Scholar Publishing Group
International Journal of Educational Innovation and Science
https://doi.org/10.38007/IJEIS.2023.040102
ISSN 2789-7184 Vol. 4, Issue 1: 14-26

Effect Evaluation and Trend of Higher Education Online Courses Based on Digital Artificial Intelligence Technology

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Keywords: Higher Education, Online Course Teaching, Artificial Intelligence Technology, Digital Educational Resources, Feature Weighted Support Vector Machine Algorithm

Abstract: At this stage, a new online course teaching mode has emerged in higher education, which has promoted the development of education and teaching to a certain extent. However, the existing online course teaching mode still has many problems. For example, the function of online course system is not perfect. Students' online course learning lacks a sense of on-site learning atmosphere. The students' self-discipline is not strong, which leads to the low completion rate of courses. The emergence of digital educational resources has provided teachers and students with rich educational resources, and has gradually become an important part of education and teaching. In view of the deficiency of online course teaching mode, this paper proposed that artificial intelligence (AI) technology was applied to online courses. Combined with feature weighted support vector machine algorithm, the online course learning behavior was analyzed experimentally. The experimental results showed that the average prediction accuracy of the four learning behaviors was 93.38%, and the average prediction error was 1.20. From the above data, it can seen that this algorithm could play a good optimization effect on the prediction of online course learning behavior. This paper also conducted a questionnaire survey on the use frequency of digital education resources in various disciplines. The results showed that English was the most frequently used discipline, accounting for 24.8%. Digital education resources have certain applications in various disciplines.

1. Introduction

In the new age, the traditional model of higher education has become unable to meet the new

demands of educational development, and some reforms have been introduced in higher education to keep up with the times. Therefore, online course teaching has emerged, which has to some extent contributed to the growth of education. However, there are still some problems in the current online courses that need to be improved. Under the influence of science and technology, AI technology has become increasingly mature and has certain applications in many industries. AI technology is applied to online courses of higher education, which can effectively improve its shortcomings and promote the overall development of online courses.

In recent years, higher education has aroused widespread concern in the academic community, and scholars have carried out research on it. Kebritchi Mansureh pointed out that online education had adjusted many components of higher education teaching. In view of some challenges faced by online education, he believed that higher education institutions should help teachers improve their professional abilities and provide students with corresponding training [1]. Redmond Petrea pointed out that the benchmark to measure the quality of students' experience in higher education was student participation. By studying articles related to online participation in higher education environment, he proposed a conceptual framework, which defined five indicators of online participation [2]. Bunce Louise, to explore the relationship between college students' consumption attitude and behavior and their higher education and learner identity, conducted an investigation and analysis on several undergraduate students in higher education institutions in England. The investigation found that there was a reverse relationship between consumer orientation and academic performance [3]. Crawford Joseph pointed out that the COVID-19 epidemic had brought great challenges to the global higher education community. By studying the simultaneous response of higher education in many countries to the COVID-19 epidemic, he found that the response of these higher education providers was significantly different [4]. Macaro Ernesto pointed out that it was necessary to systematically sort out English teaching research in higher education. In order to expand the scope of research, he also compared the research results of higher education with those of other education stages [5]. Nabi Ghulam reviewed the empirical evidence of the role of entrepreneurship education in entrepreneurship achievements in higher education with the help of the teaching model framework, and provided the latest direction for future research on entrepreneurship education in higher education [6]. However, the research of these scholars on higher education is not comprehensive enough. Based on AI, the research on higher education can play a better role.

Some scholars have also conducted corresponding research on AI and higher education. Zawacki-Richter Olaf gave a systematic overview of the research on the application of AI in higher education. He found that there was a lack of critical thinking on AI education, and pointed out that the application of AI education in higher education needed to find a feasible education method [7]. Popenici Stefan AD explored the use of AI in teaching in higher education, and pointed out the problems in higher education institutions and students' teaching and learning using AI technology [8]. In general, there are not many researches on AI and higher education. In order to improve the relevant research on online courses of higher education, it is necessary to study the effect evaluation and trend analysis of online courses of higher education under AI technology.

