

RESPONSIBLE AND SUSTAINABLE AI IN EDUCATION: OPPORTUNITIES, CHALLENGES, AND GOVERNANCE FRAMEWORKS

Meylina^{1*}

¹STMIK Jayanusa

*Correspondence email: meylina@jayanusa.ac.id

ABSTRACT

The rapid development of Artificial Intelligence (AI) has significantly transformed various sectors, including education, by introducing innovative technologies that support teaching, learning, and educational management. This study aims to examine the educational benefits, emerging challenges, and governance frameworks related to the implementation of AI in education through a literature review approach. The study analyzed selected scholarly articles focusing on AI applications in educational settings, including personalized learning, intelligent tutoring systems, learning analytics, virtual classrooms, and automated assessment systems. The analysis was conducted qualitatively by identifying recurring themes, major findings, and current issues associated with AI-based education. The findings reveal that AI provides substantial benefits in improving learning effectiveness, supporting personalized instruction, increasing administrative efficiency, and enhancing students' engagement and learning experiences. However, the study also identifies several critical challenges, such as ethical concerns, data privacy risks, reduced human interaction, technological inequality, and fears regarding the changing role of teachers in future educational environments. Furthermore, the study highlights the importance of AI governance in education, particularly in relation to policy development, ethical standards, transparency, and responsible technology integration. The findings suggest that while AI has the potential to improve educational quality and accessibility, its implementation should be carefully managed to ensure balanced, inclusive, and ethical educational practices. This study contributes to the growing discussion on AI in education by providing a comprehensive understanding of its opportunities, risks, and governance implications for future educational development.

Keywords: artificial intelligence, educational governance, educational technology, literature review, personalized learning

1. INTRODUCTION

The rapid development of Artificial Intelligence (AI) has significantly influenced various sectors, particularly education. AI generally refers to the ability of computer systems to perform

tasks that normally require human intelligence, such as learning, reasoning, problem-solving, and decision-making (Gan et al., 2023). In the field of educational technology, AI plays an important role in improving the effectiveness and efficiency of teaching and learning processes. In recent years, the integration of AI tools in schools and higher education institutions has increased considerably as educational institutions attempt to adapt to digital transformation and technological advancement (P. Diep et al., 2021; Rwodzi & Jager, 2021). For example, AI has been widely applied through personalized learning systems that adjust learning materials according to students' individual needs and abilities. In addition, intelligent tutoring systems provide automated guidance and support for learners, while automated assessment tools assist teachers in grading assignments more efficiently. Furthermore, virtual learning environments and educational chatbots have become increasingly popular in supporting online learning and facilitating communication between students and instructors (Ardiasih et al., 2023). As a result, the adoption of AI has transformed traditional teaching and learning processes by creating more flexible, interactive, adaptive, and technology-driven educational environments.

However, despite the many advantages offered by AI in education, the growing dependence on AI technologies also raises various opportunities and concerns that require serious attention. On the one hand, AI can improve learning efficiency and accessibility and its implementation may create new educational and social challenges (Holmes & Tuomi, 2022). One major issue is the unequal access to AI technologies between developed and developing countries, particularly in terms of technological infrastructure, internet access, and digital literacy. Consequently, this inequality may widen the educational gap among learners and institutions worldwide. Moreover, the increasing use of AI in education has generated several ethical concerns, including issues related to data privacy, algorithm bias, reduced human interaction, and excessive reliance on technology (Gocen & Aydemir, 2020; Holmes et al., 2019; Sadiku et al., 2021). For instance, AI systems often require large amounts of student data, which may create risks regarding personal information security and misuse of data. In addition, algorithm bias may lead to unfair educational outcomes if AI systems are designed using limited or unbalanced datasets. Furthermore, the extensive use of AI-based learning platforms may reduce direct interaction between teachers and students, potentially affecting students' social and emotional development. At the same time, many educators are concerned that the rapid integration of AI could gradually change the traditional roles of teachers and transform the future structure of classrooms, where technology may increasingly replace certain instructional responsibilities (Ali et al., 2024).

Therefore, understanding the impact of AI in education has become increasingly important and urgent in today's digital era. AI is not only transforming classroom practices but also influencing educational policies and learning systems worldwide. As governments and educational institutions continue to adopt AI-based technologies, there is a growing need for clear guidance regarding the responsible and effective implementation of AI in educational settings (Ali et al., 2024; Williamson et al., 2023). In this context, educational institutions must carefully balance the potential benefits of AI with the possible risks and challenges associated with its use. Moreover, the urgency of this issue is closely related to the rapid expansion of

global digital transformation and the ongoing discussions surrounding Industry 4.0 and Society 5.0, where technology plays a central role in human activities and educational development. Consequently, governance frameworks have become essential to ensure that AI integration in education remains ethical, transparent, inclusive, and beneficial for all stakeholders. Such frameworks are important for addressing issues related to privacy, fairness, accountability, and the changing roles of teachers and learners in AI-supported educational environments.

