Artificial Intelligence Empowering Education: The Distinction Between Supporting and Substituting Roles

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Abstract. This study focuses on the supporting and substituting roles of artificial intelligence in the field of education, delving into their application and impact in education. Through the research of examples such as intelligent tutoring systems and artificial intelligence writing tools, it reveals the differences in capabilities, limitations, and influences on education between the two. The study finds that supporting role artificial intelligence can provide personalized learning support, helping students improve their autonomous learning abilities; while substituting role artificial intelligence can enhance efficiency, but lacks in creativity and emotional understanding. In the future, the role of artificial intelligence in education will develop towards deeper integration, intelligence, and personalization, while also needing to address challenges such as data privacy and security, and ethical and moral issues.

Keywords: Artificial Intelligence; Education; Supporting Role; Substituting Role.

1. Introduction

With the rapid development of technology, artificial intelligence (AI) has gradually permeated various fields of society, including education [1]. The application of AI in education has brought unprecedented opportunities for traditional educational models, from intelligent tutoring systems to artificial intelligence writing tools, from personalized learning recommendations to intelligent voice assessment, these applications are gradually changing the face of education. Intelligent tutoring systems can provide personalized learning suggestions and guidance based on students' learning progress and abilities, helping students better master knowledge; artificial intelligence writing tools can assist students in improving writing skills, providing grammar checks, vocabulary suggestions, and even inspiring students' writing ideas to some extent. However, as AI is increasingly applied in education, the distinction between its supporting role and substituting role has gradually drawn attention. On one hand, as an educator's assistant, AI can assist teachers in teaching management, provide personalized learning suggestions, and help students solve learning problems, becoming a reliable assistant for teachers and students; on the other hand, with the continuous development of technology, AI has demonstrated the possibility of replacing human teachers in certain aspects, such as automated scoring and intelligent tutoring, which has triggered in-depth thinking about the positioning of teacher roles and the essence of education [2]. Studying the distinction between the supporting and substituting roles of artificial intelligence in education is of great significance for clarifying the application boundaries of AI in education, fully leveraging its advantages, and avoiding potential risks.

2. Theoretical Foundation of AI Roles in Education

2.1 Overview of AI Technology

Artificial intelligence is a comprehensive cutting-edge technology that aims to achieve some of the functions of human intelligence through computer programs, covering key areas such as machine learning, natural language processing, and computer vision. These technologies play a significant role in educational scenarios, driving the transformation and innovation of educational models.[3]

Machine learning, as one of the core fields of artificial intelligence, enables computers to learn patterns and rules through data, thereby making predictions or decisions. It is mainly divided into supervised learning, unsupervised learning, and reinforcement learning. In supervised learning, the

model is trained with labeled data to learn the relationship between input features and output labels, such as decision tree algorithms can classify students' learning status, determining whether they are in an efficient learning, average learning, or need to pay more attention state. Unsupervised learning, on the other hand, attempts to discover the internal structure of data without labeled data, such as K-means clustering algorithms can group students based on learning behaviors, interests, and hobbies, and teachers can formulate differentiated teaching strategies for different groups of students. Reinforcement learning learns how to make the best decisions in certain situations through interaction with the environment. For example, in an intelligent education game, each student's action is regarded as an interaction with the environment, and the system gives corresponding rewards or punishments based on the student's actions, guiding the student to continuously optimize their learning strategies to achieve better learning outcomes.

Natural language processing aims to enable computers to understand and generate human language, and it has extensive applications in the field of education. Its key technologies include lexical analysis, syntactic analysis, semantic understanding, machine translation, text generation, etc.[4] Lexical analysis can break down the text into words or word stems, helping the computer understand the basic composition of the text. In intelligent writing tools, it can perform lexical analysis on the text input by students to check for spelling errors; syntactic analysis is used to analyze the grammatical structure of sentences, helping the computer understand the organization of sentences, which is crucial for analyzing students' essays for grammar errors and determining whether a sentence conforms to grammatical rules; semantic understanding enables the computer to understand the meaning of the text, such as an intelligent question-answering system accurately grasping the core of students' questions through semantic understanding and providing precise answers; machine translation technology can convert between different languages, providing students with multilingual learning resources and helping them overcome language barriers to learn high-quality educational content from abroad; text generation technology can generate text based on a given topic or prompt, assisting students in writing.