This paper combined AI technology with feature weighted support vector machine algorithm to test and analyze the learning behavior of online courses. The test results showed that the average prediction accuracy of this algorithm was 93.38%, and the average prediction accuracy of traditional algorithm was 88.68%. In contrast, the average prediction accuracy of this algorithm was improved by 4.7%. In terms of prediction error, the average prediction error of this algorithm was 1.20, and the average prediction error of the traditional algorithm was 3.81. In contrast, the average prediction error of this algorithm was reduced by 2.61. It can be seen from the above data that this algorithm can effectively improve the prediction accuracy of online course learning behavior and

reduce the prediction error. When investigating the use frequency of digital education resources in various disciplines, it is found that digital education resources are widely used in middle school curriculum, among which the use frequency of English is the highest, reaching 24.8%.

2. Higher Education and Online Courses Based on AI

2.1. Digital Education Resources

Digital education resources are specially designed to serve education and teaching after digital processing in order to realize the goal of classroom teaching. Digital education resources are the basic component of the education system and one of the key elements to improve the quality of education and teaching. There are various types of digital education resources, including materials, teaching knowledge, tools and extensions. Among them, teachers often use the first two types of resources, while the latter two types of resources are used less.

The research have found that materials and teaching knowledge resources are mostly used to serve exam oriented education, which cannot shape students' high-level thinking ability. In order to more effectively and scientifically display the resource structure, this paper combines the current types of educational resources and AI technology to determine the building and implementation of new educational resources, as shown in Figure 1.

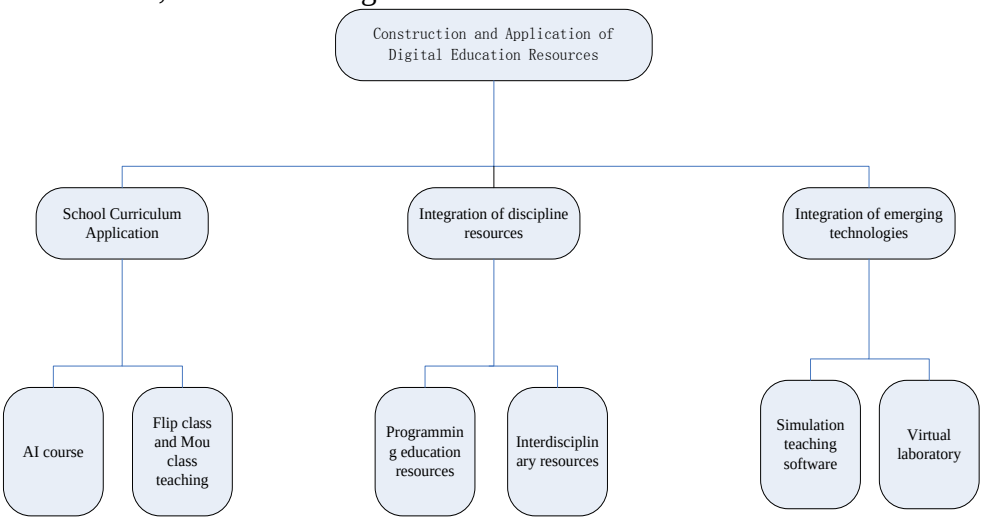

Figure 1. Construction and application of new educational resources

2.2. Higher Education under Artificial Intelligence

2.2.1. Artificial Intelligence to Promote Reform of Higher Education

The growing maturity of AI technology has caused a certain impact on the traditional way of higher education, but it also adds new possibilities for the reform of the way of higher education [9]. At this stage, higher education must be reformed to meet the development needs of the new era. The contents of the reform include the following three aspects.

(1) Reform of the concept of higher education

In China, moral education is the basic policy of education. Students are the kernel of the development of education. It is advocated to take students as the center and promote the all-round development of students [10]. At the same time, higher education must always adhere to reform and innovation to advance the modernization of higher education, the close integration of education, industrial development, and social and economic development. The innovative development of AI

applications and the continuous promotion of AI industry development promotes the upgrading of education concepts and the transformation and innovation of education methods. In the face of students' personalized and diversified learning needs, it is also necessary to provide personalized higher education as much as possible.

(2) Reform of teachers' teaching methods

The traditional higher education is dominated by teachers. In the classroom, it is also dominated by face-to-face teaching by teachers [11]. Teachers just blindly instill knowledge into students. Most of the time, teachers are teaching knowledge. In teaching design, teachers also play an absolute principal role, designing teaching according to the systematization and rationality of the subject, but without taking into account the students' learning interests and real needs. With the rise of AI technology, a lot of course knowledge can be learned on intelligent products. Teachers should pay more attention to improving students' thinking ability in the classroom, and the classroom teaching methods should be adjusted accordingly. In addition, the media of teachers' classroom teaching should also be changed. Some intelligent terminal devices, intelligent robots, virtual reality devices, etc. can be used to attract students to participate in the teaching process through novel teaching equipment, and personalized teaching can be carried out closely around students.