In line with these developments, recent studies have shown a significant increase in academic discussions and publications related to AI in education (Ali et al., 2024; Huang et al., 2021; Sadiku et al., 2021; Williamson et al., 2023). Many researchers have highlighted AI as a promising solution for improving various aspects of educational systems at both national and international levels. In particular, AI has been widely associated with the development of personalized learning, which enables learning materials and instructional approaches to be adjusted according to students' individual needs and abilities. Furthermore, researchers have emphasized the role of AI in learning analytics, where educational data can be analyzed to monitor student performance, predict learning outcomes, and support decision-making processes in education. AI technologies have also been recognized for improving teaching efficiency through automated assessment systems, intelligent tutoring systems, and virtual educational assistants. In addition, many studies have discussed the potential of AI to increase educational accessibility by supporting flexible and technology-based learning environments. More recently, the development of AI-supported educational platforms and adaptive learning systems has accelerated alongside the rapid expansion of online learning and digital education trends (Mihaela Băiceanu et al., 2026). As a result, AI is increasingly viewed as an important component of future educational transformation in response to the demands of modern digital society.

Previous studies have extensively discussed both the positive and negative impacts of AI implementation in education. Many researchers have reported that AI contributes significantly to improved learning outcomes by providing adaptive and personalized instruction that accommodates students' different learning needs, abilities, and preferences. In addition, AI technologies have been shown to support teachers in various instructional and administrative tasks, such as grading, monitoring student progress, and delivering learning materials more efficiently (Al-Khresheh, 2024). Furthermore, intelligent tutoring systems, educational chatbots, and AI-supported learning platforms have helped create more interactive and flexible learning environments. Nevertheless, alongside these benefits, several studies have also highlighted important challenges related to AI adoption in education. Ethical concerns, including data privacy, algorithm bias, and transparency issues, remain major topics of discussion in the literature (Al-Khresheh, 2024; Huang et al., 2021). Moreover, some researchers argue that excessive dependence on AI technologies may reduce direct social interaction between teachers and students, potentially affecting students' communication and emotional development (Garzón et al., 2025). Technological inequality has also been identified as a significant issue, particularly for institutions and learners in developing countries with limited access to digital infrastructure and AI resources. In short, earlier findings suggest that

although AI offers considerable opportunities for improving educational quality and efficiency, its implementation also presents complex challenges that require careful management and balanced policy development.

Despite the growing number of studies on AI in education, several important gaps can still be identified in the existing literature. Previous research has generally focused on specific aspects of AI implementation separately, such as technical applications, educational benefits, or ethical concerns (Ali et al., 2024; Gan et al., 2023; Kim et al., 2024). For example, some studies mainly examined the effectiveness of AI technologies in improving learning outcomes and teaching efficiency, while others concentrated on ethical issues such as data privacy, algorithm bias, and security risks. Although these studies provide valuable insights, only a limited number of researchers have comprehensively discussed educational benefits, emerging challenges, and governance frameworks simultaneously within a single analysis. Therefore, a more comprehensive review is necessary to provide a balanced understanding of both the opportunities and risks of AI integration in educational systems.

Based on the gaps identified in previous studies, this research seeks to provide a more comprehensive understanding of AI implementation in education by examining both its opportunities and challenges within educational systems. In particular, this study focuses on identifying the major educational benefits and challenges associated with the integration of AI in teaching and learning processes. Furthermore, the study also investigates the governance frameworks that are necessary to support ethical, responsible, and effective AI integration in educational environments. Therefore, the main research questions addressed in this study are: (1) What are the major educational benefits and challenges of AI implementation in education? and (2) What governance frameworks are necessary to support ethical and effective AI integration in educational systems? These questions are expected to guide the analysis and contribute to a broader understanding of AI-based educational transformation.

This study aims to provide a comprehensive analysis of the implementation of Artificial Intelligence (AI) in education by examining its benefits, challenges, and governance aspects. The study explores how AI can enhance learning effectiveness, support personalized instruction, assist teachers, and improve educational accessibility. The study also identifies key challenges associated with AI adoption, including ethical issues, data privacy concerns, technological inequities, and the changing role of teachers in modern learning environments. Furthermore, the study examines a governance framework that can support the responsible, ethical, and effective use of AI in education. The findings are expected to contribute to academic discussions on AI-driven educational transformation by integrating educational, technological, and societal perspectives into a single analysis. From a practical perspective, the study provides useful insights and recommendations for educators, schools, and higher education institutions regarding the effective and responsible use of AI in teaching and learning. From a policy perspective, the study offers guidance for policymakers in developing appropriate AI governance strategies related to ethics, data protection, transparency, and equitable access to technology. This study also highlights its originality by presenting a

balanced analysis that combines educational benefits, implementation challenges, and governance considerations, which are often discussed separately in previous studies. Furthermore, the study examines the broader societal impacts of AI, including ethical issues, digital inequalities, and changes in educational practices and human interactions. Through this integrated approach, the study contributes to a deeper understanding of how AI can be implemented responsibly and sustainably to support the development of inclusive and effective education in the digital age.

