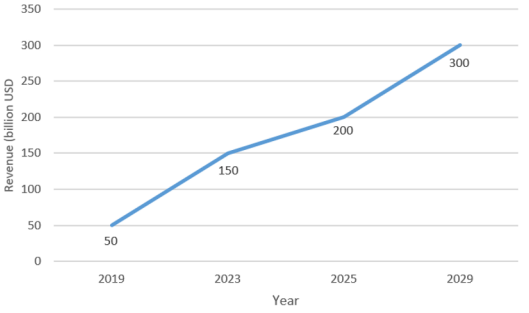

Figure 3. Revenue of the E-learning Market from 2019 to 2029

As shown in Figure 3 and using data from Statista, the e-learning market is rising at a very fast pace. The online education market is projected to reach US$203.81bn in revenue by the end of 2025. With an anticipated annual growth rate of 8.20%, the market is expected to reach a value of US$279.30 billion by 2029.This paper will explore the contributions of Artificial Intelligence (AI) within the emerging Education 5.0 paradigm, focusing on how AI-driven innovations impact pedagogical strategies, faculty roles, and ethical implementation practices. Additionally,

the study aims to assess how Education 5.0 aligns with the United Nations SDGs 4, 8, and 10 via the synthesis of peer-reviewed literature and empirical data using the PRISMA methodology.

Following the introduction, there will be a literature review that covers 4 thematic areas: Evolution of Education Systems, AI-Driven Pedagogical Innovations, Ethical and Operational Considerations, and Implementation of AI. A detailed methodology section explains the use of a systematic literature review (SLR) guided by the PRISMA model. The analysis section is organized according to the three research questions, each accompanied by PRISMA flow diagrams, selected literature, and findings. The paper concludes with a synthesis of key findings and a discussion of identified research gaps, such as the need for longitudinal studies and improved faculty training.

II. Literature Review

A) Evolution of Education Systems

Education 4.0 has previously achieved success in various ways, especially in regards to providing universal access to education with technology, which has led to an increase in literacy rates worldwide. The grading systems in modern education test students not just based on the capacity of the student to absorb knowledge but also their acquired knowledge, skills, and performance in extracurricular activities (Y. Supriya et al., 2024).

However, there are still areas in the education sector that require attention and improvement. Case in point, previous methods oftentimes have failed to fuel curiosity in students' minds, which could further help them pursue their interests (Huk, T., 2021). Students often hesitate to question and point out issues about the existing teaching-learning method, which further enables them to identify possible reasons for gaps between expectation and reality (Y. Supriya et al., 2024). The advancements in technology introduced in Industry 5.0, such as automation technologies and IoT, can be used to develop Education 5.0 (Baskara FXR et al., 2024). Education 5.0, at its core, prioritizes human qualities by identifying skills and roles that are suitable for any individual student (Y. Supriya et al., 2024). To achieve this, Education 5.0 strongly emphasizes a curriculum that not only adapts to a particular student's interests and preferences but also adapts to the student's pace and the demand of the field of interest. (Nitin Liladhar Rane et al., 2024). This ensures that not only can learners slower achieve their targets, but gifted learners can also learn without the progression feeling like a chore (Nitin Liladhar Rane, et al., 2024).

B) AI-Driven Pedagogical Innovations

Disruptive technologies, such as NLP, ML, ITS, and Generative AI, are instrumental to the development and proper execution of Education 5.0. These systems can help to identify the weak areas in infrastructure, management systems, teaching methodologies, and learning environments. (Khan, N. D. R. 2025)