(3) Reform of students' learning style

In China's higher education, the awareness of students' dominant position is not strong. In the era of AI, when AI is applied to higher education, teachers can share appropriate learning resources with students through the intelligent education platform, and students can learn independently before and after class. The technology can also provide teachers with students' learning footprints in the curriculum, so that teachers can understand students' learning. In addition, the AI platform can also be used to analyze and comment on the completion of students' homework to help students correct mistakes, so as to check and fill the gaps. With the help of AI technology, students can be specifically guided to carry out independent learning to help students grasp the essentials of independent learning, thus encouraging students to explore and practice learning.

2.2.2. Application of Artificial Intelligence in Higher Education

At present, AI has certain applications in many industries, and the specific application fields are shown in Figure 2. Among them, the application of AI in higher education is as follows:

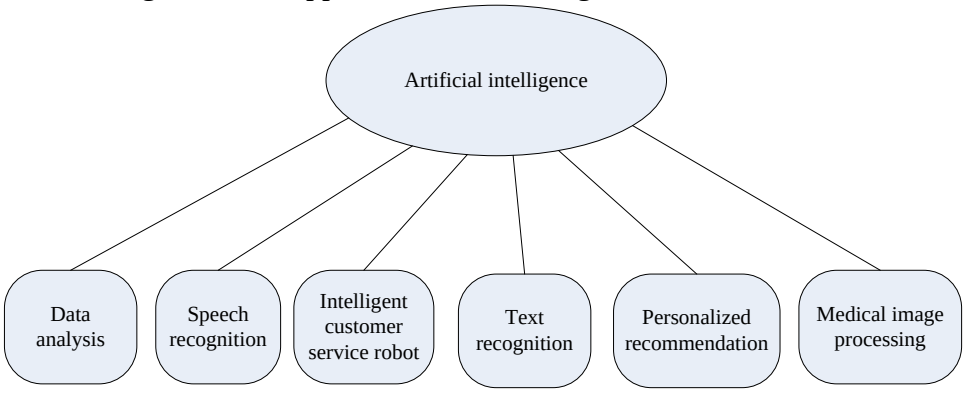

Figure 2. Application of AI

(1) Intelligent tutor system

The intelligent tutor system emulates the teaching links of teachers, so as to achieve the "one-to-one" intelligent teaching method, which effectively demonstrates the specific efficacy of AI technology in the teaching process [12]. As shown in Figure 3, the intelligent tutor system is

divided into teacher model, application model and student model. The application model is composed of semantic network, ontology, structure analysis and other parts. The model is responsible for logical reasoning and calculation of knowledge points. The teacher model can provide the teaching design scheme and teaching content suitable for learners according to different learning conditions of learners. Student model is to describe students' learning style and learning ability.

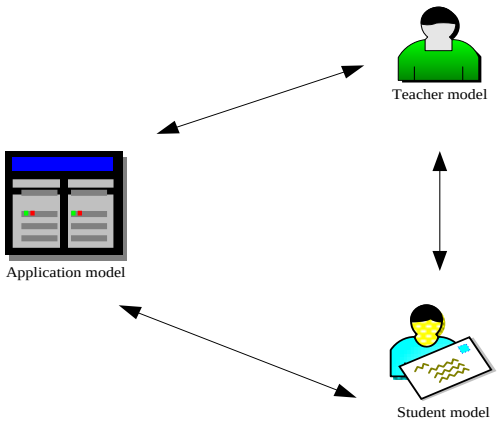

Figure 3. Intelligent tutor system

(2) Automatic evaluation system

At this stage, the automatic evaluation system software developed based on AI technology can achieve objective and effective evaluation, and can also give accurate results, which can provide reference for teaching decisions, thus reducing the workload of teachers. The automatic evaluation system software consists of two parts. One is an automatic short article evaluation system integrating text data mining, which can translate and analyze short articles. The second is an automated oral evaluation system that integrates voice recognition technology. With the help of mobile devices, voice information can be transmitted at a high speed. Data can be analyzed and evaluated in the cloud, and the final results can be transmitted to the terminal. Taking iFLYTEK as an example, it takes advantage of voice technology. The intelligent evaluation system for English listening and speaking ability and the CET-4/CET-6 examination system are developed for English subjects. These evaluation systems can assist oral training and provide effective oral evaluation for learners.