2. LITERATURE REVIEW

Artificial Intelligence (AI) has been widely recognized for its significant contributions to improving learning outcomes in educational settings (Huang et al., 2021; Marzuki et al., 2023; Sadiku et al., 2021). In particular, AI-based systems such as personalized learning platforms and adaptive learning technologies have enabled instruction to be tailored according to individual learners' needs, abilities, and learning pace (Al-Khresheh, 2024). Moreover, intelligent tutoring systems and various AI-powered learning support tools have further enhanced student engagement by providing real-time feedback and guidance (Hooda et al., 2022). In addition, AI has been increasingly utilized to assist teachers in instructional delivery as well as to improve administrative efficiency, including tasks such as grading, student monitoring, and learning management (Akinwalere & Ivanov, 2022). Overall, previous studies consistently highlight that AI contributes positively to educational innovation and learning effectiveness. However, despite these strengths, existing research tends to be limited in terms of contextual diversity, as many studies focus on specific educational settings without considering broader variations. Furthermore, there is still a lack of long-term impact analysis, which limits understanding of AI's sustained effects on education quality and learning outcomes.

In contrast to its benefits, the implementation of AI in education also presents several emerging challenges that must be carefully addressed. First, ethical issues such as data privacy, transparency, and algorithm bias remain major concerns in the development and use of AI systems (Mihaela Băiceanu et al., 2026). Furthermore, social challenges have been identified, particularly related to the reduction of human interaction between teachers and students as well as increasing dependency on technology in learning processes (Garzón et al., 2025). Additionally, digital inequality between regions and educational institutions continues to be a significant barrier, especially in developing countries with limited technological infrastructure (Sri Ardiasih, 2023). Another important concern is the potential transformation of teacher roles, where educators may need to adapt to new responsibilities in AI-supported learning environments (Ali et al., 2024). While previous studies have successfully identified these key risks and challenges, their analyses are often fragmented and focus on isolated issues. Consequently, there is still a lack of integrated discussion that comprehensively examines the interconnected challenges of AI in education.

Alongside benefits and challenges, AI governance frameworks have become an essential aspect of AI integration in education systems. AI governance refers to the set of principles,

policies, and regulatory mechanisms designed to ensure the ethical, transparent, and responsible use of AI technologies in educational contexts (Mihaela Băiceanu et al., 2026). In this regard, various policies and regulations have been developed to support ethical AI implementation, particularly concerning data protection, accountability, and fairness in decision-making processes. Moreover, institutional readiness plays a crucial role in ensuring that schools and universities are capable of effectively integrating AI technologies into their educational practices (Akinwalere & Ivanov, 2022). Previous studies have contributed positively by proposing ethical guidelines and policy recommendations for AI use in education. Nevertheless, these studies often lack practical implementation models that can be directly applied in real educational environments. In addition, there is limited comparative analysis across different countries, which restricts understanding of how AI governance frameworks operate in diverse global contexts.

However, despite these valuable contributions, several limitations can still be observed in previous studies. First, many existing studies lack an integrative approach, as they tend to examine AI in education from isolated perspectives rather than as a unified system (Rasul et al., 2023). Second, there is limited synthesis that simultaneously combines educational benefits, emerging challenges, and governance frameworks within a single comprehensive framework (Gocen & Aydemir, 2020). Third, previous research often shows insufficient connection between AI implementation, educational processes, and broader societal impacts, such as equity, digital inequality, and changes in social interaction. As a result, there remains a need for more holistic studies that can bridge these fragmented perspectives and provide a more comprehensive understanding of AI in education.

In summary, the existing literature on Artificial Intelligence (AI) in education provides important insights into its benefits, challenges, and governance aspects, thereby contributing significantly to the development of educational technology research. However, as highlighted in previous sections, these studies are often fragmented and do not sufficiently integrate educational benefits, emerging challenges, and governance frameworks into a single comprehensive analysis. Consequently, this limitation justifies the need for the current study, which aims to provide a more holistic and systematic synthesis of AI implementation in education. Furthermore, by addressing the identified research gaps, this study seeks to offer a more balanced understanding of how AI can be effectively and responsibly integrated into educational systems. Therefore, the following section presents the research methodology used to systematically analyze and synthesize the relevant literature in order to achieve the objectives of this study. This following flowchart provides a table-based visualization representing the theoretical framework of Artificial Intelligence (AI) integration within educational governance systems.

