



## IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION: A SYSTEMATIC REVIEW OF KEY CHALLENGES

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### Abstract

*Artificial Intelligence (AI) has become one of the most influential technological innovations of the twenty-first century. In education, AI offers opportunities for personalized learning, automated assessment, intelligent tutoring systems and optimized administrative tasks. Despite of its transformative potentials, the implementation of AI in educational settings faces significant challenges. Addressing these challenges is essential to fully realize the benefits of AI can bring to education. This study aims to identify the major challenges of AI implementation in education. Systematic Literature Review (SLR) approach was employed for this study and 18 studies (2016-2025) were selected based on the relevance to AI in education. Key issues include unequal access to technology, low levels of digital literacy among teachers and students, concern over data privacy and security and high implementing cost of AI systems. Resistance to Change is another challenge among the educators arises in the application of AI in education. To overcome these obstacles, this study proposes practical recommendations, including strengthening Digital Infrastructure,, enhancing teacher training, enforcing strict data protection policies, fostering collaboration between educational institutions and AI developers and curriculum alignment with AI technology. A Phased approach to implementation is also emphasized to minimize the resistance and ensuring effective adoption of AI tools. This study contributes towards to the growing body of knowledge on AI in education by addressing implementation challenges and offering actionable solutions.*

**Keywords:** Artificial Intelligence (AI), AI Challenges

### Introduction

Artificial Intelligence is rapidly transforming the landscape of education by offering personalized learning, intelligent tutoring systems, automated assessment, and data-driven decision-making. In education, AI acts as a tool capable of changing the way learning is designed, implemented and evaluated (Zawacki- Richter et al.,2019). AI offers personalized learning, where students can receive material tailored to their specific learning style, pace and needs(Holmes et al.,2019). AI also enables in-depth analysis of student learning data, provide

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useful information for teachers to monitor students progress and identify the areas that require special attention (Dwivedi et al.,2021). By automating administrative tasks, automated grading and providing feedback, AI increases the efficiency of the learning process, allowing teachers to focus more on personal interactions with students (Lu et al.,2021).

However, despite its potential, the implementation of AI in education is not free from various challenges. One of the main challenges is the gap in access to technology, where not all schools or students have adequate digital infrastructure to support the use of AI (Tamim et al., 2020). In addition, low levels of Digital literacy among teachers and students are another obstacle to the widespread adoption of AI technologies (Zhao et al., 2021). Data privacy and security are also crucial issues, considering that AI often requires students personal data to provide personalized learning (Koedinger et al., 2019). These concerns raise questions about how student's data is stored and used by technology providers (Chen et al., 2020).

Ensuring quality and relevance of AI content is also a major concern in education. In some cases, the AI system provides answers that are irreverent or do not fit the learning context. These deficiencies in integration can reduce the effectiveness of the technology and even lead to misunderstandings among students (Jia et al., 2021).

The high cost of Implementing AI often becomes an obstacle for educational institutions, especially in developing countries (Hwang et al., 2020). These barriers underscore the need for efficient and sustainable implementation strategies. Resistance to change is another crucial challenge in implementing AI in education. Many teachers who feel comfortable with traditional teaching methods tend to be reluctant to adopt new technology, even though the technology can provide benefits (Holstein et al., 2020). This shows the need for training and professional development that focuses on technological literacy to help teachers understand and make optimal use of AI (Zhai et al., 2021). Thus the successful implementation of AI not only depend on the technology but also the readiness of users to utilize the technology.

This study aims to identify the major challenges of AI implementation in education and also seeks to offer practical recommendations to overcome these barriers. By understanding these challenges and relevant solutions, it is hoped that the potential of AI can be maximized to create more inclusive and efficient education ecosystem (Baker &Siemens. 2020).

### **Challenges of AI Implementation in Education**

The implementation of AI is also faced with significant challenges that hinder the widespread adoption and use. This article discusses the six main challenges faced in implementing AI technology in education, namely gaps in technological access, lack of digital

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literacy, data privacy and security, relevance and quality of AI content, implementation costs and resistance to change.

### **1. Technological access gaps**

One of the most significant barrier to AI Integration in education is unequal access to digital infrastructure. AI-based tools require reliable internet connectivity, advanced devices, cloud computing facilities, and continuous technical support. Bridging the digital divide and ensuring equitable access to AI-enabled learning solution remains one of the most pressing challenges. The gap in access to technology is one of the biggest challenges in implementing AI in education. Many schools, especially in remote areas, face limitations in providing the hardware such as computers and tablets needed to access AI-based technology. According to Zawacki-Richter et al. (2019), educational institutions increasingly developed regions have better access technological infrastructure, while Many schools in remote areas still rely on traditional learning methods. Internet connectivity is also a major obstacle in many cases. Tamim et al. (2020) noted that many schools in rural areas do not have adequate internet access to support AI-based e-learning platforms. This expands the Inequality of education between developed and underdeveloped regions. Improved digital infrastructure is required to reduce the gap. To overcome the gap in technology access, the government and private sector need to work together to provide hardware subsidies and develop internet networks in remote areas. Hwang et al. (2020) suggest initiatives such as providing free internet Hotspot and developing budget- friendly AI tools to reach more students.

