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Artificial Intelligence-Driven Computer-Assisted Instruction: Innovative Applications and Practical Pathways

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Technology of the Artificial Intelligence, Computer-Aided Instruction, New Learning Model

ABSTRACT
With the widespread adoption of computers and technological advancements, humanity continues to benefit from and expand their functionalities. This study, based on a weighted reasoning model, conducted an experimental investigation into the application of artificial intelligence (AI) technology in computer-assisted instruction (CAI). Students were divided into two groups: one using the traditional learning approach and the other utilizing an AI-assisted teaching system. Their performance was evaluated through comparative score analysis. The data indicated that the system operated normally, with core functions processing data accurately, meeting instructional requirements, and proving user-friendly for both teachers and students. Experimental results showed that the traditional teaching group achieved an average score of 74.77, while the AI-assisted group scored significantly higher at 84.98. This study confirms that AI-based teaching systems can effectively address the limitations of conventional classroom instruction, demonstrating substantial potential for further research.

Introduction

Multimedia computing is a teaching method that is rapidly applied at present. This method is very convenient and efficient, which greatly improves the teaching quality of the whole university[1-2]. Computer aided teaching system the professional nouns also specially was kicked out for explanation corresponding to the traditional teaching in colleges and universities teaching means, whether the education itself or knowledge itself, only the system more intelligent, to make good analysis stimulate students' learning enthusiasm, improve the learning efficiency and teaching results[3-4]. The combination of multimedia technology and the characteristics of various specialized courses will, after all, continuously improve our overall teaching quality and continuously develop the computer-aided teaching system[5].

Zhen et al. showed that the intelligent computer aided system in China started very late, so it is not easy to apply it to teaching. At present, most of the research efforts are focused on the systematic presentation, which is simply PPT presentation[6]. However, the current system also attaches great importance to the richness of the content of the interface itself, ignoring the adaptability of the

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content and intelligent computing to the students. And J and others also think learning is the need to students actively construct their own learning content, instead of passive teaching by the teacher, the absorption of knowledge, but actively choose their own learning content, according to their own background and knowledge accumulation, the system can automatically recognize students suitable learning content, and students to reach a consensus on the cognitive, are truly effective[7].

At present, we have a high expectation on ARTIFICIAL intelligence, which also gives it a good development space and prospect. We hope that artificial intelligence will improve the quality of life of all people in general[8-9]. At present, more and more artificial intelligence experts have entered the teaching field, trying to improve the quality of teaching, teach students in accordance with their aptitude, combine the characteristics of textbooks and students, and make teaching methods more suitable for students themselves[10].

2. Practical Applications of Artificial Intelligence in Computer-Aided Teaching

2.1 Disadvantages of CAI

At present, CAI system does not have a high intelligence, so the teaching method for students is still set by itself. It cannot be targeted at the teaching and the remedy to the case, and it has not yet achieved the purpose of intelligent system autonomous auxiliary learning. For teachers, such a method can not let students well into the learning, the system can not automatically calculate the learning situation of students and the appropriate learning program, so it is not intelligent.

(1) Lack of intelligence

The existing CAI courseware system cannot carry out targeted education for students of different levels, students' learning is passive, and students can't learn selectively by automatically providing financial aid information. For teachers, they cannot actively participate in teaching, can't prepare the most suitable learning content according to students' cognitive model according to the information provided by the system, and can't provide different teaching modes and methods, so they are not intelligent.

(2) Lack of openness

CAI courseware still has many shortcomings, among which the most important one is that it is not open. Users can only teach according to the fixed contents of the courseware, but cannot make use of the existing resources to give full play to the course, so that the course can adapt to the current situation more.

(3) Lack of man-machine interaction ability

The present computer intelligent teaching is according to the textbook process rigid provided to the students, the classroom teacher through the courseware to show the course content, so basic, and the traditional blackboard teaching students and the teacher or a traditional learning method, only into the multimedia technology, there is no very good realization of human-computer interaction effect.

(4) Lack of communication between teachers and students

After students learn according to the existing CAI courseware, when they encounter problems, they cannot ask for help from teachers. Due to the lack of communication between teachers and students,

teachers cannot understand the situation of students at all, which reduces the learning effect of students. To sum up, IT can be seen that CAI has many problems. With the continuous emergence of new technologies, these problems will make CAI more and more unable to meet the new requirements. Therefore, the new computer-aided teaching system represented by intelligent CAI will become the development direction that needs to be explored and realized constantly in education technology.