Natural Language Processing (NLP) techniques are used in analyzing student feedback in a text format (Shaik, T., et al., 2022). Speech techniques like BoW, Word Embedding, and Text Evaluation methods such as Text summarization, Document Categorization are used to process written and spoken language to provide useful feedback for learning (Shaik, T., et al., 2022). Intelligent Tutoring Systems use AI systems such as LLMs to provide personalized tutoring for students based on their progress and feedback without the need for teacher intervention. ITSs, by leveraging the previously stated NLP technologies, can be used to track students' progress, assess their psychological state of mind, and their prior knowledge. This will give the information needed to make a complete evaluation of the students' current abilities and weaknesses, which will allow the system to select the required problems for practice (Lin, C.C., et al., 2023). Large Language Models or LLMs are tools that can be used by teachers and students as they can provide personalized explanations to specific enquiries and provide interactive tasks (Chakraborty, S. 2024). A study from Chakraborty S. (2024) on a dataset of essays graded by humans and ChatGPT shows a 0.86 correlation of grading between the 2 datasets. Augmented Reality (AR) and Virtual Reality (VR) are 2 of the most innovative technologies in the modern world. These technologies introduce students to new immersive environments for learning that cannot be replicated through traditional classroom methods (Phakamach et al., 2022). Furthermore, incorporating AR and VR into the classroom has been shown to enhance student engagement and learning outcomes. (Sun et al., 2022). A study conducted by Alizadehsalehi (2021) shows that students who integrate AR and VR technologies into their learning environments often have higher academic motivation and, as a result, they have higher retention of knowledge and higher participation in the lesson. This results in better performance on academic tasks.

***C)* Ethical and Operational Considerations**

Unfortunately, disruptive technologies can also be used by educators or students for nefarious reasons, whether knowingly or not. They can be used to cheat on assignments and/or exams. AI can also exhibit cases of algorithmic bias in grading and feedback. More alarmingly, student data fed to the AI tools can be sold to others, such as advertising companies. Therefore, it is crucial to examine the ethical and operational methods of using AI and its tools to improve education (Smyrnaiou, Z., et al., 2023). Data privacy refers to the laws that protect the rights of users to control how their personal information is handled. As the amount of data collected increases, the concerns of educators and parents should be taken into account to pinpoint potential influences on the use of AI in education (Florea, D., et al., 2020). Frameworks regarding Ownership of research data, Type of consent, reducing the fragmented nature of ethics, and Data portability must be in place to ensure data privacy (Florea, D, et al., 2020).

The implementation and acceptance of AI into education can be negatively impacted by numerous biases that arise during the teaching or grading process. These biases have a profound effect on algorithmic performance, which leads to a lack of confidence in the AI systems and the institution (Barnes, E., et al., 2024). These biases are mostly gender and ethnicity-based based with a study from St George's University found the systems were biased against women and certain ethnicities (Zawacki-Richter, O., et al., 2019). To address these concerns, Steven Umbrello and Ibo van de Poel present an updated version of the Value Sensitive Design laws, one that integrates a recognized philosophy that is intended to act as new standards for AIEd design. This approach is designed to guarantee that the AI systems in use properly enhance the learning experience of the students without causing any harm (Kasif, S. 2020).

***D)* Implementation of AI**

While the future of Education 5.0 seems to be promising, there are a few infrastructure requirements that need to be examined and addressed before the ground-level implementation. The first of these is the system's foundation model, which is a core part of modern AI systems. Foundation models are multifaceted, general-purpose models that are trained on extensive and diverse datasets. These models enable the systems to be fine-tuned to a wide range of downstream tasks (Liang, 2021). Open models are generally trained on a list of public datasets, while closed models keep the precise contents of their training data secret. (Longpre et al., 2023) Secondly, the foundation model should be fine-tuned specifically for an application at a lower cost. (Hu et al., 2021) The availability and quality of fine-tuning training data may affect which tasks can be done accurately and affordably, so institutions should consider what sources of fine-tuning data are available to them and how they can appropriately be used. (Mukk, K., et al., 2024) Thirdly, each call to an AI model sends an input prompt from an application and returns model output, which process called inference. Inference is energy-intensive and requires specialized hardware, so it is often hosted on a specialized hosting platform independent from the application platform. (Longpre et al., 2023) Finally, once a model is available, the user application will run application code to submit prompts to the hosted AI model and perform much of the real work of the overall AI system (Mukk, K. et al., 2024). The following paragraph describes 2 studies that show the practical effect of AI systems. A study that was conducted by Taha, F., et al (2025) involved 130 students in a Lebanese High School over 5 months. The findings suggested that there was a significant improvement in academic performance, ranging from 9.1-18%. The findings also showed that the ADHD percentages of the participants had dropped to zero, while the risks of developing anxiety and depression had decreased. Another study was conducted by J. Han et al (2019) where a total of 107 effect sizes were extracted and analyzed, which involved over 14,000 participants. The findings indicated that the use of ITSs was linked to a higher number of successful students when compared to non-ITS-based learning, such as teacher-led large-group instruction, non-ITS computer-based instruction, and traditional resources such as textbooks or workbooks. The following paragraph discusses the costs needed to build and incorporate the system, as well as the benefits of the system.

