Data Mining Technology in Higher Vocational "Double Helix" Hybrid Teaching

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Abstract. In this paper, a hybrid teaching personalized learning system model based on data mining technology is proposed. The data mining technology is used to discover each student's personality, learning behavior, learning feedback information and teaching information that the teacher is interested in, adjust the teaching strategy in time, and make the teaching content and teaching activities suitable for the student's personality. The personalized learning system based on this model truly embodies the educational concept of teaching students according to their aptitude. Hybrid teaching is the development trend of college teaching, but there are not many colleges and universities that push forward the reform of hybrid teaching mode as a whole at the school level. On the basis of the literature research on the strategies for promoting the reform of hybrid teaching mode at home and abroad, this paper constructs the strategies for promoting the reform of Hybrid Teaching Mode in Colleges and universities in China from five aspects: top-level design, training system, quality monitoring and information feedback mechanism, incentive system and service system. Practice has proved that the promotion strategy creates a mixed teaching mode reform atmosphere in Colleges and universities, improves teachers' teaching ability, and improves students' enthusiasm and ability to learn.

Keywords: Personalized learning · Data mining · Teaching strategy · Hybrid teaching · Reform · Security system · Research

1 Introduction

Web based learning system with the help of Internet However, most of the existing learning system models are static, lack of interaction, lack of personality, and students can not learn on demand. In addition, a large number of useful teaching information accumulated on the site has not been used, such as user's access log, registration information, question answering information, test results, assignments, exchange information, learning progress Degree and so on, which causes a great waste of resources. These shortcomings limit its further development. Therefore, it is necessary to introduce intelligent and personalized services, which is also a trend of web-based learning system development. With the rapid development of the Internet, modern online education is developing rapidly in the United States, Britain, Australia, Japan and other countries with

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high degree of information technology. The hybrid teaching reform has been successfully implemented in many foreign universities and formed a systematic hybrid teaching reform management and practice mode. Its excellent experience is worth learning from domestic universities [1].

Although blended teaching is a hot research topic, but from the analysis of the results of literature review at home and abroad, there are few research results on the implementation of institutional level blended teaching. In foreign countries, Siemens pointed out in the Research Report "welcome Digital University: on distance, hybrid and online learning", that "in our literature search, we only found an article that systematically combed the implementation of Hybrid Teaching at the institutional level". At the same time, some scholars pointed out the gap in the current research: "first of all, the research on the role of teachers in blended learning is not enough. Due to the lack of information on the policies and implementation of teacher training and University blended learning, the research on the views of teachers and institutions is also insufficient." There are not many colleges and universities that carry out the reform of mixed teaching mode in domestic colleges and universities, and there are few successful experiences. Therefore, how to build an effective strategy to promote the reform of mixed teaching mode in Colleges and universities is an urgent problem to be solved.

2 Basic Design Idea

The personalized learning system based on Web can guarantee students' learning in two aspects: first, adopt the teaching design based on learning, students should be able to choose the knowledge learning they need according to their own needs, and teachers can choose the learning strategy suitable for students according to their knowledge background, that is, "personalized teaching"; second, Take effective learning navigation mechanism to ensure that students can learn smoothly, and will not be delayed or even give up learning due to difficulties without timely help (see the Fig. 1).

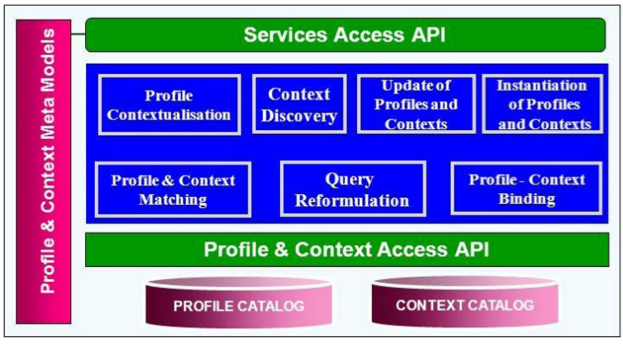

Fig. 1. Services assess API

3 The Realization of Personalized Learning System Based on Web

3.1 Formal Definition of Course Related Association Rules

This paper takes the students' scores in the course selection database of a college as an example to formally describe the relevant association rules of courses [2].

Definition

$$LetI = \{i_1, i_2, \cdots i_n\}\ \mathrm{D} = \{t_1, t_2, \cdots t_n\} \tag{1}$$

is the set of student's achievement database records, where $t_i \subseteq I(1 \leq i \leq N)$ only contains the course names that meet the conditions, for example, courses that meet the requirements of excellent or higher than 80 scores. The association rules are implicit in the following form:

$$p_1 \wedge p_2 \wedge \cdots p_n \rightarrow q_1 \wedge q_2 \wedge \cdots \wedge q_m \tag{2}$$

The definitions of confidence and support are given below.

3.2 Framework of Personalized Learning System

This paper constructs an intelligent and personalized network teaching system. Figure 2 is the functional framework of the system.