2.3. Online Courses in Colleges Based on Artificial Intelligence

2.3.1. Application of Machine Learning Algorithm

The online courses in colleges apply the machine learning algorithm in AI, which automatically collect the relevant data of students' learning process and learning effect [13]. For example, the time and frequency of watching videos and the completion of test questions in professional learning are integrated into learning data. With the help of data analysis and machine learning algorithm of intelligent control system, the learning rules hidden in the data information of students are excavated to find the individual differences of students. The learning behavior of students is further predicted and analyzed, so that teachers can deal with the problems of students in a timely and efficient manner, and guide students in a timely manner.

2.3.2. Combination of Multiple Technologies

By matching natural language processing with knowledge map, the matching degree of teachers' teaching content and curriculum standards can be compared, so as to judge the speed of teaching progress. Speech processing and recognition technology can perceive the basic expression of the teacher's teaching in the classroom, such as the size of the voice, the appeal of the classroom, and the speed of the lecture. With the help of face recognition technology, students' emotions can be identified according to their facial reactions, so that whether students are listening carefully can be judged. According to students' emotions, students' classroom performance, seriousness and other data are recorded to obtain students' feedback on the curriculum, so as to adjust the teaching content and improve teaching strategies.

2.3.3. Interactive Intelligent Robot Assisted Learning

The technology of interactive intelligent robot has been gradually improved. It has been integrated into online course teaching, which contributes to the improvement of teaching quality and learning efficiency [14]. When students are learning online courses, teachers do not need to be online all the time. With the continuous increase of learning content, knowledge points have changed from easy to difficult, and students have encountered more problems that they do not understand in the learning process. The difficulty of these problems is beyond the scope of students' ability. To ensure the continuous effectiveness of classroom teaching, students must be provided with assistance in a timely manner. At this time, interactive intelligent robots can be used. Interactive intelligent robot is the intelligent helper of online classroom students, and also their learning partner. It collects a lot of voice data and problem data information, which can automatically identify students' voice and problems, and give corresponding solutions.

2.4. Online Course Design Mode Based on Artificial Intelligence

2.4.1. Online Course Mode of School Teaching

From the aspect of service teaching application, the types of online curriculum design models for schools are as follows:

(1) Course service mode focusing on teaching

The design of online course resources focusing on teaching is shown in Figure 4. The main goal of online course construction is to help teachers teach new lessons and students learn new knowledge, consolidate knowledge, and learn to draw inferences from one instance. The service content of online courses includes the preparation stage of teachers before class, in which teachers' preparation is the dominant stage, and students' preview before class is the auxiliary. In class, teachers mainly display online resources. After class, teachers mainly comment on and guide students' homework.

The construction of online courses is mainly reflected in two aspects. One is the teaching resources that teachers need to use when preparing lessons before class. In addition, a series of teaching resources and materials used by teachers to interpret teaching knowledge points in the classroom.