The associated costs of implementing such a system start with the purchase of hardware and software that is suitable for supporting AIEd applications. This requires expensive investments towards high-performance computing systems as well as specialized software that has to be made from scratch (Brown, A., 2018). Institutions must also dedicate substantial resources to training staff as the success of AI integration largely depends on ensuring that teachers and administrators have the necessary skills and knowledge (Ananyi, S. O., et al., 2023). Nonetheless, the advantages of personalized learning and self-directed education are significant, improving learning outcomes and addressing diverse student needs. At the same time, AI helps streamline administrative tasks, promoting data-driven decision-making and greater operational efficiency (Ananyi, S. O, et al, 2023). The

table below shows and summarizes the research papers that were used to identify research gaps in these 4 thematic areas.

Table I. Extensive Literature Review Table

Reference	Methodology	Key Findings	Gaps Identified
Lin, C. C, et al., 2023	Systematic review	AI-driven ITS has been shown to improve student engagement and learning outcomes by providing tailored feedback and adaptive learning paths.	There is a lack of longitudinal studies that assess the long-term impact of AI in ITS on student learning and educational sustainability.
Sun, J. C. Y., et al., 2023	Quasi-experimental	Students using the hybrid AR/VR materials reported higher levels of interest in the content compared to the students in the control group. This suggests that immersive technologies can enhance students' curiosity and motivation in learning physics.	The impact of individual differences, such as prior knowledge and learning styles, on the effectiveness of AR/VR materials was not thoroughly examined. Further studies could investigate how these factors influence the outcomes.
Barnes, E., & Hutson, J. 2024.	Mixed-methods approach	The authors found that AI systems often reflect and perpetuate existing biases present in training data, leading to unfair outcomes for marginalized student populations. This highlights the need for rigorous data auditing and bias mitigation strategies.	The paper does not extensively address how AI technologies may alter faculty roles and responsibilities, which warrants further investigation.
Ananyi, S. O., & Somieari-Pepple, E., 2023	Mixed-methods approach	The study revealed that while the initial costs of integrating AI technologies can be significant, the long-term benefits, such as improved administrative efficiency, personalized learning experiences, and enhanced decision-making capabilities, often outweigh these costs.	Further studies should examine how AI solutions can be scaled effectively across different educational systems and what factors influence successful implementation.

This review follows PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) principles while customizing them to fit empirical AI-in-education research, especially involving Intelligent Tutoring Systems (ITS), interpretability, ethics, and scalability. We have followed the sequence of Identification (Research Foundation), Screening (Eligibility Criteria & Scope), Eligibility (Inclusion Criteria), and Inclusion to decide the papers in the final review. After doing the extensive literature review, we have come up with these research questions.

Research Questions

1. How does AI integration affect faculty roles and pedagogical strategies?

2. What are the ethical barriers to scaling AI solutions across different educational systems?

3. How does Education 5.0 integrate with the United Nations SDGs' outcomes?

III. Research Methodology

We conducted a Systematic Literature Review (SLR) to understand the role of AI in Education 5.0 based on the research questions stated above. A SLR is used to examine past and current research to analyze trends, identify gaps, and provide insights for future directions. In this review, Scopus and Google Scholar were chosen to locate relevant articles related to AI in Education 5.0, Ethical barriers, SDGs, etc. IEEE, Taylor & Francis, Springer, Elsevier, and Science Direct are the main publishers of the papers used in the review. For this review, papers from 2018 to 2025 were selected.

A. PRISMA Model Analysis

RQ 1: How does AI integration affect faculty roles and pedagogical strategies?

