Research on the Application of Artificial Intelligence in Course Content Design and Teaching Practice

Wang Hui*
Taiyuan No.5 Middle School Taiyuan Shanxi, 030000

18734588068@163.com

Abstract. This study is dedicated to analyzing the role of artificial intelligence technology in curriculum development and teaching activities, with a special focus on the contribution of intelligent tutoring systems to improving students' English learning outcomes. In an urban public high school, an optimized artificial intelligence teaching system using genetic algorithms was implemented. The system automatically adjusts teaching content and difficulty by analyzing students' learning data to achieve personalized learning. According to the latest research results, the average English score of students using the artificial intelligence-assisted teaching system increased by 14.7% compared with the previous one. At the same time, students' teaching feedback satisfaction also increased to 85%. This system has shown significant results in improving students' reading comprehension and writing skills. The number of ways to participate in personalized learning has increased, with an increase of 62.5%. According to the conclusions of the study, the artificial intelligence-assisted teaching system has significantly promoted students' learning outcomes and learning experience, provided a solid technical support and optimization strategy for educational activities, and revealed the broad application potential and development direction of artificial intelligence in the field of education.

Keywords: artificial intelligence, teaching practice, personalized learning, intelligent teaching system

1. Introduction

In the field of education, the rapid progress of artificial intelligence technology is fundamentally changing the design methods of courses and the practical application in the teaching process. In the current educational scenario, the limitations of traditional teaching models have become increasingly obvious when facing the ever-changing learning needs. At the same time, the intervention of artificial intelligence technology provides teachers and students with customized and adaptable learning programs, which greatly promotes the improvement of teaching effectiveness. With the advancement of science and technology, many educational entities are trying to integrate artificial intelligence into their teaching process in order to improve teaching effectiveness and optimize learners' interactive experience. A major challenge is how to closely integrate artificial intelligence technology with teaching design to ensure the effectiveness and appropriateness of technology application. The goal of this study is to analyze the

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practical application of artificial intelligence technology in the process of curriculum development and teaching implementation. Through in-depth discussion of specific cases, a comprehensive evaluation of its actual role in improving teaching effectiveness and efficiency and future prospects is conducted, thereby contributing theoretical basis and practical reference to the progress of educational technology.

2. Theoretical Overview

A. Overview of Artificial Intelligence

The advancement of artificial intelligence technology has inspired fundamental changes in the education industry, which has had a profound impact on the traditional way of teaching activities and curriculum arrangement. As shown in Figure 1, business cognition, data collation, AI model construction and deployment are sequential steps. Each step requires precise management and strict review to ensure the fairness, transparency and reliability of the entire process. In the early stages of project development, it is important to pay attention to in-depth insights into business needs, which is the key to ensuring that technical proposals are consistent with teaching objectives. In the initial stage of data processing, we focus on evaluating the accuracy and bias of the original data to ensure that the subsequent input information has the required accuracy and representativeness. In the process of building artificial intelligence models, it is crucial to ensure that the model design is explainable so that relevant parties can understand the internal logic of the model's decision-making. Before the model is deployed, a thorough evaluation and compliance review must be conducted to ensure the effectiveness of the solution in real teaching scenarios and compliance with ethical standards [4].