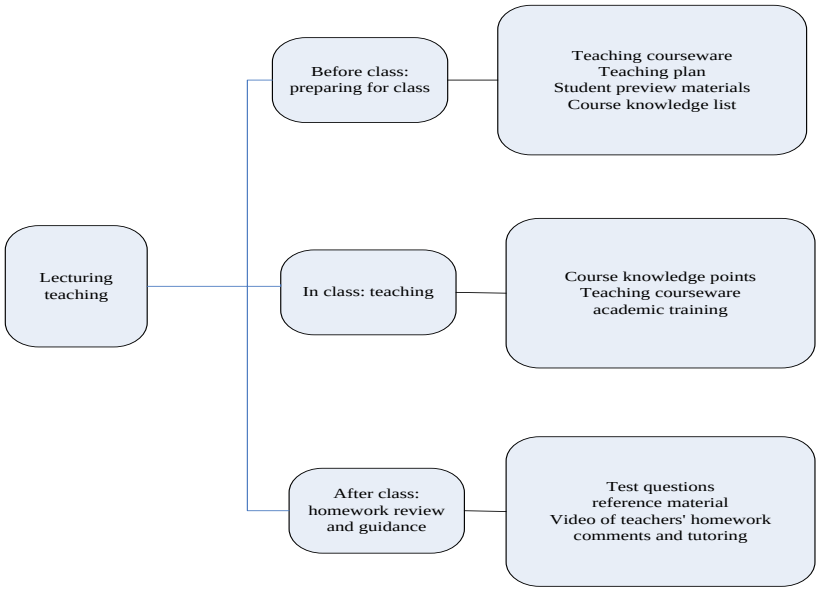

Figure 4. Design of online curriculum resources focusing on teaching

(2) Learning oriented curriculum service model

Compared with traditional learning, personalized independent learning has obviously different characteristics, mainly including diversified learning objectives, personalized learning specific content, practical learning methods, and ubiquitous learning environment. Information technology has created a natural environment for ubiquitous learning, individual learning and intelligent learning in the face of individual independent learning of school learners. The construction of online courses should make full use of the relevant advantages of online courses to serve personalized learning. The design of online course resources serving autonomous learning is shown in Figure 5.

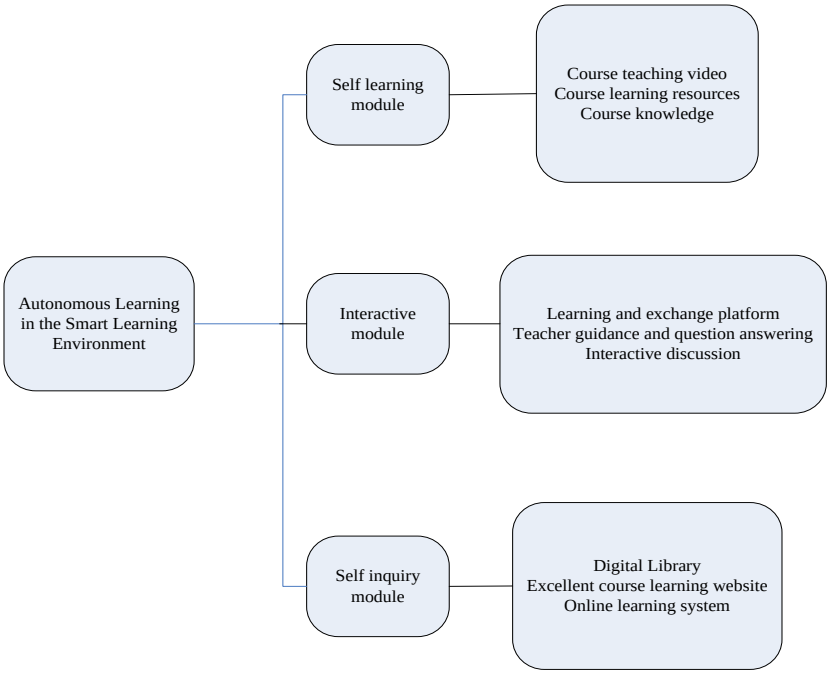

Figure 5. Design of online course resources for autonomous learning

2.4.2. Teaching Online Course Mode outside the School

The course for online autonomous learning includes the following two parts.

(1) Focusing on individuality and differentiation

The learning level of online learners is quite different, and the source of learners is also different. Therefore, the personalized needs and differentiated concerns of online learners must be learned more. This is equivalent to building a course network resource market. It should try to provide learners with a free choice to meet the requirements of different people.

(2) Focusing on learning guidance and teaching talks

Online learners cannot feel a good learning atmosphere, which easily leads to the idea of giving up learning. Therefore, in terms of curriculum research and development, the function of dialogue and interaction should be strengthened to improve the conversational guidance service for learners. For online courses such as expert speeches, online learning text materials, and micro courses, it is necessary to improve the dialogism and interactivity of these courses to strengthen the communication guidance and dialogue suggestions for learners. For example, when making micro videos, it is necessary to solve the learners' confusion. For some small knowledge points, practical dialogue type explanation is carried out. Self taught written materials can be explained in the form of talks or voice guidance.

2.4.3. Trend of Online Course Construction

At this stage, the curriculum resources for teachers' teaching are very rich. However, there are not many curriculum resources for learners to learn, and the quality of curriculum resources is uneven, which needs to be further improved. In the future, learning has become the main direction of teaching development in colleges and universities. Online courses should move in this direction to build a learning based curriculum learning and education resource system [15].