Keywords (AI, Higher education, Intelligent tutoring systems, Faculty roles, Edtech, Machine Learning)

Analysis

This part of the review investigates the impact of AI integration on faculty roles and pedagogical strategies in higher education.

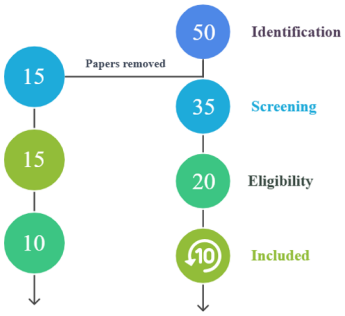

Figure 4. Literature review/PRISMA model process for RQ 1

Following the PRISMA model, a systematic search and screening process was conducted, starting with an initial pool of 40 papers, which were then narrowed down through screening of duplicates and unrelated papers (where 15 are removed, n=35) eligibility assessment using an exclusion criteria (15 are removed, n=20) and final inclusion criteria (10 are removed), resulting in a final selection of 10 relevant studies.

IV. Findings and Results

AI is reshaping the role of faculty, shifting their focus from serving as the main source of information to guiding and supporting the learning process as facilitators. Faculty are increasingly expected to guide and support their students in evaluating AI-generated information, fostering digital literacy, and promoting ethical AI use. As highlighted by Zawacki-Richter et al. (2019), educators themselves need to learn and adapt to the fast-paced, ever-changing landscape and focus on higher-order skills such as analytical thinking, innovation, and complex problem-solving. Additionally, there is a need for professional development to boost faculty confidence in using AI tools effectively (Mah & Groß, 2024).

AI-driven intelligent tutoring systems (ITS), discussed by (Lin, C. C., et al, 2023) and (Hemachandran et al., 2022), enable personalized experiences by altering the methodology and content to fit the student's needs and learning styles. Faculty can utilize these systems to provide targeted support and feedback, freeing up time for more individualized interaction with students. According to the systematic review by Hamd et al. (2023), teachers and faculty members are lacking in adequate education and training programs. Consequently, students report that their general knowledge of AI is quite limited; as a result, they will struggle to use AI in their future careers (Busch et al., 2024). Therefore, teachers and faculty members should be trained on how to use and assimilate AI systems and methodologies into teaching methods. Without well-equipped educators, AI cannot be effectively integrated into teaching and research (Shin et al., 2024).

RQ 2: What are the ethical barriers to scaling AI solutions across different educational systems?

Keywords (AI, education 5.0, higher education, ethical barriers, Privacy, bias, fairness)

Analysis

This part of the review explores the ethical barriers encountered when scaling Artificial Intelligence (AI) solutions across diverse educational systems. It synthesizes findings from recent research to identify key challenges related to bias, fairness, privacy, accessibility, and the potential for exacerbating inequalities. The review also considers the practical and policy-related obstacles that hinder the equitable implementation of AI in education, providing

insights into strategies for promoting responsible AI adoption. Figure 4 shows the process of inclusion and exclusion done for this review using the PRISMA model.

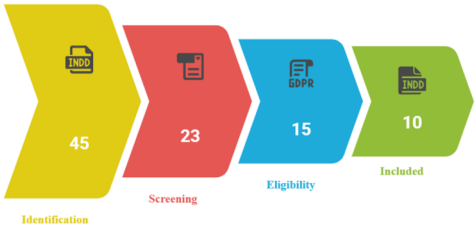

Figure 5. Literature review/PRISMA model process for RQ 2

Following the PRISMA model, a systematic search and screening process was conducted, starting with an initial pool of 40 papers, which were then narrowed down through screening of duplicates and unrelated papers (where 22 are removed, n=23) eligibility assessment using an exclusion criteria (8 are removed, n=15) and final inclusion criteria (4 are removed), resulting in a final selection of 10 relevant studies.