### **2. Lack of Digital Literacy**

Lack of digital literacy among teachers and students is significant obstacle to the implementation of AI technology. Many teachers lack adequate training to effectively integrate AI tools into their teaching practices. Holstein et al. (2020) noted that a lack of Training leaves many educators feeling self-conscious and reluctant to adopt this technology in the classroom. Students also faced similar challenges in digital literacy. Jia et al.(2021) show that students low digital literacy limits their ability to make most of AI-based technology. Many students do not understand how AI platforms work or how this technology can support their learning. Increasing digital literacy can be done through continuous training for teachers and technology education programs for students. Luckin et al. (2016) recommend the integration of digital literacy into national curriculum to ensure that students and teachers have the skills needed to utilize AI-based technology effectively.

### **3. Data Privacy and Security**

The most challenging area of concern in implementing AI in education is ensuring data privacy and security. AI-based systems often require high amounts of student's personal data to provide personalized learning experiences. However, this data collection increases the risk of privacy breaches. Chen et al. (2020) noted that the lack of strict regulations regarding student data management is one of the biggest obstacles to AI adoption.

Another key concern is the lack of transparency about how student data is managed by technology providers. Koedinger et al. (2019) suggest that educational institutions need to ensure that student data is protected with clear security policies and adheres to International standards.

To overcome these challenges, educational institutions and governments need to work together to develop strong data privacy policies. Dwivedi et al. (2021) recommend trainings on ethical data management for educators and administrators, as well as the implementation of encryption technology to protect the student data from potential misuse.

### **4. Relevance and quality of AI content**

Although AI has great potential to support learning, the quality and relevance of the AI content produced is often a challenge. In some cases, the AI system provides answers that are irreverent or do not fit the learning context. Siau & Yang (2020) noted that errors in AI content can confuse students and reduce learning effectiveness. Lack of integration between AI technology and national curriculum produce another challenge in implementing AI in education. Hwang et al. (2020) show that the curricula that do not support AI technology can limit the effectiveness of its use. Therefore, technology developers need to work closely with educators to ensure that AI-generated content is relevant and in line with local educational standards. Luckin et al. (2016) recommend teacher involvement in monitoring the use of AI technology to ensure that students receive appropriate learning experiences

### **5. High Cost of Implementation**

The cost of implementing AI technology is one of the biggest obstacles for many educational institutions, especially in developing countries. Tamim et al. (2020) noted that the initial costs of purchasing AI hardware and software are too high for schools on a limited budget.

In addition to initial costs, maintaining AI infrastructure also requires substantial financial investment. Dwivedi et al. (2021) noted that many educational institutions do not have funds to regularly update their hardware or software. This makes implementing AI

difficult to implement for a long term basis. Zhao et al. (2021) recommends a partnership model between educational institutions and technology companies to reduce implementation costs and ensure the sustainability of AI programs in education.

## **6. Resistance to change**

Resistance to change is another crucial challenge that often arises in the application of new technologies such as AI in education. Teachers who are comfortable with traditional learning methods are more often reluctant to adopt new technology. Holstein et al. (2020) noted that the fear that AI will replace the role of teachers is one of the main reasons for the resistance. Educational institutions that have a conservative culture also tend to be slow up to respond to technological changes. Zhao et al.(2021) suggest that a gradual approach to AI technology implementation can help reduce resistance. By starting with small scale implementation and involving teachers in the adaptation process, institutions can be more confident in integrating this technology into learning. Education and training on the benefits of AI technology must be a priority to overcome this resistance. Luckin et al. (2016) suggest that teachers need to be given the understanding that AI is a supporting tool, not a replacement, so that they can be more confident in integrating this technology into learning.

## **Practical Recommendations for overcoming AI Challenges in Education**

The application of AI technology in the field of education needs a mature strategy and support from various stakeholders. This article offers six practical recommendations based on the studied reviews to address the key challenges and optimize the implementation of AI technology in education.