AI is applied to online courses. Through the development of personalized and intelligent course learning system, it can provide intelligent course services for the majority of learners. The utilization of this technology greatly promotes the growth of online courses in higher education.

3. Online Course Learning Behavior Based on Feature Weighted Support Vector Machine

3.1. Online Course Learning Behavior

The analysis of learners' learning characteristics and habits is conducive to the improvement of learners' learning achievements, thus improving their learning achievements.

Learning report analysis: According to learners' mastery of knowledge and habit characteristics, their online learning situation is observed. Combined with their learning performance, their problems in learning in time can be found out. Teachers can also analyze their learning situation in a timely manner, so as to make some fine adjustments to the teaching method of online learning.

Prediction and analysis of learning effects: Many researchers use big data technology to build computing models. According to the basic theory of data relation education, the study effect is predicted and analyzed. Some researchers also use linear regression models to predict and analyze students' learning.

3.2. Support Vector Machine Algorithm

Support Vector Machine (SVM) is an algorithm based on statistics. The algorithm can simulate the solid model, and transform and map the initial features with the help of kernel function. Then, in

high-dimensional space, the eigenmatrix is disassembled, and the problem can be transformed into the calculation of convex quadratic programming problem. It is supposed that the data set of online course learning behavior is $(r_j, q_j), r_j \in P^m, q_j \in \{-1,1\}, i = 1, \cdots, m$. Optimal hyperplane formulas are:

$$\min \frac{1}{2}\|\delta\|^2 + A\sum_{j=1}^{m} \mu_j \left(\mu_j \geq 0, j = 1, \cdots, m\right) \quad (1)$$

$$s.t \quad q_j\left[(\delta \cdot r_j) + a\right] \geq 1, (j = 1, \cdots, m) \quad (2)$$

The relaxation variable is expressed as μ_j. The penalty parameter is expressed as A. a represents the threshold.

The training set of online course learning behavior is projected into high-dimensional space by means of nonlinear mapping quantity. The kernel function formula is:

$$L(r_j, r_n) = \varphi(r_j) \cdot \varphi(r_n) \quad (3)$$

Among them, $\varphi(r_j)$ represents the nonlinear mapping quantity.

The convex quadratic programming problem is used to calculate the optimal hyperplane of learning behavior. The formulas are:

$$\max \sum_{j=1}^{m} e_j - \frac{1}{2}\sum_{j=1}^{m}\sum_{n=1}^{m} e_j e_n q_j q_n L(r_j, r_n) \quad (4)$$

$$s.t \sum_{j=1}^{m} e_j q_j = 0, (0 \leq e_j \leq A) \quad (5)$$

Among them, e_j represents the Lagrange multiplier, and e_j is used to calculate the decision function:

$$g(r) = \operatorname{sgn}\left(\sum_{j=1}^{m} e_j q_j L(r_j, r_j) + a\right) \quad (6)$$

3.3. Feature Weighted Support Vector Machine Algorithm

When analyzing the learning behavior of online courses, the support vector machine algorithm is easy to cause certain errors. Therefore, the algorithm needs to be improved. In this paper, the stochastic forest model is integrated, and a feature weighted support vector machine algorithm is proposed. The Gini coefficient in this model is used to calculate the characteristic weighting value. The weight is determined according to the level of different attributes. Then, the improved algorithm is used to calculate the weight value, so as to obtain the analysis of online course learning behavior.

The characteristic weight value is increased with the help of kernel function, and the formula is:

$$L_y(r^{(j)}, r^{(n)}) = L(yr^{(j)}, yr^{(n)}) \quad (7)$$

The kernel function is represented by L_y. y represents the linear transformation matrix, and L_y is tested.

If any $r^{(j)}, r^{(n)}$ is substituted into L, it can be obtained:

$$L_{jn} = L(r^{(j)}, r^{(n)})(j, n \in 1, \cdots, m) \quad (8)$$

3.4. Test Experiment of Online Course Learning Behavior

This article takes the students of a university as the study object, and combines the feature weighted vector machine algorithm to make an experimental analysis of the relevant data of the

students' learning behavior in the online course learning platform of the university. Among them, students' learning behavior includes the number of assignments completed, the number of experiments, the number of discussions, and the number of practical activities, and has been compared with the traditional algorithm.

3.4.1. Prediction Accuracy Test

This experiment tests the online course learning behavior under the two algorithms from the perspective of prediction accuracy. The experimental results are shown in Figure 6.