Findings and Results

The equitable scaling of AI solutions requires addressing issues of accessibility and inclusivity, which at times can be arduous. Case in point, the development of ITSs in third-world countries is strenuous at best, as their technological infrastructure remains underdeveloped compared to several first-world and some third-world countries. Resources such as reliable internet, electricity supply, and computing resources are often scarce and expensive, which makes it difficult for ITS to thrive (Dzisah, J.S. 2022). Integration of the system also requires costly investments into infrastructure, training of staff, and ongoing maintenance. Ananyi et al (2023) conducted a cost-benefit analysis of the integration of AI systems in education management. The findings highlighted the importance of considering the economic implications of AI adoption and ensuring that resource allocation is done effectively and equally between different areas.

The implementation also requires the gathering and analysis of extensive student data, which inadvertently raises issues regarding data privacy, as well as potential bias. Yan et al (2024) highlight data privacy as a major ethical concern related to the deployment of LLMs in educational contexts in their comprehensive scoping review. Barnes & Hutson (2024) discuss the different biases present in the algorithms of various AI applications and underline the necessity of addressing these biases. The negative effects of biases include, but are not limited to

- AI bias has the potential to exacerbate existing social and educational disparities, putting certain groups at a disadvantage based on factors such as place of origin, gender, and socioeconomic status (Roshanaei, M., 2024)
- Biased AI can result in incorrect decisions regarding admissions, grading, and student support, which can have a major influence on students' future in education and their careers (Broussard, M. 2023)
- Institutions could encounter legal issues if biased data results in discriminatory practices or breaches norms concerning privacy and fairness (Slimi, Z., et al, 2023)

RQ 3: How does Education 5.0 integrate with the United Nations SDGs outcomes?

The SDGs are 17 interconnected global objectives that aim to tackle the world's most urgent issues, including poverty, inequality, climate change, education, and economic growth, by promoting inclusive and sustainable progress for everyone. Each goal has specific targets and indicators to guide countries and organizations in developing policies and actions that foster a fairer and more resilient future. Figure 5 shows the 17 United Nations SDGs:

Figure 6. United Nations Sustainable Development Goals

Keywords (Education 5.0, SDGs, quality education, economic growth, reduced inequalities, AI in education)

Analysis

This part of the review examines the intersection of Education 5.0 and the United Nations Sustainable Development Goals (SDGs)

Using the PRISMA methodology, we analyzed existing literature to understand how Education 5.0 principles and technologies contribute to achieving these SDGs. Figure 5 shows the inclusion and exclusion process.

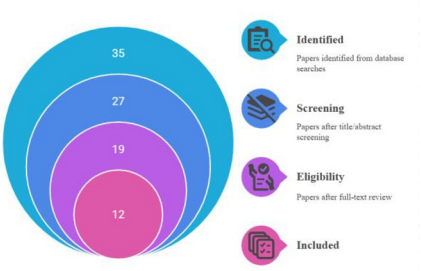

Figure 7. Paper selection for Education 5.0 & SDGs

PRISMA Flow:

1. **Identification:** 35 papers were initially identified through database searches using keywords related to Education 5.0, SDGs (4, 8, and 10), and related concepts.
2. **Screening:** 8 papers were excluded after the initial screening due to irrelevance or duplication, leaving 27 papers.
3. **Eligibility:** A full-text review of the remaining papers resulted in the exclusion of 8 more documents that failed to meet the criteria for inclusion (focus on Education 5.0 and its direct impact on SDGs 4, 8, and 10). This leaves 19 papers.
4. **Included:** 12 papers were deemed suitable for inclusion in the final synthesis.

Findings and Results

SDG 4 seeks to ensure high-quality education, as well as promote opportunities for learning for all.

Arruda, E. P. et al. (2024) point out that the Education 5.0 methodology holds significant potential for advancing the goals set by SDG 4. PL methods can address discrepancies in learning abilities and improve educational outcomes for diverse student populations. Additionally, AI can enhance the efficiency of educational processes, leading to improved learning outcomes and furthering access to high-quality education (Savec, V. F. et al., 2024). However, Holstein, K., et al. (2021) caution that AIEd (AI in Education) could potentially amplify existing inequities if not implemented carefully. They emphasize the importance of addressing issues such as bias in

algorithms and unequal access to technology to ensure that AIEd benefits all students, regardless of their background.