2.2 Classification of the Roles of Artificial Intelligence in Education

In the field of education, artificial intelligence plays two different but interrelated roles, which play unique roles in the educational process. The difference lies in multiple dimensions.

From the perspective of definition and functional essence, the supporting role of artificial intelligence is that it serves as an auxiliary tool, assisting teachers in conducting teaching activities and helping students improve their learning outcomes. The intelligent assistant function in intelligent tutoring systems can answer students' questions encountered during learning at any time and provide immediate knowledge support; in terms of course design, artificial intelligence can provide suggestions for course content design based on the teaching outline and students' characteristics, such as recommending appropriate teaching cases, teaching videos, etc., helping teachers better organize teaching content. The alternative role of artificial intelligence is that in certain specific educational stages, artificial intelligence, with its technical advantages, replaces human teachers to complete corresponding tasks. Automatic grading systems, using optical character recognition technology and natural language processing technology, can quickly and accurately grade multiple-choice, fill-in-the-blank, and even short-answer assignments and exams, significantly saving teachers' time and effort in grading; for some simple knowledge explanation courses, artificial intelligence can teach through pre-recorded videos or virtual teacher images, allowing students to study at their own pace and time.[5]

From the perspective of participation in the teaching process, the supporting role of artificial intelligence is in an auxiliary position, together with teachers and students, constituting the main body of teaching activities. Teachers remain the dominant force in teaching, responsible for setting teaching goals, planning teaching processes, guiding students' thinking, and other core teaching tasks. Artificial intelligence mainly provides personalized learning suggestions, learning resource recommendations, and immediate assistance in the learning process based on teachers' needs and

students' learning situations. When students are doing math problem-solving exercises, the intelligent tutoring system can analyze students' problem-solving methods, point out errors, and recommend relevant video explanations and practice questions. Furthermore, the personalized intelligent teaching system for college students' career planning can accurately analyze students by using deep learning and natural language processing technologies, and provide customized career planning services by combining big data analysis and cloud computing technologies. During this process, students modify their goals, the artificial intelligence provides solutions, the teachers adjust the plans, which enhances the scientificity and effectiveness of career planning.[6] In the alternative role, artificial intelligence to some extent becomes the leader of the teaching activities, independently completing some teaching tasks. Some online language learning platforms utilize artificial intelligence for oral practice tutoring. Students can have real-time conversations with virtual conversation partners, and the artificial intelligence will provide real-time corrections and evaluations based on the students' pronunciation, grammar usage, etc. The entire process does not require direct participation of human teachers.

From the perspective of the mechanism that affects students' learning outcomes, artificial intelligence acts as a supporting role, focusing on providing personalized learning support to stimulate students' interest and initiative in learning, and cultivating their autonomous learning skills and problem-solving abilities. By analyzing students' learning data, it understands their learning styles and interests, and recommends learning content that suits their interests, enabling students to gain more sense of achievement and thereby increasing their learning motivation.[7] Artificial intelligence can also provide suggestions on learning strategies to help students learn how to effectively manage their study time and set study plans.

When artificial intelligence plays the role of a substitute, it mainly influences students' learning outcomes from the perspective of improving learning efficiency and standardizing teaching.[8] The automatic scoring system can quickly provide students with their learning results, allowing them to promptly understand their learning achievements. It also makes teaching evaluations more objective and standardized. However, this approach may overlook students' emotional experiences and individual needs during the learning process. For example, unique creativity and expression in writing may not be adequately recognized due to not meeting fixed scoring standards.

From the perspective of achieving educational goals, the supporting role of artificial intelligence helps to achieve comprehensive educational goals, focusing on cultivating students' comprehensive qualities, including emotions, attitudes, values, innovation ability, and social communication skills. Teachers can use the data and analysis provided by artificial intelligence to better focus on each student's individual differences, provide targeted educational guidance, and promote students' overall growth.[9] While the substitute role of artificial intelligence is efficient and accurate in achieving educational goals such as knowledge transmission and skill training, it has certain limitations in cultivating students' emotions and values. Because artificial intelligence lacks the ability to judge emotions and values like human teachers, it cannot provide emotional and value through teaching and personal example to students.