2.2 Intelligent Computer-Aided Instruction (ICAI)

As artificial intelligence and cognitive psychology technology application in the field of education, has affected the CAI teaching method, so in the 1970 s, and by the BBN technologies take the lead in developing a successful Scholar teaching system, opens the door to a new comprehensive education and technology, Intelligent Computer Assisted Instruction (Intelligent Computer Assisted Instruction, ICAI) system. ICAI system is an open human-computer interaction system, which is student-centered and computer-mediated, and uses modules such as "knowledge base", "student model" and "teacher model" to simulate the thinking process of teaching experts. The most important characteristic of ICAI system is intelligence, which changes the traditional teaching mode. It can adopt different teaching strategies according to students' learning characteristics and learning level, thus stimulating students' learning enthusiasm. It is a new method of educational reform to realize educational modernization.

The powerful ICAI system is a comprehensive system engineering that integrates educational science, psychological science and cognitive science theories, and integrates artificial intelligence, multimedia technology, data visualization and computer technology. It analyzes the characteristics and processes of human thinking, builds a learning cognitive model, and designs an intelligent computer-assisted teaching system to help teachers implement teaching in accordance with their aptitude and precise guidance, so that students can carry out personalized and adaptive learning based on different cognitive abilities. The system can bring together the teaching experience and wisdom of the teacher group, support students to actively acquire knowledge according to their own situation, improve teaching efficiency, and activate teaching activities. The ICAI system is like a knowledgeable and experienced teacher, providing professional teaching services to learners.

Computer aided teaching and artificial intelligence have a good compatibility, and in recent years the development of artificial intelligence is also very rapid. At present, the main research field is that students can choose their favorite courses independently with the assistance of computers, so that they can be more independent and efficient in learning. But it also have higher request for computer teacher, only teachers understand the present teaching high school students for learning, knowledge will be unified in a library of teaching to make students through the calculation of artificial intelligence to make a choice, and according to the calculation formula based on the choice of the course students like, better play to the artificial intelligence in the future, automatic

calculation of efficient permeance and machine and students' interaction is an important characteristic of the new teaching model.

2.3 The Weighted Inference Model Based on Artificial Intelligence Technology

Generally speaking, the influence of multiple premises of a rule on the conclusion of the rule varies, that is, the support of each premise for the conclusion varies, and the amount of information contained varies. Taking English learning as an example, in the exam for the same grammar point, different questions have different depths and focuses on the examination of the grammar point. If students answer some key questions incorrectly, it can often be judged that they have not mastered the grammar point.

In the process of approximate reasoning, when a knowledge condition involves multiple preconditions, weighted factors can be introduced to represent the relative importance of each sub-condition. By assigning different weights, the influence of each sub-condition on the final conclusion can be more accurately reflected. In general, the more independent a sub-condition is, or the more critical it is to the conclusion, the greater the weight it should be assigned.

The knowledge representation considering the weight is shown in formula (1), (2) :

$$IFA_1(w_1) \wedge A_2(w_2) \wedge A_3(w_3) \wedge \ldots \wedge A_n(w_n) \quad THENBCF(B, A) \quad \ldots\ldots\ldots\ldots(1)$$

$$\left(A = A_1(w_1) \wedge A_2(w_2) \wedge A_3(w_3) \wedge \ldots \wedge A_n(w)\right) \ldots\ldots\ldots\ldots(2)$$

Where, A, (I =1... N) is the subpremise, B is the conclusion, and their truth values are all between [0,1]. Weighted factor WI (1... N) is the weight coefficient of the sub-condition Ai, whose value must be given by the field experts and meet the normalization conditions such as (3) :

$$\sum_{i=1}^{n} w_1 = 1 \qquad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

If the credibility of each sub-condition A is CF (Ai), then the credibility of the combined evidence is calculated by Formula (4) :

$$CF(A) = \sum_{i=1}^{n} w_i \times CF(A_i) \quad \ldots\ldots\ldots\ldots(4)$$

If the normalization condition is not satisfied, CF (A) can be calculated by formula (5) below:

$$CF(A) = \sum_{i=1}^{n} w_i \times CF(A_i) / \sum_{i=1}^{n} w_i \quad \ldots\ldots(5)$$

3. Application and practical experiment of artificial intelligence (AI) technology in computer-assisted teaching

3.1 Experimental Purpose

Any artificial intelligence system should focus on "intelligent", an intelligent auxiliary English teaching system should try to can be observed from student by the student examination results and the practice results of the master degree of knowledge, or trying to guess the students' ability to in some way with values, in view of the teaching reform of English problems, the experimental system should address such questions: (1) the teacher shortage problem; (2) Weak basic knowledge of students; (3) Insufficient awareness of students' independent learning.

3.2 Experimental System Setting

Considering the characteristics of English teaching, the assessment and reinforcement of fundamental knowledge are primarily carried out through the analysis of students' responses to objective

questions, each of which corresponds to one or more knowledge points. Consequently, the English expert system is designed as a rule-based system, with its core functions including diagnosing students' learning difficulties, supporting instructional practice, and incorporating adaptive learning capabilities.

