

Advantages and Challenges of Using Artificial Intelligence in Primary and Secondary School Education

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Abstract. The application of artificial intelligence in education is one of the focal research today. Researchers have discovered that with the continuous development of artificial intelligence, various artificial intelligence are being utilized in primary and secondary education. However, many issues in this field still lack a unified explanation and understanding. Therefore, the research theme of this paper focuses on the advantages and challenges of using artificial intelligence in education. Based on an analysis of relevant literature and survey data, this study explores the advantages and challenges of artificial intelligence in education. The research findings indicate that artificial intelligence can provide personalized education, offer abundant educational resources for teachers and students, and provide timely feedback on student progress. Thus, enhancing learning outcomes. However, the application of artificial intelligence in education still faces challenges such as funding limitations, inadequate policy support, privacy concerns, varying levels of teacher acceptance, and a lack of standardized curriculum. Nevertheless, the use of artificial intelligence in education holds tremendous potential. In the future, it is necessary to formulate policy and standardization at the national level and address issues such as information security and privacy protection to promote the comprehensive application and development of artificial intelligence in education.

Keywords: Artificial intelligence education, challenge, advantage, primary and secondary education.

1. Introduction

The integration of artificial intelligence into education is concerned for students, teachers and nations around the world. Various artificial intelligence educational apps have emerged one after another in recent years [1]. The integration of artificial intelligence into teaching is an important way for modern educational advancement. It offers numerous benefits, such as enriching the presentation of instructional content and enhancing interaction and communication between teachers and students [2]. Artificial intelligence technology introduces innovative ways to enhance teaching and learning experiences, bringing better educational outcomes. This fosters a more inclusive learning environment. However, the application of artificial intelligence in education often brings various challenges. The development process of education is filled with uncertainty due to the integration of artificial intelligence [3]. There is currently a lack of standardization, uniformity, and completeness in the stage of artificial intelligence education development, which requires a rational understanding of the challenges it faces [4]. Exploring the benefits and challenges brought by the integration of artificial intelligence in education is meaningful for targeted solutions to its drawbacks. This study, based on relevant literature reviews and survey data, investigates the advantages and challenges of integrating artificial intelligence into education and attempts to analyze the current status of artificial intelligence integration in primary and secondary education. Various benefits and challenges are examined and analyzed. Firstly, the application of artificial intelligence in personalized learning and related educational tools is analyzed. These advantages include enabling teachers to tailor instruction to individual student needs, provide timely feedback, and optimize educational resources. Then, challenges in the external environment and teaching practices are discussed, including constraints in financial resources, absence of clear policies, privacy concerns, vague course design, varied levels of teacher acceptance and technical limitations.

2. Advantages of Artificial Intelligence in Assisting Teaching

2.1. Promoting Personalized Education

Flexible teaching models play a significant role in enhancing personalized education. Artificial intelligence uploads the characteristics of each student to the intelligent platform through big data analysis and intelligent assistance, providing personalized learning services for students [5]. Based on the characteristics of each student, it can offer customized learning content, methods, and modes, greatly stimulating students' inner desire to learn. With the help of intelligent platforms, teachers can analyze and summarize personal learning information. By using artificial intelligence, they can also gain insights into students' mastery levels and learning effectiveness in different subjects and knowledge areas through big data analysis of their learning behaviors [5]. Based on these findings, teachers can provide each student with a learning way that best suits them. This flexible teaching model helps to stimulate students' interest and motivation, bringing more learning outcomes and grades.

Artificial intelligence can create personalized learning experiences by analyzing student profiles, identifying their strengths and weaknesses, understanding their preferred subjects and learning activities and designing tailored learning plans for each student [6]. When artificial intelligence is integrated into education, it offers extra support and resources to students. Intelligent tutoring systems provide interactive and customized learning materials, offering explanations, examples, and practice exercises tailored to individual learning styles [6]. As students use these resources, the algorithms analyze their responses and adapt the learning content to ensure maximum comprehension.

2.2. Providing Enriched Educational Resources

By introducing a wider range of educational resources, teachers can better meet students' learning needs and provide diverse teaching methods.