3. The Supporting Role of Artificial Intelligence: Taking the Intelligent Tutoring System as an Example

3.1 Specific Manifestations of the Supporting Role

3.1.1 Personalized Learning Support

Take the Knewton intelligent tutoring system as an example. It demonstrates outstanding capabilities in personalized learning support by using advanced technological means to tailor learning plans and recommend learning resources for students. This significantly enhances the specificity and effectiveness of learning. Knewton is an intelligent tutoring system provider specializing in adaptive learning technology.[10] It employs machine learning algorithms to conduct in-depth analysis of the massive data generated by students during their learning process. This data covers various dimensions

such as students' test results, study time, mastery of different knowledge points, and learning progress. By mining this data, Knewton can accurately draw a unique learning profile for each student, thereby comprehensively understanding their learning characteristics, strengths, and weaknesses. In mathematics learning, the Knewton system determines students' knowledge mastery levels in different sections such as algebra, geometry, and statistics based on their accuracy rates in answering questions. If it is found that students have a higher error rate in the function section, the system will quickly analyze the specific problems they may have with function concepts, function graph drawing, and function application. Based on these analysis results, Knewton will create personalized learning plans for students. In terms of learning content, the system will prioritize the provision of basic knowledge explanations videos on functions to help students consolidate concepts. Provide targeted practice questions, including various function types ranging from simple to complex, to enable students to gradually improve their problem-solving skills; and recommend some supplementary learning materials.[11] Regarding the learning progress, the system will reasonably plan the learning steps based on the students' learning abilities and time arrangements, ensuring that students can gradually master the function knowledge and avoiding excessive learning pressure or slow progress.

3.1.2 Learning Process Assistance

In terms of learning process assistance, the intelligent tutoring system plays a significant role, being able to monitor the students' learning status in real time, providing timely and accurate feedback and guidance, and assisting teachers in teaching management, thereby enhancing teaching quality and learning effectiveness.

Many intelligent tutoring systems utilize sensor technology and data analysis algorithms to monitor the students' learning process. On online learning platforms, the system can record students' login time, study duration, page browsing trajectory, answering speed, and other behavioral data. Through the analysis of this data, the system can understand the students' learning concentration, whether they have learning difficulties, and their mastery of knowledge. When students stay on a certain learning page for a long time and have a high error rate in answering questions, the system can determine that the students may encounter difficulties in that knowledge point and need further assistance. Some intelligent tutoring systems also come equipped with intelligent cameras and microphones, capable of capturing students' facial expressions, body language, and voice information, and analyzing their emotional state and learning attitude. If it is found that students show anxiety, fatigue, or lack of concentration during the learning process, the system can promptly offer encouragement and reminders, such as popping up messages, suggesting that students take a break or adjust their learning methods.

Once a problem is identified in the students' learning process, the intelligent tutoring system will immediately provide feedback and guidance. When the students answer incorrectly, the system not only points out the wrong answer but also explains the reasons for the error in detail, and provides relevant review materials and supplementary exercises for the knowledge points. In language learning, when students make mistakes in reading comprehension questions, the system analyzes the types of errors, such as deviations in understanding the main idea of the article or inaccurate extraction of key information, and then provides detailed explanations and reading skills guidance, recommends related reading articles, and helps students improve their reading comprehension ability. For students with slow or fast learning progress, the system will adjust the learning plan according to their actual situation, provide more suitable learning tasks and time arrangement suggestions. If the students' learning progress is slow, the system will increase the frequency of pushing learning resources, encouraging them to accelerate their learning progress; if the students' learning progress is fast, the system will provide some expanded learning content to meet the students' learning needs, avoiding students feeling bored due to overly simple learning content.

The intelligent tutoring system can also provide strong support for teaching management for teachers. It can automatically collect and organize students' learning data, generate detailed learning reports, including students' learning progress, knowledge mastery, homework completion, and analysis of exam results. Teachers can view these reports to have a comprehensive understanding of

each student's learning status, promptly identify students' learning problems and progress, and thus adjust teaching strategies in a targeted manner. When formulating teaching plans, teachers can refer to the data provided by the intelligent tutoring system to understand the students' mastery of different knowledge points, and reasonably arrange teaching content and key points. For knowledge points that students generally master well, teaching time can be appropriately reduced, and expanded learning content can be added; for knowledge points that students have difficulty mastering, explanations and exercises can be strengthened. The intelligent tutoring system can also assist teachers in homework grading and score statistics work. The automatic grading function can quickly and accurately grade objective questions such as multiple-choice and fill-in-the-blank questions. It can also provide preliminary scoring suggestions for subjective questions, significantly reducing the workload of teachers and allowing them to devote more time and energy to teaching research and personalized guidance for students[12].