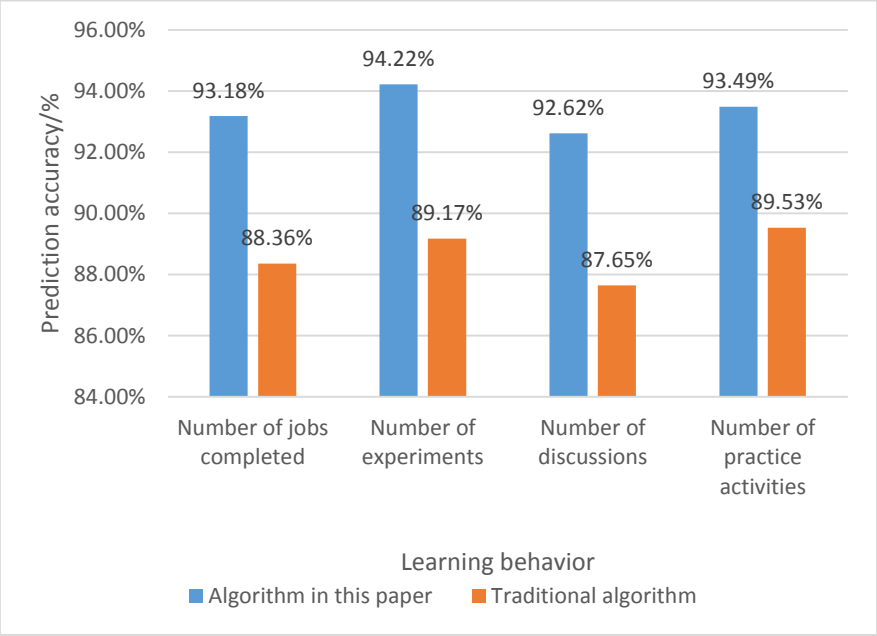

Figure 6. Comparison of prediction accuracy of students' learning behavior

It can be seen from Figure 6 that the accuracy of the two algorithms in predicting students' learning behavior is somewhat different. In this algorithm, the prediction accuracy of different learning behaviors is relatively high. Among them, the prediction accuracy of the number of experiments is the highest, 94.22%. The prediction accuracy of discussion times is the lowest, 92.62%. The average prediction accuracy of the four learning behaviors is 93.38%. In the traditional algorithm table, the prediction accuracy of different learning behaviors is lower. Among them, the prediction accuracy of discussion times is the lowest, 87.65%. The prediction accuracy of the number of practical activities is the highest, 89.53%. The average prediction accuracy of the four learning behaviors is 88.68%. From the above data, it can seen that the prediction accuracy under this algorithm is higher, and the prediction effect on students' learning behavior is better.

3.4.2. Prediction Error Test

In order to further compare the differences between the two algorithms, this paper also tests the learning behaviors of different students from the perspective of prediction error, as shown in Figure 7.