With the support of artificial intelligence, regions worldwide can use networks to share data, enable interaction regardless of time or space and facilitate course sharing [7]. By using networks, educational institutions can exchange information and learning materials, enabling a broader range of resources for students and teachers. Students can engage with teachers and peers anywhere around the world. It breaks down geographical barriers. The faster and more reliable connectivity provided by the increasingly stable network enhances the quality of live streaming. It reduces buffering and ensures smooth communication between teachers and students. This improvement can lead to a more immersive and engaging online learning environment. For teachers, these resources can be stored and disseminated through online platforms and the internet, enabling them to easily access and utilize them.

During the process of lesson preparation, many intelligent teaching tools provide teachers with abundant educational resources, such as Beike Net and 101 Education PPT. Among them, 101 Education PPT is an intelligent teaching tool that also offers a large number of 3D and VR teaching resources for teachers [2]. These resources help teachers transform abstract concepts into vivid content and stimulate students' interest and engagement in learning. By utilizing 3D and VR, teachers can create immersive virtual scenarios. It allows students to feel like they are truly experiencing the content of the subject and enhancing their understanding of knowledge. With 101 Education PPT, teachers can easily create creative and interactive presentations, immersing students in the learning process and deepening their understanding and memory of the subject matter. On Beike Net, teachers can find various teaching materials, including presentations, quizzes and lesson plans. These resources are carefully organized and can keep pace with the curriculum. They assist teachers in better preparing for their lessons. Additionally, Beike Net provides online communication and sharing features. It enables teachers to learn from each other.

2.3. Accurate and Timely Learning Data in Providing Teaching Feedback

The application of artificial intelligence can provide accurate and timely learning data. It offers effective teaching feedback to teachers. By analyzing big data on student learning behavior worked by artificial intelligence, teachers can understand students' performance and identify their learning difficulties and deficiencies on time. Teachers can then provide targeted guidance and support based on this data [5].

In practical online teaching, teachers can use techniques, such as big data analysis, to collect behavioral data from both teachers and students. By analyzing big data, teacher-student profiles can be built [7]. This enables intelligent evaluation of students' learning progress. By continuously analyzing behavioral data and monitoring students' performance, the system can identify areas where students may weaken at. It can also identify effective teaching strategies, highlight areas that require improvement. Based on these insights, teachers can optimize their teaching approaches. They can provide support and interventions to help students overcome challenges and further enhance their learning outcomes.

Intelligent teaching tools can help teachers evaluate student assignments and exam performance, providing corresponding analysis reports to enhance the efficiency of assessment and feedback. For example, Xiaohu is an intelligent teaching tool for K-12 education, equipped with a massive question bank, intelligent statistics, and learning analytics functions. Through the intelligent statistical feature, teachers can directly obtain evaluation results, saving assessment time [2].

However, it is important to note that system assessment results should serve as reference data, and actual teaching assessments still require teachers to provide comprehensive feedback based on students' real classroom learning situations [8]. Relying solely on system assessments as the sole evaluation criterion should be avoided to ensure the authenticity and diversity of assessments.

3. Challenges of Artificial Intelligence in Primary and Secondary School Education from the Perspective of the External Environment

3.1. Impact of Funding Limitations

One of the major challenges of funding limitations is cost. Artificial intelligence, as a new product in modern society, requires continuous support from advanced discoveries and knowledge for exploration and development [9]. The development and maintenance of artificial intelligence require substantial investment. Building and maintaining an intelligent educational tool requires a specialized technical team and high research and development costs. Furthermore, with advancing, artificial intelligence systems need to be constantly upgraded and updated to adapt to rapidly changing educational needs.

Also, the ongoing training costs for staff and the continuous training required for artificial intelligence systems during organizational process changes can be substantial [9]. Introducing intelligent educational tools implies that teachers and other relevant personnel need to undergo training to understand and effectively utilize these tools. This involves investing time, resources, and training expenses. Moreover, due to the ever-changing educational environment and demands, teachers and other personnel also need ongoing updates and training for professional knowledge and skills.

As the scale expands and usage increases, these costs may further.

Moreover, according to surveys, 72.06% of teachers hope that schools can provide support in purchasing AI-related products and equipment [10]. However, due to financial constraints, they are subsequently unable to meet teachers' needs for artificial intelligence teaching tools. Particularly economically underdeveloped regions with relatively backward educational facilities, lack sufficient funds to purchase and maintain advanced artificial intelligence educational equipment [2].