### **(1) Strengthening Digital Infrastructure**

Strengthening digital infrastructure is a fundamental step to ensure equitable access to AI-based learning. According to Zawacki-Richter et al.(2019), the government and educational institutions need to invest in providing high speed internet access and adequate hardware to support the application of AI technology. This initiative is important in remote areas that often lack digital infrastructure. Tamim et al.(2020) emphasize that hardware subsidies for educational institutions in less developed regions can help reduce the technology gap. With collaboration between the public and private sectors, this step can be carried out more effectively. Hwang et al. (2020) suggest developing a national program that provide devices and connectivity to educational institutions. In this way, students in various regions can have equal opportunities to access AI-based learning. This program must be accompanied by

ongoing evaluation to ensure that the available infrastructure can support growing educational needs.

## **(2) Teacher Professional Training and Development**

Teacher training and professional development is the main key in maximizing the use of AI in education. Holstein et al. (2020) emphasize the importance of ongoing training to improve teacher's digital competence and their ability to integrate AI technology into learning. This training should include practical guidance on how to use AI tools effectively integrate the classroom. Chen et al.(2020) suggest that educational institutions should also provide ongoing technical support for teachers, including access to online resources and professional learning communities. With this approach, teachers will not only feel more confident but will also be able to make optimal use of AI technology to improve students learning outcomes.

## **(3) Strong Data Protection Policy**

A strong data policy is essential to protect student data in AI-based learning systems. Protecting student's data is critical to ensuring that AI is used ethically and safely. Koedinger et al. (2019) recommend that government needs to develop strict regulations on the storage, use and management of student data. These policies should include transparency in how data is collected and used by AI technology. Dwivedi et al. (2021) recommend that AI technology providers should be comply with International standards regarding data privacy. This transparency is important to ensure that student data is used ethically and is not misused. This step can increase public trust in the use AI in education.

Siau & Yang (2020) added that training on data ethics also need to be provided to educators and administrators. By understanding the importance of data privacy and security, they can manage student information more carefully and responsibly.

## **(4) Phased Approach to Implementation**

A phased approach is essential to minimize the resistance to change and successful implementation of AI technology in education. Tamim et al.(2020)suggest that educational institutions should start with small scale implementation to evaluate the effectiveness of the technology before adopting it fully. This allows testing and customization of the tool before widespread use.

Holstein et al. (2020) recommend involving students and teachers in the technology adaptation process. By involving users directly, educational institutions can identify challenges that may arise and find relevant solutions. This approach also helps increase acceptance of the technology among users. Luckin et al. (2016) added that educational

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institutions must provide technical support during the implementation phase. By ensuring that all parties have access to the necessary resources, the adaptation process can run more smoothly and effectively.

### **(5) Collaboration with AI Developers**

Collaboration between educational institutions and AI technology developers is essential to ensure that the tools developed are relevant to local educational needs. According to Jia et al. (2021), technology companies need to work together with educators to create tools that can be adopted to local curricula and learning contexts. This approach ensures that the technology used is not only advanced but also useful. Hwang et al. (2020) suggest developing AI-based content designed to support specific learning objectives. For example, developers can create tools that help students understand difficult concepts through interactive visualization. This kind of collaboration can increase learning effectiveness and students engagement. According to Koedinger et al. (2019), technology developers must also provide training to end users, including teachers and administrators. By providing guidance on how to optimally use AI-based tools, educational institutions can ensure that this technology is truly useful information supporting learning.

### **(6) Curriculum Adjustments**

Gradually integrating AI into the curriculum is an Important step to ensure the technology's relevance to learning objectives. Siau & Yang (2020) suggest that curriculum must be designed to reflect the needs of students in the digital Era, including the use of AI as a learning tools that supports mastery of Important concepts. According to Jia et al.(2021), AI technologies must be aligned with relevant pedagogical approaches. For example, AI can be used to provide adaptive feedback to students Based on their performance, supporting more personalized learning. Koedinger et al. (2019)suggest that regular evaluation of the effectiveness of AI technology in supporting learning needs to be carried out. In this way, educational institutions can ensure that the curriculum implemented remains relevant and supports sustainable learning goals.

### **Conclusion**

Artificial Intelligence (AI) technology brings revolutionary potential to education, with the ability to create more personalized, efficient and data-driven learning. However, despite of its potential, the implementation of AI is not free from various challenges. Based on the studied literature reviews and discussions it is concluded that the challenges in implementing AI in education involves technological access gaps, lack of digital literacy, data privacy and security,

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relevance and quality of AI content, high implementation costs and resistance to change. With the right practical steps such as strengthening infrastructure, teacher training, strict data policies, collaboration with developers and curriculum adjustment, the application of AI technology can be maximized to create an educational system is more modern, adaptive and meets student needs in the digital era.

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