4. Discussion on the Application and Practice of Artificial Intelligence Technology in Computer Aided Teaching:

(1) The Acquisition of English knowledge in this system is passive. Knowledge acquisition is structured by knowledge engineers and English experts, so knowledge acquisition module should be established for knowledge acquisition and then knowledge acquisition module should be established. English experts log in the system and enter the knowledge acquisition module. They can operate according to the prompts, which is actually a passive knowledge acquisition process. This experiment USES the forward reasoning and reverse reasoning of reasoning mechanism, combining the system according to the rules in the input of information and knowledge base is uncertain, a corresponding fuzzy output variable is credible conclusion, the uncertainty of information in the process of reasoning contains rules uncertainty and credible conclusion reasoning credibility, also spread in turn. The numerical values of credible fuzzy quantifiers in the reasoning machine of the ENGLISH-assisted teaching expert system constructed by this experiment are shown in Table 1 and Figure 1:

Table 1. The Numerical Value of Fuzzy Quantifiers for the Credibility of the Inference Engine of the English Assistant Teaching Expert System

Fuzzy quantifier	Value
Absolutely credible	1.00
Very credible	0.95
Strong credibility	0.9
Average credibility	0.75
Relatively weak credibility	0.5
Credibility is weak	0.2
Untrustworthy	0.00

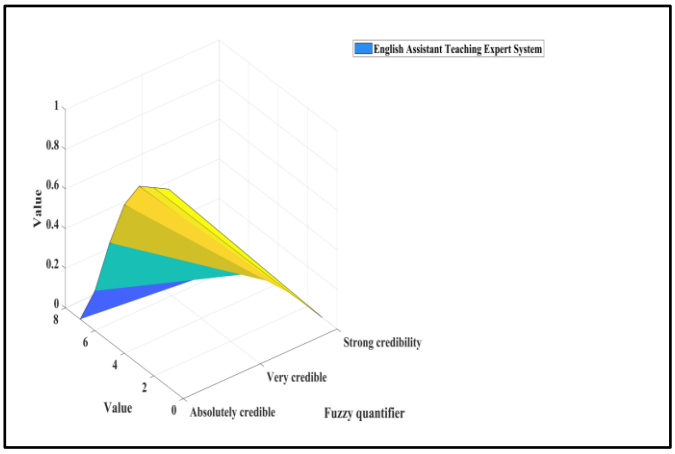

Figure 1. The Numerical Value of Fuzzy Quantifiers for the Credibility of the Inference Engine of the English Assistant Teaching Expert System

(2) Due to the limitation of time, the students who participated in the test were divided into two groups and studied the contents of the textbook in the traditional mode and the new learning mode with artificial intelligence assisted teaching system respectively. A week later, the two groups of students were assessed for their examination papers, which included multiple choice questions and computer operation questions. Himself after statistical analysis of results of two groups of students, found that the traditional model of learning students grade point average of 74.77 points, and the auxiliary teaching system of the new learning mode of students' grade point average of 84.98 points, the effect is better than traditional learning mode, investigating the use of artificial intelligence system of students, the results of the

survey as shown in table 2 in figure 2.

Table 2. Questionnaire survey results

Questions/ Satisfaction	Satisfaction (%)	Quite satisfied (%)	Not satisfied (%)
Satisfaction of knowledge content of auxiliary teaching system	56	42	2
Satisfaction with teaching effect	51	40	9
Satisfaction with the rationality of the test unit	46	42	12

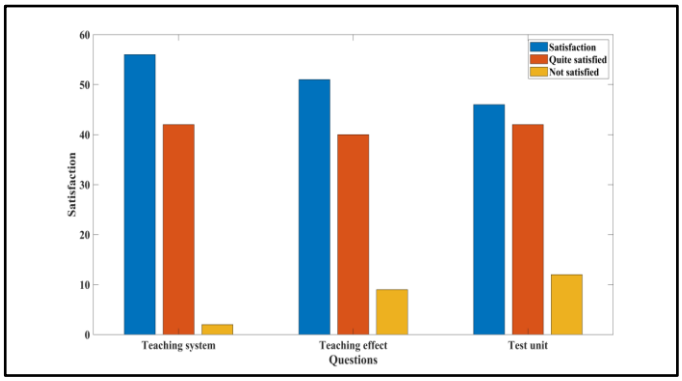

Figure 2. Questionnaire survey results

5.Conclusion

At present, high-quality ICAI systems need to implement teaching ideas and strategies and follow the laws of pedagogy and psychology, but their improvement goals are difficult to achieve in the short term. At present, relatively mature ICAI teaching systems are mostly developed as branches of expert systems, but ICAI systems designed specifically for teaching scenarios are still relatively scarce. Based on the weighted reasoning model, this paper studies the AID teaching system that incorporates artificial intelligence technology and obtains research data through a questionnaire survey. Experimental tests show that the average score of students using the traditional learning model is 74.77 points, while the average score of students using the new learning model of the auxiliary teaching system is 84.98 points, and the teaching effect is significantly better than the traditional model.

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