3.2 Analysis of Practical Application Cases

Taking the intelligent tutoring system of iFLYTEK as an example, this system has been widely applied in mathematics teaching, providing comprehensive learning support for students and achieving remarkable application results.[13]

This intelligent tutoring system employs advanced machine learning algorithms to comprehensively collect and deeply analyze the learning data of students on the platform. These data include video viewing records of students in mathematics courses, such as viewing duration, pause times, and repeated viewing of knowledge points; online test answering situations, covering answering time, accuracy rate, and error type distribution; and homework completion situations, including completion time, homework scores, and details of incorrect questions[14]. Through the mining of this massive data, the system can accurately identify each student's weak points in mastering mathematics knowledge. When it is found that students frequently make mistakes in the chapter of functions in their homework and tests regarding the judgment of function monotonicity, the system will immediately identify that the student has difficulties in understanding and applying this knowledge point. Based on the precise positioning of students' knowledge weaknesses, the intelligent tutoring system provides highly targeted learning suggestions. For students who have difficulty in mastering the monotonicity of functions, the system first pushes a series of video courses specifically explaining the monotonicity of functions, which are presented in a step-by-step manner, from the basic definition of monotonicity, image characteristics, to different types of functions' monotonicity judgment methods, with comprehensive and detailed explanations. The system will also recommend related practice questions, which are gradually progressive in difficulty, from basic concept discrimination questions to medium difficulty application calculation questions, and to difficult comprehensive expansion questions, helping students gradually improve their understanding and application ability of function monotonicity. After students complete the practice, the system will analyze their answering situation in real time. For incorrect questions, detailed analysis of the reasons for the mistakes and guidance on the solution methods will be provided, guiding students to master the correct solution methods.

During the practical application process, a follow-up survey of students using this intelligent tutoring system revealed that students' mathematics scores have significantly improved. Before using the system, the average score of students in mathematics exams was 70 points. After one semester of using the system, the average score increased to 85 points. From the score distribution, students who were originally on the borderline of passing grades saw particularly significant improvement through the personalized tutoring provided by the system. Most students successfully broke through the passing line and entered the good score range; while students who were originally performing well also consolidated and improved their scores with the help of the system's expansion learning resources and difficult practice questions. Students' interest and enthusiasm in mathematics learning have also significantly increased. According to the survey, 80% of students stated that their interest in mathematics learning has significantly increased after using the intelligent tutoring system. They no

longer view mathematics learning as a burden but actively participate in mathematics learning and explore mathematical knowledge. Many students said that the personalized learning suggestions and immediate feedback provided by the intelligent tutoring system enabled them to solve problems promptly, gain a sense of achievement, and thus stimulated their enthusiasm for mathematics learning.

4. The Substituted Role of Artificial Intelligence: Taking the Intelligent Writing Tool as an Example

4.1 Specific Manifestations of the Substituted Role

4.1.1 Content Generation Substitution

Content Generation Substitution In the current digital era, artificial intelligence writing tools demonstrate remarkable capabilities in content generation, especially in tasks such as writing papers and reports. They can generate initial drafts and, to a certain extent, replace some manual writing, providing convenience for creators. However, this has also triggered in-depth discussions about the creative subject and content quality.

Artificial intelligence writing tools like ChatGPT have been widely used in the field of academic writing. ChatGPT can generate coherent and logically structured articles based on simple prompts provided by users. When writing reports, users only need to input the topic and some key points, and ChatGPT can generate a complete report framework and content. In a report on "Enterprise Digital Transformation", ChatGPT can generate an initial draft of the report containing sections such as current situation analysis, problem discussion, solutions, and future outlook, based on the user-provided information such as the enterprise's basic information, digital transformation goals, and initial progress. It not only organizes the language to make the report content smooth and understandable, but also combines common industry cases and data to enhance the persuasiveness of the report[15]. However, the content generated by ChatGPT also has certain limitations. Since it is based on the learning and pattern recognition of a large amount of data, the generated content may lack in-depth thinking and unique insights, and sometimes may have insufficient logical coherence or inconsistencies with the actual situation.

Although artificial intelligence writing tools have high efficiency in content generation, they cannot completely replace human creators[16]. In paper writing, the depth of human authors' thinking and their unique perspectives are irreplaceable in the creative process. Creativity and emotional investment are also unique advantages of human authors[17]. In literary creation, authors express their emotions, values, and perceptions of the world through words, giving works a soul and vitality. In poetry creation, human poets can integrate their innermost emotions, delicate experiences of life, into verses, creating works with infectiousness and artistic value. Although the poems generated by artificial intelligence writing tools may conform to the rhythm and grammar norms in form, they often lack the depth of emotion and unique artistic style[18].