SDG 8 aims to promote long-term, sustainable economic growth, full and productive employment for all.

Togo, M., et al (2021), in their review about the University of Zimbabwe, discuss the role of Education 5.0 in speeding up the implementation of SDGs, including SDG 8. They emphasize the need to align educational programs with labor market needs and to encourage a culture of enlightenment, innovation, and entrepreneurship among students. The impact of this system at the University of Zimbabwe offers useful insights into the difficulties and opportunities of implementing this system within the confines of an institution in a developing country.

SDG 10 strives to decrease inequalities within and between countries.

As mentioned earlier, Holstein, K., et al. (2021) emphasize the importance of addressing equity issues in the incorporation of AIEd. Their review suggests that AIEd has the power to either amplify or reduce inequities in education, based on how the system is designed and implemented. Additionally, PL methodologies of the system can also play a role in decreasing inequalities by providing support to students from disadvantaged backgrounds (Yu, S., et al., 2021). By addressing individual learning needs and offering targeted interventions, personalized learning can help close achievement gaps and promote social mobility (Chairunnisa, N. Z., et al, 2024).

IV. Conclusion and Future Scope

This literature review confirms that AI systems play an important role in optimizing learning experiences and giving high-quality education for both gifted learners and those who require additional support. However, to ensure progress for successful implementation, the faculty at the individual institutions must be familiar with the individual systems and methodologies, and they must transition from their traditional roles as information providers to mentorship positions that can help students navigate the AI-enhanced educational landscapes to ensure successful implementation. This requires professional growth, institutional support, and a rethink of teaching methods and pedagogical strategies. Crucially, these policies' congruence with SDGs 4, 8, and 10 makes them extremely important for global economic and educational transformation.

Future research on this subject must prioritize the development of ethical frameworks that ensure transparency, fairness, and data privacy. Equity-oriented models must be explored to assist resource-scarce institutions in implementing AI effectively in their learning environment and community without widening the inequality. Moreover, integrating AI into other SDGs, such as SDGs 5 and 9, could open new opportunities and result in additional benefits. Longitudinal research is also required to determine whether generative AI fosters independent thinking or increases learner dependency. Finally, effective governance models that link national education policy with Education 5.0 ideals are essential for systemic implementation.

References

1. Kalaichelvan, R., & Subramanian, P. (2023). Historical perspective of education 1.0 to education 5.0. PrakashS. MuniammalM. A. MaruthavananM. Raja Kumar S. Thangavel K. Sundar N.(Eds.), Education, 5, 53-56.
2. Huk, T. (2021). From Education 1.0 to Education 4.0 - Challenges for the Contemporary School. New Educational Review, Article 4.
3. Khan, N. D. R. (2025). Education 5.0 and Sustainable Development. None Dr. Rubeena (N. D. R.) Khan, 1(3), 18–24.
4. Dr. A. Shaji George, Dr. T. Baskar, & Dr.Nataliia Siranchuk. (2025). The Evolution of Education 5.0 in the Innovation Era: A Review of the Progression from Teacher-Centered Learning to Student-Driven Models. Partners Universal International Innovation Journal, 3(1), 19–28.
5. Shabir Ahmad, Sabina Umirzakova, Ghulam Mujtaba, Muhammad Sadiq Amin, and Taegkeun Whangbo1 Education 5.0: Requirements, Enabling Technologies, and Future Directions (2023)
6. Stanistreet, P., Elfert, M., & Atchoarena, D. (2020). Education in the age of COVID-19: Understanding the consequences. International Review of Education, 66, 627-633.
7. Lee, D., Huh, Y., Lin, C.-Y., & Reigeluth, C. M. (2018). Technology functions for personalized learning in learner-centered schools. Educational Technology Research and Development, 66(5), 1269–1302. https://doi.org/10.1007/s11423-018-9615-9
8. Gierl, M., Bulut, O., & Zhang, X. (2018). Using computerized formative testing to support personalized learning in higher education. In R. Zheng (Ed.), Digital technologies and instructional design for personalized learning (pp. 99–119). IGI Global.
9. Schmid, R., Pauli, C., Stebler, R., Reusser, K., & Petko, D. (2022). Implementation of technology-supported personalized learning—its impact on instructional quality. The Journal of Educational Research, 115(3), 187198.https://doi.org/10.1080/00220671.2022.2089086
10. Smyrnaiou, Z., Liapakis, A., & Bougia, A. (2023). Ethical use of artificial intelligence and new technologies in Education 5.0. J Artif Intell Mach Learn & Data Sci, 1(4), 119-124.