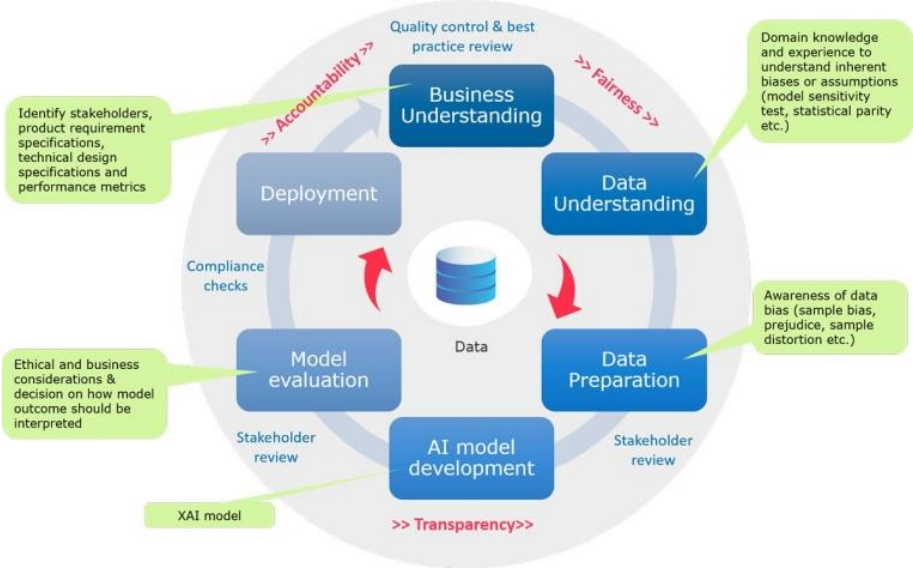

Fig. 1. Overview of artificial intelligence

B. Application of artificial intelligence in education

In the current education system, artificial intelligence technology is widely used, and its application range extends from personalized learning to intelligent assessment systems. With the help of cutting-edge technologies such as machine learning and natural language processing, artificial intelligence can provide personalized learning materials and feedback based on students' learning speed and interests, thereby significantly improving the learning experience and effectiveness. The artificial intelligence system can conduct in-depth analysis of students' answering methods and learning habits, and then propose customized learning material suggestions, and optimize the difficulty of teaching content accordingly. The intelligent assisted teaching system can provide students with immediate learning support and intervention without adding additional work pressure to teachers, so that they can quickly get the assistance they need when they encounter learning difficulties. These applications not only expand the scope and flexibility of educational resources, but also open up new channels for promoting equal educational opportunities and improving teaching standards.

C. Curriculum Design and Teaching Theory

The blueprint planning and theoretical basis of educational practice constitute its core framework, providing direction and guidelines for the implementation of educational activities and the selection of teaching methods. In the field of education, traditional theories tend to focus on the integrity and rationality of educational content, while modern theories turn the focus to learners themselves, advocating to stimulate their motivation for autonomous learning and cultivate their ability to think independently. Under the guidance of corresponding theories, curriculum planning should not only take into account the realization of teaching objectives, but also explore how to use technical tools, such as artificial intelligence, to strengthen teaching interaction and improve learning efficiency. By integrating artificial intelligence technology into teaching planning, teachers can more accurately understand students' learning needs, and then optimize teaching content and strategies in a targeted manner to support students' more effective learning progress.

3. Application of artificial intelligence in course content design and teaching practice

A. Application framework and model construction

In exploring how to embed artificial intelligence into course content design and teaching activities, the key is to use genetic algorithms to improve the efficiency of model building in the English teaching system. Genetic algorithms are a tool with high optimization efficiency. They simulate the selection mechanism of nature and continuously optimize and iterate to improve the effectiveness of teaching strategies.

In this model, we first define the objective function $F(\ )$ is used to measure the effectiveness of the teaching system. This function may include two core variables: student satisfaction and learning effectiveness, expressed as $F(x) = w_1 \times \text{Student satisfaction}(x) + w_2 \times \text{Learning outcomes}(x)$, where w_1 and w_2 represent weight factors. In the actual teaching process, the relative importance of various teaching objectives is redistributed according to specific needs in order to more effec-

tively achieve the predetermined teaching effect. In the study of teaching methods, various strategies are converted into chromosome forms, where the genes on each chromosome correspond to specific teaching activities or resources. With the help of the three mechanisms of selection, crossover and mutation in genetic algorithms, a new generation of teaching strategies can be cultivated. In this process, the adaptability of the strategy becomes the key to determining whether it can be inherited, and excellent strategies can be retained and used to reproduce new strategies. The crossover operation enables two chromosomes to combine with each other to form new features; while the mutation operation introduces new possibilities and improves diversity by randomly changing the genes on the chromosome. This program is executed repeatedly until the preset number of iterations is met or the predetermined performance standard is reached.

B. Application Case Analysis

1) Case Background

The specific research object of this study is a public senior high school located in a typical urban area. The school has approximately 1,500 students and 80 faculty and staff. After five years of in-depth observation, the performance of students in the school in the English subject, although the overall pass rate remained at 78%, but in the two major modules of writing and reading comprehension, the proportion of students who failed to meet the standards was as high as a quarter. According to feedback from educators, the large class size makes it difficult to provide individualized care and assistance to each learner.

2) Demand Analysis

In the process of learning English, many students have significant shortcomings in reading and writing skills, which is mainly reflected in the application of vocabulary and the construction of grammatical structure. Educators need auxiliary tools to gain insight into students' special difficulties and then provide appropriate guidance and training. According to the questionnaire data collected for teachers and students, there is an urgent demand for customized learning routes. Contemporary students expect to use technical means to obtain richer learning materials and instant feedback. This method will greatly enhance the degree of interaction in the learning process and the level of personalized teaching. At present, my country's educational institutions lack support for teachers' teaching for disadvantaged groups in resource allocation. It is urgent to introduce intelligent systems to improve this situation, optimize resource allocation and personalize learning content.

3) Designing AI solutions

In response to the teaching difficulties mentioned above, a set of educational auxiliary tools based on artificial intelligence technology has been developed. This system uses natural language processing technology and machine learning algorithms to realize automated personalized learning support functions. This system uses logistic regression analysis to conduct in-depth mining of students' learning behaviors and their performance data to predict their learning outcomes. Based on this prediction result, the system will make corresponding adjustments to the teaching content.