4.1.2 Evaluation Feedback Substitution

In the field of education, artificial intelligence writing tools play a significant role in evaluation feedback, capable of automatically evaluating essays and providing feedback, to a certain extent, replacing some of the grading work of teachers, improving the evaluation efficiency. However, there are still limitations in the comprehensiveness and depth of evaluation.

The evaluation tools of ChatGPT, represented by Batch Correction Network, have been widely used in English essay grading. Batch Correction Network utilizes natural language processing technology and machine learning algorithms to quickly evaluate students' English essays. It can identify grammar errors in the essays, such as subject-verb inconsistency, tense errors, and incorrect word usage, and provide detailed error prompts and correction suggestions. When a student writes "I am like playing basketball", Batch Correction Network can accurately point out that "am like" has a grammar error and the correct expression should be "like", and explain that this is a verb usage error. It can also evaluate vocabulary usage, point out repetitive word usage and inaccurate word selection,

and recommend more appropriate words[19]. If a student repeatedly uses "good" to express "good", Batch Correction Network will suggest using "excellent" "wonderful" and other more rich words. It can also analyze the essay from the perspective of paragraph structure, judging the logical coherence between paragraphs, the rationality of the beginning and ending, etc. However, the AI writing assessment tools cannot fully replace teachers in terms of assessment feedback. The humanistic care and emotional support provided by teachers are indispensable factors in the educational process. Teachers' rich teaching experience and professional knowledge also enable them to assess essays from a more comprehensive perspective.

4.2 Analysis of Practical Application Cases

Taking the DeepSeek writing tool's application in university teaching as an example, this tool has played a certain role in assisting students in writing, but it has also exposed many problems, which require us to comprehensively and objectively analyze its advantages and disadvantages, and propose corresponding countermeasures.

Many university students use this AI writing tool when writing assignments such as course papers and academic reports. This tool can quickly generate text content, provide writing ideas and materials for students, and greatly save students' writing time. When writing papers related to "the application of artificial intelligence in the field of education", after inputting the topic, the tool quickly generated some content including the current situation, advantages, and challenges of the application of artificial intelligence in education. This is a powerful support for some students who find writing difficult, helping them overcome the psychological barriers of writing and improving their writing enthusiasm. The grammar checking and vocabulary recommendation functions of the tool also help students improve the language quality of their essays, reduce grammatical errors, and enrich vocabulary expression. However, there are also some drawbacks of this tool in university teaching applications. Some students overly rely on the AI writing tool, resulting in a decline in their independent writing ability[20]. Some students no longer carefully consider the structure, logic, and viewpoints of the papers, but directly copy the content generated by the tool, lacking independent thinking and innovation ability. The quality of the content generated by the tool varies, sometimes presenting logical confusion, empty content, and factual errors. Moreover, due to the widespread application of AI writing tools, concerns about academic integrity issues have also arisen.

To address these problems, universities and teachers need to take a series of measures. Universities should strengthen academic integrity education for students, guide them to correctly understand and use AI writing tools, clarify academic ethical norms, and let students understand the importance of independent writing and innovative thinking. When assigning writing tasks, clearly require students not to rely entirely on AI writing tools, encourage students to think independently, conduct in-depth research, and guide students to critically analyze and modify the content generated by the tool to make it conform to academic requirements. Teachers should also strengthen guidance and supervision of students' writing process, promptly identify problems in students' writing, and provide targeted suggestions and assistance. Furthermore, it is strongly recommended that AI-driven tools for human language generation must implement licensing and strict regulations [21].

5. Comparative Analysis of Supporting Roles and Alternative Roles

5.1 Comparison of Capability Advantages

In the field of education, there are significant differences in capability advantages between the supporting role and the alternative role of artificial intelligence. A detailed analysis of these differences can help us use artificial intelligence technology more appropriately and improve educational quality.