11. Jagatheesaperumal, S.K., Ahmad, K., Al-Fuqaha, A., & Qadir, J. (2024). Advancing education through extended reality and the Internet of Everything-enabled metaverses: applications, challenges, and open issues. IEEE Transactions on Learning Technologies, 17, 1120-1139.
12. Supriya, Y., Bhulakshmi, D., Bhattacharya, S., Gadekallu, T. R., Vyas, P., Kaluri, R., ... & Mahmud, M. (2024). Industry 5.0 in smart education: Concepts, applications, challenges, opportunities, and future directions. IEEE Access.
13. Baskara FXR, Vasudevan A, Sain ZH, et al. (2024). Redefining educational paradigms: Integrating generative AI into society 5.0 for sustainable learning outcomes. Journal of Infrastructure, Policy and Development. 8(12): 6385.
14. Nitin Liladhar Rane, Saurabh P. Choudhary, and Jayesh Rane. (2024) Education 4.0 and 5.0: integrating Artificial Intelligence (AI) for personalized and adaptive learning.
15. Shaik, T., Tao, X., Li, Y., Dann, C., McDonald, J., Redmond, P., & Galligan, L. (2022). A review of the trends and challenges in adopting natural language processing methods for education feedback analysis. IEEE Access, 10, 56720-56739.
16. Lin, C. C., Huang, A. Y., & Lu, O. H. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. Smart Learning Environments
17. Chakraborty, S. (2024). Generative AI in Modern Education Society. arXiv preprint arXiv:2412.08666.
18. Phakamach, P., Senarith, P., & Wachirawongpaisarn, S. (2022). The Metaverse in Education: The future of immersive teaching & learning. RICE Journal of Creative Entrepreneurship and Management, 3(2), 75–88.
19. Sun, J. C. Y., Ye, S. L., Yu, S. J., & Chiu, T. K. (2023). Effects of wearable hybrid AR/VR learning material on high school students' situational interest, engagement, and learning performance: The case of a physics laboratory learning environment. Journal of Science Education and Technology, 32(1), 1-12.
20. Alizadehsalehi, S., Hadavi, A., & Huang, J. C. (2021). Assessment of AEC Students' Performance Using BIM-into-VR. Applied Sciences, 11(7), 3225.
21. Barnes, E., & Hutson, J. (2024). Navigating the ethical terrain of AI in higher education: Strategies for mitigating bias and promoting fairness. In Forum for Education Studies (Vol. 2, No. 2).
22. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators?. International journal of educational technology in higher education, 16(1), 1-27.
23. Kasif, S. (2020). Artificial Tikkun Olam: AI Can Be Our Best Friend in Building an Open Human-Computer Society. arXiv preprint arXiv:2010.12015.
24. Liang, Percy (2021). Reflections on Foundation Models. https : / / hai . stanford. Edu / news / reflections-foundation-models. Accessed January 14, 2024. Stanford Center for Research on Foundation Models (CRFM).
25. Longpre, S., Mahari, R., Chen, A., Obeng-Marnu, N., Sileo, D., Brannon, W., ... & Hooker, S. (2023). The data provenance initiative: A large-scale audit of dataset licensing & attribution in AI.
26. Mukk, K., & Klein, S. (2024). AI Infrastructure for Higher Education.
27. Taha, F., Mhanna, R., Harakeh, Z., Awada, S., Assi, R. B., El-Kak, A., & Hatem, G. (2025). Neuro-linguistic programming's impact on academic performance in primary school children at risk of ADHD. Language and Health, 3(1), 100044.
28. J. Han, W. Zhao, Q. Jiang, M. Oubibi and X. Hu, "Intelligent Tutoring System Trends 2006-2018: A Literature Review," 2019 Eighth International Conference on Educational Innovation through Technology (EITT), Biloxi, MS, USA, 2019, pp. 153-159, doi: 10.1109/EITT.2019.00037.