Overall, although intelligent educational tools offer immense educational potential and convenience for teachers, cost remains a challenge. Only when costs are decreased can the widespread

adoption and maximum benefits of intelligent educational tools be ensured to drive the sustainable development of intelligent educational tools. On the other hand, AI-assisted teaching programs or platforms rely on data support. It requires strong economic resources to support. Thus, economic costs pose a challenging factor in driving artificial intelligence development.

3.2. Degree of Policy Support and Implementation

In the process of artificial intelligence development in education, the deployment of intelligent decision-making struggles to adapt to the complexity and variability of educational scenarios, as it requires decision-makers to consider the collaborative interaction between artificial intelligence and human teachers when designing educational processes [5].

The Internet education industry lacks specific legal provisions and regulations, resulting in vague and general evaluation criteria for teachers' digital literacy and a lack of practical implementation [7]. The vague legal framework and specific legislation hinder the development of the Internet education industry. Educational policies fail to provide concrete guidance as there is no explicit legal basis to support and promote teachers' teaching practices, leading to a low emphasis on digital literacy among teachers.

For comprehensive advancement of the integration of artificial intelligence with education, it is necessary to establish visionary and regulatory policies at the national level. At the macro level, artificial intelligence education has not yet been integrated into the five-level educational development plans at the national, provincial, municipal, county, and school levels in China [4]. Therefore, there are policy limitations that hinder the promotion of artificial intelligence education. Furthermore, 68.66% of teachers believe that the government should increase investment in school informatization construction and issue relevant policy documents for guidance [10]. Such policy frameworks can provide more specific guidance, ensuring consistent standards and directions for the implementation of artificial intelligence education in different regions and schools.

3.3. Existence of Information Leakage Risk

With the integration of artificial intelligence in education, there may be a risk of information leakage. Artificial intelligence collects and analyzes various types of student data to improve learning services. However, improper use of data can lead to security issues. Survey results indicate that many teachers and students are concerned about the personal information leakage and security risks associated with the application of artificial intelligence in education. Only one-fifth of teachers consider artificial intelligence trustworthy in terms of privacy information storage [10]. Therefore, when promoting the adoption of artificial intelligence in schools, technical staff need to pay attention to the risks and challenges of information leakage and take appropriate measures to protect personal privacy and data security.

The concerns of teachers and students regarding the risk of information leakage are reasonable. The risk of information leakage becomes particularly crucial in the context of applying artificial intelligence in education. The student data collected by learning systems includes sensitive information such as personal identities, learning behaviors, and interests. Without proper protection, unauthorized individuals may gain access to this data. It leads to the explosion of personal privacy. Additionally, hacker attacks and data breaches can cause threats to schools.

To address the risk of information leakage, technical staff need to implement a series of measures to protect personal privacy, such as enhancing system security defenses and fostering awareness of personal information protection. Only then can artificial intelligence bring greater benefits to education and gain the trust and support from teachers and students.

4. Challenges of the Insufficient Ability in Teaching Practice

4.1. Lack of Standardization and Completeness in Course Design

Currently, the instructional design of integrating artificial intelligence into education tends to be casual, which has led it to be seen as an option rather than a necessity [7].

Lack of standardization and completeness in course design is a major issue that needs to be addressed in the integration of artificial intelligence into education. Although some regions have promoted artificial intelligence education in primary and secondary schools, such as Weifang and Qingdao in Shandong province [4], it is still necessary to establish unified requirements at the national or provincial level regarding grade levels, hours of instruction and course content. If there is a lack of standardization and completeness in course design, it can lead to a series of issues, such as the proliferation of textbook versions, varying quality of textbooks, inconsistency in the expertise of textbook authors and so on [4].

When course design lacks standardization and completeness, it results in a wide range of textbook versions available around the nation. Also, textbooks cover content with different depth and accuracy of content. Some authors may have strong subject knowledge and pedagogical skills while others may lack the necessary qualifications. This leads to disparities in the quality and usefulness of the textbooks. This creates confusion for teachers and students as they struggle to select the most suitable textbook, and it may lead to inconsistencies in the curriculum across different schools or regions.