From the perspective of personalized service capabilities, the supporting role of artificial intelligence performs exceptionally well. For example, the intelligent tutoring system can achieve highly personalized learning support through in-depth analysis of students' learning data. The

Knewton intelligent tutoring system continuously collects multi-dimensional data such as students' answering situations, study time, and mastery of different knowledge points, and creates a unique learning profile for each student. Based on these profiles, the system can precisely understand students' knowledge weak points, learning habits, and interests and preferences, and thus tailor personalized learning plans for students. This personalized service is based on the precise grasp of individual differences and can meet students' diverse learning needs, stimulating their learning interest and initiative. In contrast, the alternative role of artificial intelligence in personalized services has certain limitations. Taking the artificial intelligence writing tool as an example, it can generate text content based on the user-provided theme or keywords, but this generation is often based on preset algorithms and a large amount of data learning, lacking in-depth understanding of the user's individual emotions, thinking patterns, and unique needs.

In terms of knowledge reserves and update capabilities, the alternative role of artificial intelligence has obvious advantages. The artificial intelligence writing tool relies on its powerful database and rapid information retrieval capabilities to obtain a large amount of knowledge and information in a short time. Writefull, when generating literature reviews for academic papers, can quickly search and integrate a large number of academic documents, providing authors with comprehensive research background information covering multiple disciplinary perspectives. It can also track academic trends in real time and update knowledge reserves, providing users with the latest research materials and viewpoints. This speed and breadth of knowledge reserves and updates are beyond human reach and can provide rich learning and teaching resources for students and teachers. The supporting role of artificial intelligence, although it also has some knowledge reserves, does not focus on providing extensive knowledge information but rather on selectively screening and presenting knowledge based on students' learning situations. It pays more attention to the application of knowledge and the cultivation of students' abilities, guiding students to think and solve problems to enhance their learning abilities.

5.2 Limitations Comparison

In terms of emotional understanding, the supporting role of artificial intelligence has certain limitations. Although the intelligent tutoring system can, to a certain extent, infer students' learning status based on their learning data and behaviors, it is still insufficient in perceiving and understanding the subtle emotions such as anxiety, depression, and joy of students, and is unable to provide warm emotional support and effective psychological counseling. In contrast, the limitations of the alternative role of artificial intelligence in emotional understanding are more prominent. The artificial intelligence writing tool mainly focuses on text generation and grammar checking tasks and has almost no understanding of human emotions. It cannot perceive the emotions expressed by students during writing and cannot provide personalized writing guidance and encouragement based on students' emotional states.

In terms of creativity cultivation, the supporting role of artificial intelligence does not possess true creativity. The intelligent tutoring system can provide students with various training questions for innovative thinking and case analysis, guiding students to expand their thinking, but it cannot, like human teachers, bring unique inspiration and guidance to students with its own creativity and rich life experience. The limitations of the alternative role of artificial intelligence in creativity cultivation are even more obvious. The texts generated by artificial intelligence writing tools are often based on existing data and patterns, lacking innovation and uniqueness. The works produced are often soulless and lacking in individuality, and it is difficult for them to reach the level of human creation.

From the perspective of ethical and moral education, the supporting role of artificial intelligence in this field has inherent deficiencies in conveying ethical and moral concepts. Intelligent tutoring systems mainly focus on the transmission of knowledge and the cultivation of learning ability. Although they can convey certain ethical and moral knowledge to students through some case analysis methods, they cannot compare with human teachers in terms of moral sentiment cultivation and moral behavior demonstration. The alternative role of artificial intelligence in ethical and moral

education has even more serious limitations. Artificial intelligence writing tools do not have their own moral judgment and values, and cannot provide correct ethical and moral guidance to students. The texts generated by them may contain content that does not conform to ethical and moral norms, or they may be unable to accurately judge and guide the ethical and moral issues involved in students' writing.

5.3 Differences in the Impact on Education and Teaching

The supporting role and alternative role of artificial intelligence in education have produced completely different impacts on education and teaching, which involve multiple key aspects such as teaching methods, students' learning outcomes, and the role of teachers.

In terms of teaching methods, the supporting role of artificial intelligence promotes the innovation and optimization of teaching methods. The intelligent tutoring system analyzes students' learning data and provides teachers with personalized teaching basis, prompting teachers to adopt more flexible and diverse teaching methods. Teachers can design teaching activities based on the knowledge weak points and learning progress information provided by the intelligent tutoring system, and adopt group cooperative learning and project-based learning methods to meet the learning needs of different students. While the alternative role of artificial intelligence changes the subject and process of teaching to some extent. Taking the automatic marking system as an example, it makes the examination evaluation process more efficient and standardized, but it also leads to a reduction in the interaction between teachers and students in the homework correction and feedback section. In the traditional teacher's homework correction process, teachers can understand students' learning situations and thinking processes through detailed corrections of students' homework, discover students' problems and provide personalized guidance.