29. Ananyi, S. O., & Somieari-Pepple, E. (2023). Cost-benefit analysis of artificial intelligence integration in education management: Leadership perspectives. International Journal of Economics, Environmental Development and Society, 4(3), 353-370.
30. Brown, A. (2018). Personalized Learning and Artificial Intelligence in Education. Educational Technology Journal, 45(3), 112-128.
31. Ananyi, S. O., & Nwosu, L. K. (2023a). Utilizing artificial intelligence to enhance the economic aspects of Nigerian public universities. In N. P. Ololube, T. Koroye, & D. T. Elisha (Eds.), Proceedings of the 3rd International Conference on Institutional Leadership and Capacity Building in Africa (pp. 383-398), held on 30th July - 2nd August, 2023 at the University Auditorium, University of Africa, ToruOrua, Bayelsa State Nigeria.
32. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators?. International journal of educational technology in higher education, 16(1), 1-27.
33. Mah, D. K., & Groß, N. (2024). Artificial intelligence in higher education: exploring faculty use, self-efficacy, distinct profiles, and professional development needs. International Journal of Educational Technology in Higher Education, 21(1), 58.
34. Lin, C. C., Huang, A. Y., & Lu, O. H. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. Smart Learning Environments, 10(1), 41.
35. Hemachandran, K., Verma, P., Pareek, P., Arora, N., Rajesh Kumar, K. V., Ahanger, T. A., ... & Ratna, R. (2022). Artificial intelligence: A universal virtual tool to augment tutoring in higher education. Computational Intelligence and Neuroscience, 2022(1), 1410448.
36. Busch, F., Hoffmann, L., Truhn, D., Palaian, S., Alomar, M., Shpati, K., et al. (2024). International pharmacy students' perceptions towards artificial intelligence in medicine—a multinational, multicentre cross-sectional study. Br. J. Clin. Pharmacol. 90, 649–661. doi: 10.1111/bcp.15911
37. Dzisah, J. S. (2022). Digitalisation of Basic Services in Ghana: State of Policies in Action and Lessons for Progress.
38. Roshanaei, M. (2024). Towards best practices for mitigating artificial intelligence implicit bias in shaping diversity, inclusion, and equity in higher education. Education and Information Technologies, 29(14), 18959-18984.
39. Broussard, M. (2023). More than a glitch: Confronting race, gender, and ability bias in tech. MIT Press.
40. Slimi, Z., & Carballido, B. V. (2023). Navigating the Ethical Challenges of Artificial Intelligence in Higher Education: An Analysis of Seven Global AI Ethics Policies. Tem Journal, 12(2).
41. Yan, L., Sha, L., Zhao, L., Li, Y., Martinez-Maldonado, R., Chen, G., ... & Gašević, D. (2024). Practical and ethical challenges of large language models in education: A systematic scoping review. British Journal of Educational Technology, 55(1), 90-112.
42. Togo, M., & Gandidzanwa, C. P. (2021). The role of Education 5.0 in accelerating the implementation of SDGs and challenges encountered at the University of Zimbabwe. International Journal of Sustainability in Higher Education, 22(7), 1520–1535.

43. Arruda, E. P., & Arruda, D. P. (2024). Artificial intelligence for SDG 4 of the 2030 agenda: Transforming education to achieve quality, equality, and inclusion. Sustainable Economies, 2(2), Article 34.
44. Savec, V. F., & Jedrinović, S. (2024). Impact of AI Implementation in Higher Education on Achieving the Sustainable Development Goals.
45. Holstein, K., & Doroudi, S. (2021). Equity and artificial intelligence in education: Will "AIEd" amplify or alleviate inequities in education? In Equity in Artificial Intelligence in Education (pp. 1–20). arXiv.
46. Yu, S., & Lu, Y. (2021). An introduction to artificial intelligence in education. Singapore: Springer.