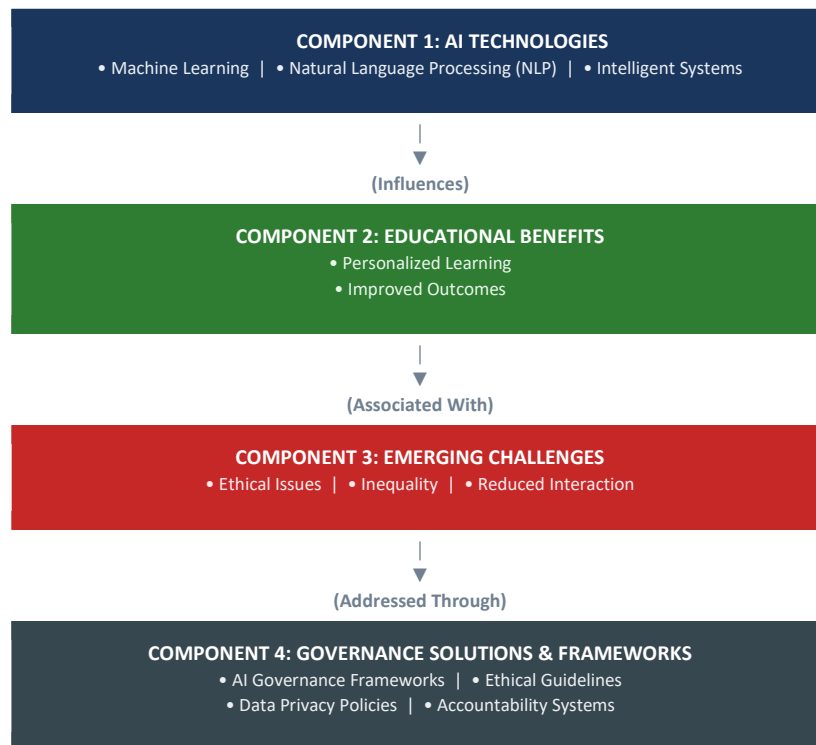


Figure 1. Conceptual Flowchart Diagram

3. METHODS

This research uses a qualitative approach with descriptive methods. This approach was chosen because the research aims to understand and explain the use of Artificial Intelligence (AI) in education and the various challenges and opportunities that arise in the digital learning process (Al-Khresheh, 2024; Mihaela Băiceanu et al., 2026). Descriptive research is used to describe conditions and phenomena related to the use of AI in education without conducting specific treatments or experiments (Miles et al., 2014; SurveyMonkey, 2024). Through this approach, researchers can explain the relationship between technology, education, and social values in greater depth.

The research design used was a literature review (Grygorenko & Naydonova, 2023). The research was conducted by collecting and analyzing various scientific sources related to AI in education, the ethics of technology use, academic integrity, and the concept of human-centered learning. Data sources were obtained from journal articles, conference proceedings, academic books, and education policy documents published in recent years. Sources were selected based on topic suitability, publication credibility, and relevance to the research objectives.

The population in this study was 15 scientific literatures discussing the use of AI in education. Meanwhile, the research sample consisted of academic articles and documents specifically discussing the role of AI in learning, ethical challenges, educational technology governance, and the social impact of AI use. The sample was selected using a purposive sampling technique, selecting sources deemed most relevant to the research focus. Inclusion

criteria for this study included publications discussing AI in the context of higher education and digital learning, while sources not directly related to the research topic were excluded.

Table 1. Scientific Literatures on Artificial Intelligence in Education, Educational Challenges, and Governance

No	Author(s) & Year	Focus of Study	Method/Approach	Contribution to This Research
1	Holmes, Bialik, & Fadel (2019)	AI applications in educational systems	Conceptual and policy review	Provides theoretical foundation for AI integration in education
2	Zawacki-Richter et al. (2019)	Systematic review of AI in higher education	Systematic literature review	Identifies trends, benefits, and research gaps in AI-based education
3	Luckin et al. (2016)	Intelligence Unleashed: AI and future learning	Educational technology framework	Explains AI potential for personalized learning and adaptive systems
4	Chen, Chen, & Lin (2020)	AI use in smart learning environments	Review study	Supports understanding of AI-driven digital learning innovation
5	Dave (2025)	Ethical implications of AI in education	Systematic review	Highlights ethical challenges and responsible AI practices
6	Baiceanu et al (2025)	AI literacy in education	Qualitative review	Explains the importance of AI literacy for teachers and students
7	Williamson & Eynon (2023)	Governance and policy of AI in education	Critical policy analysis	Provides governance perspectives for educational AI systems
8	Selwyn (2022)	Social consequences of educational technology	Critical educational analysis	Discusses inequality and ethical concerns in digital education
9	Nair et al (2023)	Challenges of ChatGPT in higher education	Descriptive review	Explains risks of plagiarism and academic dishonesty
10	Gan et al. (2023)	Opportunities and risks of large language models in education	Interdisciplinary review	Supports analysis of AI benefits and ethical risks
11	UNESCO (2021)	AI ethics and governance in education	International policy framework	Provides global guidelines for ethical AI implementation
12	Jesus et al. (2026)	Human-centered learning and AI integration	Educational perspective study	Emphasizes maintaining human interaction in AI-supported learning

No	Author(s) & Year	Focus of Study	Method/Approach	Contribution to This Research
13	Garzon et al. (2025)	Systematic review of AI in education	Bibliometric and systematic review	Identifies recent developments and educational impacts of AI
14	OECD (2021)	Digital transformation and AI policy in education	Policy report	Explains governance strategies and digital equity issues
15	Holmes & Tuomi (2022)	State of AI in education and future directions	Conceptual review	Supports sustainable and responsible AI integration frameworks

Source: Secondary Data Processed (2026)

Data collection was conducted through documentation studies, reading, recording, and categorizing important information from various selected sources (Sukmawati et al., 2023). The obtained data was then analyzed using content analysis techniques. The analysis process identified key themes such as the benefits of AI in learning, challenges of AI use, academic integrity, and the importance of technology governance in education. The results of the analysis were used to explain how AI can be used wisely while still supporting human-centered learning.