From the perspective of students' learning outcomes, the supporting role of artificial intelligence focuses on cultivating students' comprehensive abilities and learning interest. The personalized learning support of the intelligent tutoring system can meet the differentiated learning needs of students and stimulate their learning interest and initiative. When students encounter difficulties in learning, the intelligent tutoring system provides timely help and guidance, allowing students to feel the sense of achievement in learning, thereby enhancing their self-confidence and motivation. The alternative role of artificial intelligence is efficient in knowledge transmission and skill training, but it has certain limitations in the cultivation of students' comprehensive qualities. Although artificial intelligence writing tools can quickly generate text content to help students complete writing tasks, they may also lead students to rely too much on tools, lacking independent thinking and innovation abilities, and may develop bad habits such as plagiarism and patchwork, unable to truly improve their writing skills and thinking abilities. Moreover, the content generated by artificial intelligence writing tools often lacks emotion and individuality, which is not conducive to cultivating students' literary appreciation abilities and aesthetic levels.

In terms of the role of teachers, the supporting role of artificial intelligence frees teachers from the cumbersome teaching affairs and enables them to devote more time and energy to personalized guidance and emotional care for students, accelerating the transformation of the teacher's role from a task executor to a guide and promoter of learning. The alternative role of artificial intelligence has a certain impact on the positioning of teachers' roles, triggering thoughts on teacher career development. If the role of artificial intelligence in teaching expands continuously, teachers may face the risk of role marginalization. However, this also prompts teachers to continuously enhance their professional qualities and innovation capabilities, and to leverage the roles of artificial intelligence that cannot be replaced by humans, such as emotional communication and value guidance.

6. The Development Trends and Challenges of the Role of Artificial Intelligence in Education

6.1 Trend Prediction

With the continuous innovation of technology and the continuous evolution of educational needs, the role of artificial intelligence in education will exhibit a significant trend of deep integration, intelligence, and continuous improvement in personalized levels.

In terms of deep integration, artificial intelligence will be fully intertwined with education in all aspects and at multiple levels. Starting from the curriculum design phase, artificial intelligence will deeply intervene, leveraging its powerful data analysis capabilities to generate highly customized course content and teaching plans based on subject characteristics, students' cognitive levels, and learning needs. During the teaching implementation process, artificial intelligence will become an indispensable assistant for teachers, providing real-time support for teaching decision-making.[22] When teachers explain knowledge points in the classroom, the artificial intelligence system can monitor students' real-time learning status, such as facial expression analysis and classroom interaction data statistics, and promptly provide feedback on students' understanding and attention concentration, helping teachers adjust teaching rhythms and methods. In the after-class tutoring stage, artificial intelligence will also deeply participate, providing immediate and precise tutoring services for students, meeting their learning needs anytime and anywhere. After students submit their homework through the intelligent tutoring system, the system can quickly grade the homework and provide detailed explanations for students' mistakes, offering relevant review materials and extension exercises to help students consolidate knowledge.

The improvement of intelligent levels is one of the important trends in the development of artificial intelligence in education. Future artificial intelligence education systems will possess more powerful natural language processing capabilities, enabling more natural and fluent conversations with students, understanding the deep meanings of students' questions, and providing targeted answers. The reasoning and judgment abilities of artificial intelligence will also continue to enhance, capable of intelligently adjusting teaching content and difficulty based on students' learning progress and knowledge mastery, achieving true adaptive learning.[23] Artificial intelligence will also deeply integrate with emerging technologies such as virtual reality (VR) and augmented reality (AR), creating immersive learning environments for students, making the learning process more vivid and interesting, and increasing students' enthusiasm and participation.

Personalized development is also an important direction for the role of artificial intelligence in education. In the future, artificial intelligence will be able to more accurately analyze students' learning data, pay attention to students' mental health and emotional needs, and provide personalized psychological counseling and emotional support for students. In career planning, artificial intelligence will use students' academic performance, interests and specialties, career tendency test results, etc., to provide professional career planning suggestions and development path guidance for students, helping them better plan their future development directions.