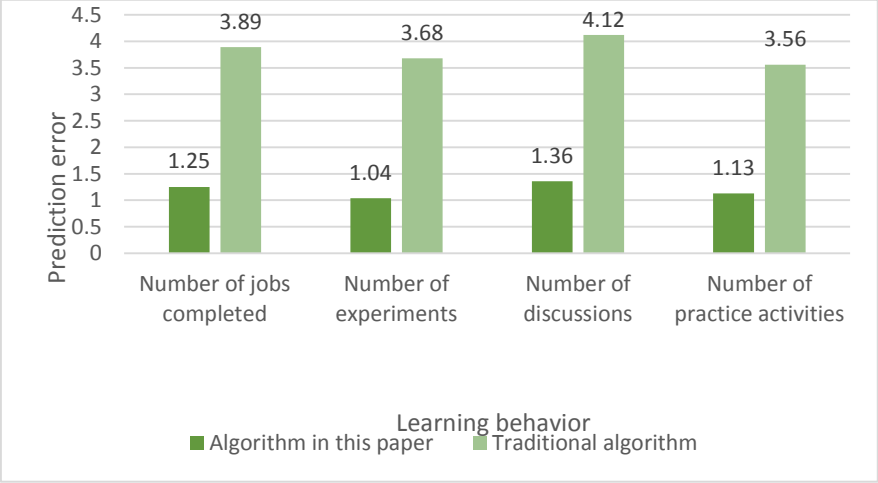

Figure 7. Comparison of students' learning behavior prediction errors

It can be seen from Figure 7 that the two algorithms have different errors in predicting students' learning behavior. In this algorithm, the prediction error of different learning behaviors is relatively small, and the fluctuation amplitude is also small. Among them, the prediction error of the number of experiments is the smallest, which is 1.04. The prediction error of discussion times is the largest, 1.36. The average prediction error of the four learning behaviors is 1.20. Under the traditional algorithm, the prediction error of different learning behaviors is large. Among them, the prediction error of discussion times is the largest, 4.12. The prediction error of the number of practical activities is the smallest, 3.56. Therefore, the average prediction error of the four learning behaviors is 3.81. To sum up, the prediction error under this algorithm is smaller, and the prediction effect is better.

3.5. Investigation on the Use Frequency of Digital Education Resources in Various Disciplines

In this paper, 3000 middle school teachers from various regions in China are taken as the research objects, and the frequency of digital education resources in various disciplines is investigated in the form of online questionnaires. The survey results are shown in Figure 8.

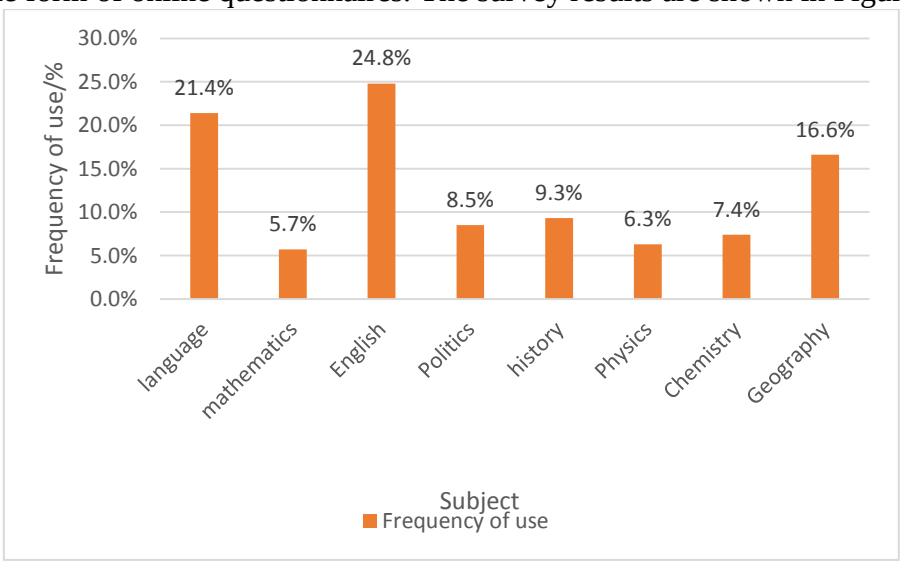

Figure 8. Frequency of digital education resources in various disciplines

It can be seen from Figure 8 that digital education resources have certain applications in various disciplines in middle schools. Among them, English has the highest frequency of using digital education resources, reaching 24.8%, followed by Chinese, 21.4%, geography, 16.6%, and mathematics, 5.7%. On the whole, digital education resources are widely used in middle school curriculum, which is instrumental in promoting the development of information based teaching.

4. Conclusion

With the help of science and technology, online course teaching has gradually been introduced into higher education. However, the existing online course system is not perfect, there are still many deficiencies, which need to be further improved. Online course teaching cannot be separated from the support of digital education resources, which has provided teachers and students with massive data and play an important role in it. In order to improve the shortage of online courses, this paper applied AI technology to online courses of higher education. Combined with feature weighted support vector machine algorithm, online course learning behavior was tested and analyzed. Under this algorithm, the learning behavior prediction accuracy of online course learning platform has been significantly improved. The prediction error was also smaller, which could make more effective prediction of students' learning behavior. This paper also conducted a questionnaire survey on the use frequency of digital education resources in various disciplines. The results showed that digital educational resources have been used in various disciplines in middle schools, and English is the most frequently used discipline. Due to the limitations of the experimental conditions, this experiment only conducted an experimental analysis of students' learning behavior from the aspects of prediction accuracy and prediction error, and did not carry out research on other aspects. In the future research work, feature weighted support vector machine algorithm still needs to constantly adapt to the development needs of online course learning platform to improve the performance of the algorithm, which provides more accurate prediction information for online courses.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

Reference

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