4. RESULTS AND DISCUSSION

4.1 The major educational benefits and challenges of AI implementation in education

To better understand the growing role of AI in education, it is important to examine both the opportunities it offers and the challenges that accompany its implementation. This discussion highlights the educational benefits of AI while addressing key concerns that may impact the effective and responsible use of AI in learning environments. The integration of Artificial Intelligence (AI) in education has transformed the relationship between technology, learning processes, and social values.

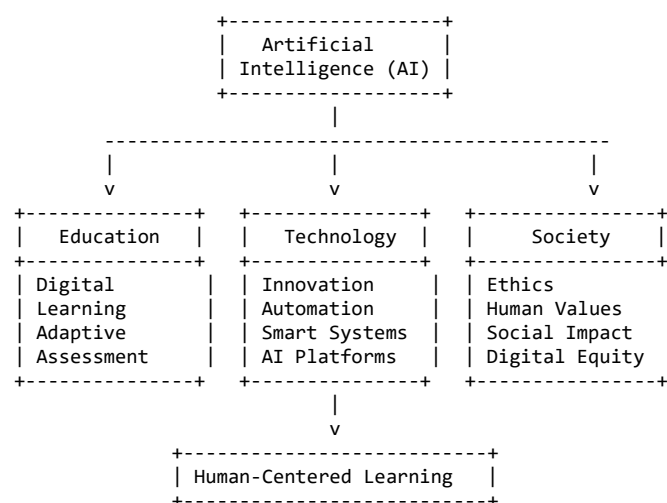


Figure 2. Relationship Between AI, Education, and Society

Figure 2 illustrates the relationship between artificial intelligence, education, technology, and society. AI has become an important part of modern education because it supports digital learning, adaptive assessment, and access to information (Al-Khresheh, 2024; Ali et al., 2024). At the same time, AI is closely related to technological innovation and social issues such as ethics, human values, and digital equity. The figure highlights the use of AI in education should not only focus on technology, but also consider human interaction and social responsibility (Mokoena, 2013). Therefore, human-centered learning becomes an important approach to balance innovation and educational values.

Furthermore, the implementation of AI in education is closely connected to broader technological and social developments. AI does not only influence teaching and learning activities, but also affects ethical considerations, human interaction, and digital equity (Gan et al., 2023; Khalifa & Albadawy, 2024). On the other hand, the increasing dependence on AI raises concerns regarding reduced social interaction, unequal access to technology, and the ethical use of digital systems (Owusu et al., 2024). Therefore, the relationship between AI, education, and society demonstrates that technological advancement must be accompanied by social responsibility and ethical awareness.

In this context, human-centered learning becomes an essential approach to balance innovation and educational values. This approach emphasizes that technology should support, rather than replace, the role of teachers, communication, and critical thinking in the learning process (Darojat et al., 2023; Saidalvi & Fakhruddin, 2021). In addition, human-centered learning encourages educational systems to maintain empathy, collaboration, and moral responsibility while integrating AI technologies (Mihaela Băiceanu et al., 2026). The findings indicate that AI integration should not only focus on efficiency and automation, but also preserve human values and promote responsible educational practices.

While AI offers numerous benefits, such as personalized learning and increased educational efficiency, it also raises concerns regarding ethics, privacy, and equity. Therefore, a balanced understanding of the opportunities and challenges is crucial for the responsible integration of AI. Table 2 presents the key benefits and challenges of AI implementation in educational settings.

Table 2. Benefits and Challenges of AI in Education

No	Benefits of AI in Education	Challenges of AI in Education
1	Faster access to information	Risk of plagiarism
2	Flexible learning process	Overdependence on technology
3	Personalized learning support	Decreasing critical thinking
4	Automated assessment system	Reduced human interaction
5	Better learning efficiency	Digital inequality
6	Support for online learning	Ethical issues in academic work

The table presents the main benefits and challenges of AI in education (Akinwalere & Ivanov, 2022; Al-Khreshah, 2024; Dave, 2025; Gocen & Aydemir, 2020; Kim et al., 2024; Rasul et al., 2023). The findings show that AI can improve learning efficiency and provide flexible access to educational resources. AI also supports personalized learning and helps teachers in academic assessment. However, the use of AI also creates several challenges. Students may become too dependent on technology, which can reduce critical thinking and creativity. Ethical issues such as plagiarism and misuse of AI-generated content are also major concerns in higher education. In addition, unequal access to digital technology may widen the gap between students from different social and economic backgrounds.

As educational institutions increasingly adopt AI-based technologies, it becomes important to evaluate how these systems influence learning effectiveness, academic integrity, and human interaction (Ali et al., 2024; Williamson et al., 2023). In terms of educational benefits, AI improves access to information and supports more flexible learning processes. Students can access educational materials quickly through digital platforms, which increases learning accessibility and efficiency. Moreover, AI supports online learning environments and enables personalized learning experiences by adapting content to students' individual needs and learning styles. Automated assessment systems also help teachers provide faster feedback and reduce administrative workloads. Consequently, AI contributes to more efficient and adaptive educational practices that support modern digital learning demands.