The model formula can be expressed as $P(y=1|\ x)=\frac{1}{1+e^{-(\beta_0+\beta_1 x_1+\cdots+\beta_n x_n)}}$, where

$P(y=1|\ x)$ is the probability that the student achieves the learning goal, $x_1,\ldots,x_n$ is the input feature, such as learning time, error rate, etc., and is the model parameter. $\beta_0,\beta_1,\ldots,\beta_n$

4) Implementation and Integration

During the project implementation phase, the key task is to combine the artificial intelligence system with the school's current education management platform to improve management efficiency and teaching quality. First, the school must work closely with the information technology department to ensure the technical compatibility of the system and conduct preliminary testing, and then make appropriate adjustments to the system configuration and functions. Subsequently, professional training courses for educators are carried out to enable them to skillfully operate the new education platform and master the methods of analyzing the data and reports provided by the platform. After multiple rounds of experimental teaching activities, the application boundaries of the system gradually extended from a single class to cover the entire grade, and finally were widely deployed in the overall campus environment.

5) Teaching activities and learning interaction

After the introduction of the artificial intelligence system, the interactivity and personalization of teaching have been significantly improved. The teaching support platform can dynamically capture students' behavioral indicators in various teaching interactions and quickly give evaluation opinions. With the help of the question bank containing customized questions built by the system, educators can implement targeted teaching strategies for learners' knowledge blind spots. By simulating the students' learning process, the system can intelligently propose the most suitable learning materials and practice projects, greatly enhancing the direction and efficiency of learning. This system provides an interactive and collaborative learning model among students, and uses an intelligent matching mechanism to pair students with similar learning progress into groups to promote social interaction and teamwork in learning.

4. Effect evaluation

A. Evaluation Results

After the AI teaching assistant system was put into use, its effectiveness was carefully analyzed and evaluated. The collected results and performance surveys involved the improvement of students' academic achievements and the change of subjective satisfaction:

TABLE I. CHANGES IN STUDENTS' ACADEMIC PERFORMANCE AND SATISFACTION BEFORE AND AFTER IMPLEMENTATION

index	Average value before implementation	Average value after implementation
Student satisfaction (%)	70	85
English total score (%)	68	78
Reading comprehension score (%)	65	76
Writing skills score (%)	62	75
Personalized learning participation (%)	40	65

According to the data analysis in Table 1, after the introduction of the AI teaching assistant, the students' satisfaction in the teaching process and their academic performance showed a significant growth trend. Specifically, the overall score of the subjects in the English subject increased by about 15 percentage points, among which the improvement in reading comprehension and writing skills was particularly prominent. The number of students participating in personalized learning has increased significantly, which reflects that their recognition and interest in customized learning content have increased significantly. Through in-depth analysis of the collected data, it can be clearly seen that the teaching assistance system built with AI technology has played a significant role in optimizing classroom teaching results and enhancing the student experience. This study aims to explore the use of the system to provide students with customized learning resources and instant feedback, in order to achieve higher efficiency in English knowledge acquisition and significantly improve students' learning enthusiasm and classroom participation. This finding confirms the effectiveness of AI in education and provides a solid data foundation for its wider application in the field of educational technology in the future.

B. Discussion and Improvement

In the process of promoting the application of intelligent educational auxiliary tools, although its positive impact on students' learning outcomes and experience is quite obvious, it also reveals many problems to be solved and the necessity of further optimization and upgrading. This study found that the demand for system operation training for teachers exceeded the previous estimate. In actual application, many teachers encountered difficulties in operation, which highlighted the urgency of strengthening technical guidance and training. Although students' personalized learning participation has increased, some students still said that the learning resources provided by the system cannot always meet their specific learning needs. This phenomenon indicates that there is still potential for improvement in the ability of algorithms to understand students' individual needs. In the current educational environment, ensuring the security of students' personal information and maintaining the privacy of data have become core issues that parents and educational institutions pay close attention to. To this end, security measures must be strengthened to prevent potential data leakage risks. In future work, the focus will be on improving the accuracy of algorithms, creating a personalized learning roadmap that better meets students' needs, strengthening teacher training in the field of technology, and continuously strengthening the system's data protection mechanism, aiming to build a trust relationship involving all relevant parties. These changes will not only improve the practicality of the system and the user's interactive experience, but will also promote the in-depth application and continuous progress of artificial intelligence technology in the education industry.

5. Conclusion

This experiment verified the effectiveness of artificial intelligence technology in teaching English in urban public high schools. After systematic layout and implementation, students' learning effects and pleasure were significantly enhanced, especially in the field of English reading comprehension and writing skills. There are many areas to be deepened and expanded, such as the scope of teacher professional development, the accuracy of students' personalized learning materials, and the perfection of data protection measures. These challenges have just outlined a clear development trajectory for

subsequent research and practical activities. Future work tasks are aimed at dealing with these problems, improving system performance through this process, and extending its scope of application to a wider range of educational occasions. Technology iteration and strategy optimization are indispensable. Artificial intelligence technology plays an irreplaceable role in promoting efficient and high-quality changes in education, injecting fresh vitality into the existing education framework, and promoting its essential renewal.

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