6.2 Challenges

In terms of data privacy and security, artificial intelligence education systems will collect, store, and process a large amount of students' personal information and learning data during operation. If this data is leaked, the consequences will be unimaginable. Students' learning achievements, learning habits, interests and hobbies, family background, etc., if illegally obtained, may be used for commercial marketing, identity theft, etc., causing great distress and losses to students and their parents. Some criminals may use students' personal information for precise fraud or use students' learning data for commercial analysis, infringing upon students' privacy rights[24]. The artificial intelligence system itself may also have security vulnerabilities, vulnerable to hacker attacks, resulting in data being tampered with, deleted, or leaked.

Ethical and moral issues are also challenges that cannot be ignored in the application of artificial intelligence in education. Artificial intelligence algorithms are trained based on a large amount of data. If the training data is biased, the algorithm may develop biases and unfairly evaluate and treat students of different genders, races, and socio-economic backgrounds. The application of artificial intelligence in education may also trigger some ethical controversies, such as whether virtual teachers can completely replace human teachers in emotional education and value guidance, and whether students' excessive reliance on artificial intelligence will lead to a decline in their autonomous learning ability and innovative thinking[25].

Over-reliance on artificial intelligence also brings a series of problems. In the educational process, if students overly rely on the answers and guidance provided by artificial intelligence, they may gradually lose the ability to think independently and solve problems, becoming lacking in critical thinking and innovative spirit. For example, if teachers overly rely on artificial intelligence for assisted teaching, they may neglect the improvement of their own teaching abilities and reduce in-depth research and exploration of teaching content and methods.

6.3 Discussion on Countermeasures

To effectively address the challenges brought by the development of artificial intelligence in the field of education and fully utilize its advantages, it is necessary to work together from multiple aspects such as policy regulations, technological research and development, and educational concept transformation to build a favorable ecosystem for the deep integration and healthy development of artificial intelligence and education.

At the policy regulation level, the government should accelerate the improvement of relevant laws and regulations, clearly defining the data usage norms, privacy protection requirements, and liability determination of artificial intelligence in education applications. Develop a specialized education data protection law, detailing the rights and obligations of educational institutions in collecting, storing, and using student data, and clearly stipulating the legal responsibilities and penalty measures for data leakage. Establish a strict data access permission management mechanism, stipulating that only authorized personnel can access students' personal information and learning data, and recording the access process in detail for traceability and supervision. Strengthen the supervision of artificial intelligence education products, establish product review and certification systems to ensure that products meet educational ethics and safety standards.

In terms of technological research and development, research institutions and enterprises should increase investment in the research and development of artificial intelligence technology, improve the security, reliability, and intelligence level of the technology. Strengthen research on data encryption technology, adopt advanced encryption algorithms to ensure the security of student data during transmission and storage, prevent data from being stolen or tampered with. Develop explainable artificial intelligence algorithms to increase the transparency and explainability of the algorithms, enabling educators and students to understand the decision-making process of artificial intelligence, reducing algorithm bias and unfairness. For the scoring algorithms in intelligent assessment systems, make them clearly display the basis and standards for scoring, avoiding evaluation injustice due to opaque algorithms. Strengthen technological innovation for the deep integration of artificial intelligence and education, develop more artificial intelligence applications that meet the needs of education and teaching.

The transformation of educational concepts is also crucial. Educators should establish a correct view of artificial intelligence education, recognizing that artificial intelligence is a tool to assist teaching, not an existence that replaces teachers. Teachers should actively embrace artificial intelligence technology and integrate it into teaching practice to improve teaching effectiveness. They should also strengthen information literacy and digital citizenship education for students, enhancing students' understanding and application ability of artificial intelligence, teaching students how to correctly use artificial intelligence tools, how to protect personal privacy, and how to distinguish the

authenticity of information, cultivating students' information security awareness and digital responsibility, enabling them to grow healthily in the digital age.

7. Summary

The supporting and substitutive roles of artificial intelligence in education exhibit significant differences in terms of functions, advantages, limitations, and educational impacts. The supporting role serves as a crucial driving force for educational transformation, while the application of the substitutive role requires careful boundary management. Reasonably leveraging the supporting role of artificial intelligence and avoiding the negative impacts of the substitutive role can achieve a positive interaction between education and technology. In the future, further exploration of the mechanisms and models of the integration of artificial intelligence and education is possible, and in-depth research on how to balance the supporting role and the substitutive role in educational practices is needed. At the same time, research on the ethical and social impacts of artificial intelligence in education applications should be strengthened to provide more scientific theoretical guidance and practical solutions for the digital transformation of education.

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