Nevertheless, the implementation of AI also presents several important challenges. As shown in Figure 2 and Table 2, the increasing use of AI may encourage plagiarism and academic dishonesty through the misuse of AI-generated content. In addition, excessive dependence on technology can reduce students' critical thinking, creativity, and problem-solving abilities (Garzón et al., 2025). AI-based learning systems may also decrease direct interaction between teachers and students, which is an essential element of effective education. Furthermore, digital inequality remains a major issue because not all students have equal access to technological facilities and internet connectivity (Loi et al., 2022; Sri Ardiasih, 2023). Ethical concerns regarding data privacy, responsible AI usage, and academic integrity also continue to emerge alongside technological advancement.

These findings indicate that AI provides substantial advantages for learning accessibility and efficiency; however, uncontrolled dependence on technology may negatively affect creativity, ethics, and academic responsibility. Therefore, educational institutions should balance technological innovation with human-centered educational practices that prioritize communication, critical thinking, and moral values. In this context, ethical guidelines for AI implementation are necessary to ensure responsible technology use in academic environments. Additionally, teachers and students should strengthen digital literacy and develop a deeper understanding of ethical AI usage to support sustainable and responsible educational development (Ali et al., 2024).

4.2 Governance frameworks in supporting ethical and effective AI integration in educational systems.

Given the growing influence of AI on teaching, learning, and educational management, developing an appropriate governance framework has become a critical priority. Effective AI governance can help educational institutions maximize the benefits of AI while minimizing potential risks related to ethics, privacy, bias, and unequal access to technology. Furthermore, a governance framework provides guidance for stakeholders in implementing AI in a manner that is transparent, accountable, and aligned with educational goals. To address these concerns, Table 3 proposes a governance framework that integrates key governance dimensions necessary for the responsible and sustainable use of AI in education.

Table 3. Proposed AI Governance in Education

Aspect	Description	Expected Outcome
Academic Policy	Guidelines for responsible AI use	Better academic integrity
Digital Literacy	AI training for students and teachers	Responsible technology use
Ethical Awareness	Understanding ethics in digital learning	Reduced misuse of AI
Human-Centered Learning	Maintaining interaction between teachers and students	Balanced learning process
Technology Access	Improving digital facilities and internet access	More inclusive education

Table above explains several important strategies for AI governance in education. Educational institutions need clear academic policies to regulate the use of AI in teaching and learning activities (Ali et al., 2024; Huang et al., 2021). Digital literacy training is also important to help students and teachers use AI responsibly. Ethical awareness should be strengthened to reduce academic dishonesty and misuse of technology (Ali et al., 2024; Khalifa & Albadawy, 2024). In addition, the concept of human-centered learning is necessary to maintain communication and interaction in the learning process. Improving access to digital facilities can also help reduce inequality in technology-based education.

Several governance strategies are necessary to support effective AI integration in education. First, academic policies should provide clear guidelines regarding responsible AI use in learning and assessment activities (Mihaela Băiceanu et al., 2026; Rasul et al., 2023). These policies are important to prevent misuse of AI-generated content and to maintain academic integrity. Second, digital literacy training for teachers and students is required to improve understanding of AI technologies and encourage responsible technology usage (Kim et al., 2024; Oyetade et al., 2023).

The above discussion highlights several critical concerns regarding the adoption of AI in education. These issues need to be addressed to ensure the responsible and effective use of AI technology in learning environments. Figure 3 provides an overview of the key issues in AI-based education.

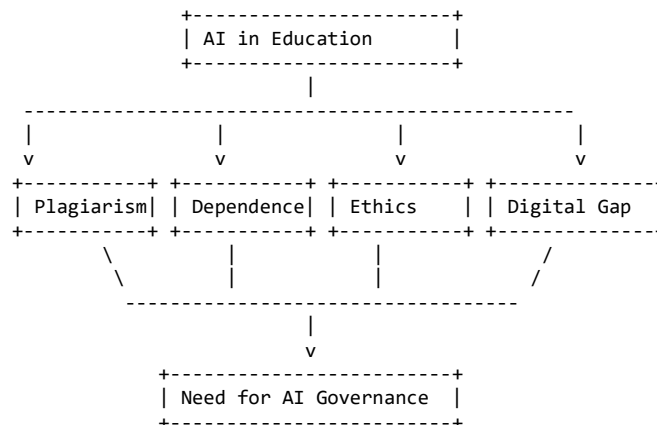


Figure 3. Main Issues in AI-Based Education

Figure 3 synthesizes the principal issues identified in the literature on AI-based education, including ethical challenges, digital inequality, data privacy concerns, and the evolving role of teachers and learners. The use of AI creates several educational challenges, including plagiarism, dependence on technology, ethical problems, and digital inequality (Al-Khresheh, 2024; Huang et al., 2021). These problems show that AI cannot be used without clear guidance and supervision. Educational institutions need to develop proper AI governance to ensure that technology is used ethically and responsibly (Ali et al., 2024; Dave, 2025; Khalifa & Albadawy, 2024). Effective governance can help maintain academic quality and support sustainable digital education.