Without standardized course design, the effectiveness of teaching and learning is hard to promise, as students may receive inadequate or misleading course content.

Therefore, a lack of standardization and completeness in course design can damage the effectiveness of education and create challenges for both teachers and students. Therefore, it is crucial to ensure the consistency of educational resources in course design.

4.2. Differences in Teachers' Acceptance

Teachers' acceptance of artificial intelligence in education varies based on several factors. Some teachers struggle to effectively integrate artificial intelligence into their teaching due to a lack of understanding of education and teaching issues among artificial intelligence researchers. Additionally, older teachers who haven't adapted to the "Internet+" era may not fully utilize the benefits of artificial intelligence tools in their instruction, as many teachers lack proficiency in artificial intelligence literacy and struggle with using intelligent teaching tools effectively, which hinders widespread adoption [2].

Factors influencing acceptance include perception, understanding, and perceived value of artificial intelligence in education. Higher-educated teachers and those with more teaching experience are more likely to accept artificial intelligence education while some teachers worry about artificial intelligence replacing human teachers and believe that artificial intelligence is imperfect and can make mistakes [11].

From the survey results, it can be seen that some teachers have concerns and doubts about artificial intelligence. Among them, 54.95% of teachers think that artificial intelligence cannot accomplish what teachers do and teacher involvement is necessary; 47.74% of teachers believe that artificial intelligence is not perfect and may make mistakes in executing tasks; and 18.44% of teachers worry that artificial intelligence will take away job opportunities for teachers [10]. These data indicate that some teachers show concern regarding the impact of artificial intelligence in the field of education.

Thus, it is necessary to address and resolve their concerns and doubts and to cultivate a professional literacy framework for primary and secondary school artificial intelligence teachers to shape artificial intelligence education awareness, artificial intelligence subject knowledge, and artificial intelligence practical skills [12]. Furthermore, strengthening teachers' acceptance of artificial intelligence and utilizing artificial intelligence as a teaching aid can enhance teaching effectiveness and improve students' learning experiences.

4.3. Technological Constraints in the Development and Application

The development and application of artificial intelligence in education are subject to technological constraints. One limitation lies in the current artificial intelligence teaching tools. They lack a specific software program and fail to fully meet teachers' needs. Although artificial intelligence enhances education by providing instructional content and abundant resources, it overlooks emotional communication with students [13]. It limits students' comprehensive development.

Also, areas like image and speech recognition are not accurate enough, which need constant improvement [13]. The need for constant improvement is essential as it ensures that artificial intelligence can accurately interpret and understand visual and auditory inputs, providing more effective assistance in education.

5. Conclusion

This study evaluates the current status of integrating artificial intelligence into education. It aims to clarify the advantages and challenges of incorporating artificial intelligence into primary and secondary school education.

The integration of artificial intelligence in education holds great potential for transforming the learning experience and improving educational outcomes. Flexible teaching models powered by artificial intelligence and big data analysis enable personalized learning experiences for students. The use of intelligent teaching tools and platforms facilitates access to diverse resources and promotes collaboration among teachers. By analyzing learning data, artificial intelligence can provide accurate feedback and targeted guidance for students' individual needs as well as send related information to the teachers on time.

However, several challenges need to be addressed for the widespread adoption and maximum benefits of artificial intelligence in education. Funding limitations hinder the development and maintenance of artificial intelligence systems, limiting their accessibility, especially in economically underdeveloped regions. The lack of specific policies and regulations contributes to vague evaluation criteria for teachers' digital literacy and a lack of practical implementation.

Moreover, the concerns about information leakage and security risks must be addressed to build trust among teachers and students. Standardization in course design is crucial to ensure consistency and quality in educational resources. Due to teachers' concerns, their acceptance of artificial intelligence varies, making it challenging for artificial intelligence to be integrated into education constantly.

Finally, despite the numerous benefits of artificial intelligence, its integration into education faces various challenges and limitations. However, its potential is vast. As mentioned in this research literature, it is important to analyze issues such as funding constraints, lack of policies and regulations, privacy leaks, vague course design, different teacher acceptance, and technological limitations. In the future, solutions to these problems can facilitate further research on this topic.

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