The importance of governance frameworks becomes more evident when considering the major issues associated with AI-based education. As presented in Figure 3, plagiarism, technological dependence, ethical problems, and digital inequality are among the primary challenges requiring institutional regulation and supervision (Ali et al., 2024; Garzón et al., 2025). Without proper governance, AI may weaken academic honesty, reduce critical thinking skills, and increase disparities between students with different levels of technological access (Williamson et al., 2023). Therefore, governance frameworks play a significant role in balancing technological innovation with educational responsibility and social fairness.

The study's findings indicate that effective AI governance is crucial to ensuring the responsible and sustainable integration of AI into education. Clear policies, ethical guidelines, digital literacy, and equal access to technology help maintain academic integrity, inclusivity, and transparency. The study also revealed that AI offers significant benefits, such as increased accessibility, personalized learning, flexibility, and greater educational efficiency. However, its implementation can pose challenges, including plagiarism, technology dependency, a decline in critical thinking skills, and digital inequality. Therefore, educational institutions and policymakers must establish appropriate governance frameworks to maximize the benefits of AI while minimizing its risks. These findings further emphasize that human-centered learning remains crucial, as AI should support, not replace, the role of teachers, human interaction, and critical thinking in the educational process.

5. CONCLUSION AND LIMITATION

In conclusion, this study demonstrates that Artificial Intelligence (AI) has an important role in transforming modern education through personalized learning, flexible digital instruction, automated assessment, and improved learning efficiency. At the same time, the findings reveal that AI implementation also creates significant ethical and social challenges, including plagiarism, technological dependence, reduced critical thinking, and digital inequality. Therefore, effective governance frameworks are necessary to ensure responsible and sustainable AI integration in educational systems. Academic policies, ethical guidelines, digital literacy, and human-centered learning approaches are essential to balance technological innovation with educational values and social responsibility. This study contributes to the understanding of how AI, education, and governance are interconnected in the context of digital learning development. However, this research is limited by its reliance on secondary data from literature sources, which may not fully represent practical implementation in different educational contexts. In addition, the study does not examine specific quantitative impacts of AI usage on learning outcomes.

Therefore, future research is recommended to conduct empirical studies involving teachers, students, and educational institutions in order to analyze the practical effectiveness, ethical implications, and long-term impact of AI integration in education more comprehensively.

6. REFERENCES

- Akinwalere, S. N., & Ivanov, V. (2022). Artificial Intelligence in Higher Education: Challenges and Opportunities. *Border Crossing*, 12(1), 1–15. <https://doi.org/10.33182/bc.v12i1.2015>
- Al-Khresheh, M. H. (2024). The Future of Artificial Intelligence in English Language Teaching: Pros and Cons of ChatGPT Implementation through a Systematic Review. *Language Teaching Research Quarterly*, 43(October), 54–80. <https://doi.org/10.32038/ltrq.2024.43.04>
- Ali, O., Murray, P. A., Momin, M., Dwivedi, Y. K., & Malik, T. (2024). The effects of artificial intelligence applications in educational settings: Challenges and strategies. *Technological Forecasting and Social Change*, 199, 123076. <https://doi.org/10.1016/j.techfore.2023.123076>
- Ardiasih, L. S., Meylina, M., & Rahmiaty, R. (2023). An Analysis of Distance Learners' Technological Competence on Moodle-Based Learning Experiences. *International Research-Based Education Journal*, 5(1), 18. <https://doi.org/10.17977/um043v5i1p18-32>
- Darojat, O., Idrus, O., & Ardiasih, L. S. (2023). Disruptive Change and Learning Innovations: Challenges and Opportunities for Universitas Terbuka. *Turkish Online Journal of Distance Education*, 24(3), 60–70.
- Dave, A. (2025). The Ethical Implications of AI in Education. *The Ethical Implication of AI in Education*, 5(1), 1–8. <https://doi.org/10.31305/rjss.2025.v05.n01.001>
- Gan, W., Qi, Z., Wu, J., & Lin, J. C. (2023). Large Language Models in Education : Vision and Opportunities. *Computer Science*. <https://arxiv.org/abs/2311.13160>

- Garzón, J., Patiño, E., & Marulanda, C. (2025). Systematic Review of Artificial Intelligence in Education : Trends , Benefits , and Challenges. *Multimodal Technologies and Interaction*, 1–19. <https://doi.org/https://doi.org/10.3390/mti9080084>
- Gocen, A., & Aydemir, F. (2020). Artificial Intelligence in Education and Schools. *Research on Education Media*, 12(1). <https://doi.org/10.2478/rem-2020-0003>
- Grygorenko, Z., & Naydonova, G. (2023). Theoretical and Practical Aspects of Modern Psychology. *Public Administration and Law Review*, 2(14), 76–85. <https://doi.org/https://doi.org/10.36690/2674-5216-2023-2-76-88>
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education* (pp. 151–180). Globethics Publica- tions. <https://doi.org/10.58863/20.500.12424/4276068>
- Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *Eur Journal Education*, 1–29. <https://doi.org/10.1111/ejed.12533>
- Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial Intelligence for Assessment and Feedback to Enhance Student Success in Higher Education. *Mathematical Problems in Engineering*, May. <https://doi.org/10.1155/2022/5215722>
- Huang, J., Saleh, S., & Liu, Y. (2021). A Review on Artificial Intelligence in Education. *Academic Journal of Interdisciplinary Studies*, 10(3), 206–217.
- Khalifa, M., & Albadawy, M. (2024). Using artificial intelligence in academic writing and research: An essential productivity tool. *Computer Methods and Programs in Biomedicine*, 5(March), 100145. <https://doi.org/10.1016/j.cmpbup.2024.100145>
- Kim, J., Yu, S., Detrick, R., & Li, N. (2024). Exploring students’ perspectives on Generative AI-assisted academic writing. In *Education and Information Technologies* (Issue July). <https://doi.org/10.1007/s10639-024-12878-7>
- Loi, C. K., Lau, Y. L., Soon, C. T., & Ku, C. J. @ N. A. K. (2022). Students’ Perceptions on Online Learning. *International Journal of Education, Psychology and Counseling*, 7(45), 234–249. <https://doi.org/10.35631/ijepc.745019>
- Marzuki, Widiati, U., Rusdin, D., Darwin, & Indrawati, I. (2023). The impact of AI writing tools on the content and organization of students’ writing: EFL teachers’ perspective. *Cogent Education*, 10(2), 1–17. <https://doi.org/10.1080/2331186X.2023.2236469>
- Mihaela Băiceanu, C., Hammami, M. B., & Popa, C.-S. (2026). ARTIFICIAL INTELLIGENCE LITERACY IN TEACHER EDUCATION: TOWARDS A PEDAGOGICAL FRAMEWORK FOR RESPONSIBLE INTEGRATION. In *Values, Education and Change. Global Perspectives and Local Realities Values, Education and Change. Global Perspectives and Local Realities* (pp. 200–218). CEEOL. <https://doi.org/https://doi.org/10.56177/epvl.ch21.2025.en>
- Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd ed.). SAGE Publications, Inc.
- Mokoena, S. (2013). Engagement with and participation in online discussion forums. *The Turkish Online Journal of Educational Technology*, 12(2), 97–105.
- Owusu, D., Arthur, F., Okyere-Dankwa, R., Affreh, O., Kwame Kumedzro, F., & Maison, R.

- S. (2024). Academic stress and burnout among distance education students in a Ghanaian higher education institution. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186X.2024.2334686>
- Oyetade, K., Harmse, A., & Zuva, T. (2023). Factors Influencing Students' Use of e-Learning Technologies. *International Journal of Learning, Teaching and Educational Research*, 22(9), 617–632. <https://doi.org/10.26803/ijlter.22.9.33>
- P. Diep, C., T.L. Nguyen, G., & T. Vo, N. (2021). Structure and Procedure for Developing an Online Course. *Journal of Technical Education Science*, 62, 83–98. <https://doi.org/10.54644/jte.62.2021.83>
- Rasul, T., Nair, S., Kalendra, D., Mulyadi, R., Santini, Oliveira, F. de, Junior Ladeira, W., Sun, M., Day, I., Rather, R. A., & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. *Journal of Applied Learning & Teaching*, 6(1), 1–16. <https://doi.org/https://doi.org/10.37074/jalt.2023.6.1.29>
- Rwodzi, C., & Jager, L. De. (2021). Resilient English Teachers' Use of Remote Teaching and Learning Strategies in Gauteng Resource-Constrained Township Secondary Schools. *Perspectives in Education*, 39(3), 62–78. <https://doi.org/10.18820/2519593X/PIE.V39.I3.6>
- Sadiku, M. N. O., Ashaolu, T. J., Ajayi-majebi, A., & Musa, S. M. (2021). Artificial Intelligence in Education. *International Journal of Scientific Advances*, 2(1), 5–11. www.ijscia.com
- Saidalvi, A., & Fakhruddin, W. F. W. W. (2021). Students' Learning Status and Expectations with Online Distance Learning. *International Journal of Academic Research in Business and Social Sciences*, 11(9), 1–17. <https://doi.org/10.6007/ijarbss/v11-i9/10776>
- Sri Ardiasih, L. (2023). An Analysis of Distance Learners. In *Technological Competence on Moodle-Based Learning Experiences* (Vol. 5, Issue 1).
- Sukmawati, Sudarmin, & Salmia. (2023). DEVELOPMENT OF QUALITY INSTRUMENTS AND DATA COLLECTION TECHNIQUES. *Jurnal Pendidikan & Pengajaran Guru Sekolah Dasar*, 6(1), 119–124. <http://journal.unpak.ac.id/index.php/>
- SurveyMonkey. (2024). *Types of survey research*. <https://www.surveymonkey.com/mp/3-types-survey-research/#H2-1>
- Williamson, B., Eynon, R., Knox, J., & Davies, H. (2023). Critical perspectives on AI in education: Political economy, discrimination, commercialization, governance and ethics. *Handbook of Artificial Intelligence in Education*, 553–570. <https://doi.org/https://doi.org/10.4337/9781800375413.00037> Abstract