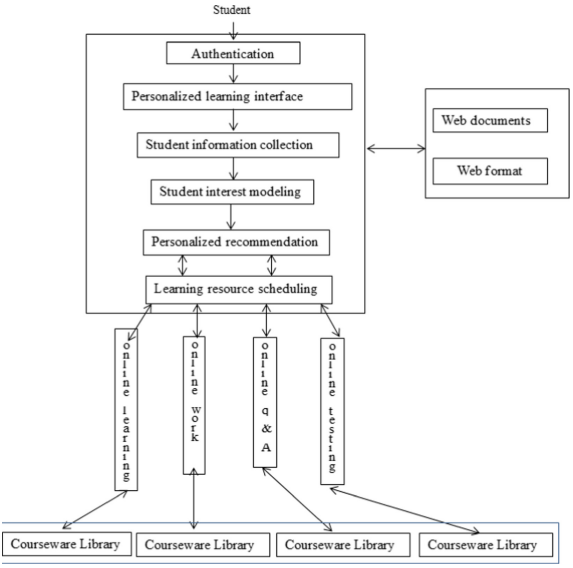

Fig. 2. System model of personalized learning based on Web

The web-based personalized learning system is based on Browser / server architecture, which realizes the management of students, teachers, educational administration

and the system under the synchronous interactive teaching mode and asynchronous interactive teaching mode. The main difference between it and the general distance learning system is that learners will not see the same page after logging in the system [3], but a personalized learning environment closely related to their own. Including: completion and correction of online assignments, test scores, frequently erroneous knowledge points, learning progress of courseware, participation in Q & A, BBS questions, course selection, student records and teacher comments, etc. These information are based on the characteristics of the learners, different learners will see the system interface will be very different. The system can make full use of the rich information accumulated on the education platform and allocate teaching resources reasonably according to each student's different personality. Using the modules of Web Mining and data mining to analyze and accumulate various information on the site regularly, such as various server logs, interactive information between students and the site, etc., to mine some interesting patterns and rules.

4 The Effect of Promoting the Reform of the Mixed Teaching Mode in the Third Three Universities

In 2015–2016 academic year, the school carried out a one-year practice of hybrid teaching mode reform. In order to analyze the effectiveness of the promotion strategy of hybrid teaching mode reform, this study conducted a questionnaire survey, interview and performance comparison study.

From December 29, 2015 to January 4, 2016, this study conducted a student satisfaction survey on the first batch of students who participated in the reform of hybrid teaching mode, and collected 2354 papers and 2336 effective papers. From July 1 to July 15, 2016, a student satisfaction survey was conducted on the second batch of teachers and students who participated in the reform of hybrid teaching mode. 78 scores were collected from teachers, 76 valid papers, 2364 from students and 2349 valid papers. From March to June 2016, a questionnaire survey was conducted on the training satisfaction sent to the college. On July 20, 2016, the final examination results of the compulsory course of the reform of mixed teaching mode were carried out analysis. Through the analysis of the above data, we can conclude the achievements of the reform and guarantee system of Hybrid Teaching Mode in one year.

4.1 The Reform of Hybrid Teaching Mode Promotes the Transformation from "Teaching" Centered to "Learning" Centered

Through one year's construction, the school has constructed 103 courses of mixed teaching mode reform. The first batch of 33 courses participated in the reform of hybrid teaching mode, 32 of which passed the acceptance; the second batch of 70 courses participated in the reform of hybrid teaching mode, 69 of which passed the acceptance. It can be seen that at present, there are 101 courses of mixed teaching mode reform in the school that have passed the acceptance. These courses have completed the input of basic information of courses, the construction of teaching resources such as courseware and question bank, and carried out teaching activities such as homework, discussion and

test by using the network at different levels. In addition, learning has also approved the construction of resources of network integrated teaching platform 192 courses. As of July 21, the online integrated teaching platform has attracted more than 870000 visitors, 412 teachers and 8914 students have logged in to the platform. The course construction of mixed teaching mode reform plays an important role in deepening the reform of classroom teaching mode, improving the comprehensive quality of students and promoting the transformation of teaching mode from "teaching" centered to "learning" centered.

4.2 The Reform of Mixed Teaching Mode Improves Teachers' Teaching Ability

Since the reform of the mixed teaching mode, 19 trainings have been organized by the joint teacher development center of the Modern Educational Technology Department of the academic affairs office and the Institute of educational technology of Tsinghua University, with 1265 teachers trained. Through a series of training, teachers' understanding of the necessity of teaching reform in our school has been improved, and teachers' teaching ability has been improved.

In the second half of 2016, the Modern Education Technology Department of the academic affairs office, together with the teacher development center, promoted the mixed teaching mode in 11 colleges (departments) including the school of media, the school of music and the foreign language teaching department of the University. The results show that 93.9% of the teachers think it is necessary for the school to reform the classroom teaching mode, and 89.2% of the teachers are willing to try the mixed teaching mode in the future classroom.

A series of training activities in the reform of mixed teaching mode provide a platform for teachers of different colleges and disciplines to exchange teaching methods. Teachers who did not participate in the reform actively applied for the reform of hybrid teaching mode. Teachers who participated in the reform began to carry out the construction of online courses and hybrid teaching design, and their teaching design ability was significantly enhanced. Data shows that in the first batch of excellent teaching plan selection activities in our school, 24 of the 39 teachers who won the prize participated in the reform of hybrid teaching mode, accounting for 61.5% of the total number of winners [4].

4.3 The Reform of Mixed Teaching Mode Improves Students' Enthusiasm for Learning

Because the hybrid teaching mode emphasizes the organic combination of online learning and offline learning, it effectively mobilizes students' enthusiasm for learning through different forms of teaching activities such as pre class preview, pre class self-test, on class discussion and off class homework. Through one year of practice, students gradually adapt to and recognize the hybrid teaching mode. According to the survey results of the second semester of 2015–2016 academic year, 82.89% of teachers think hybrid teaching improves students' learning enthusiasm; 95.24% of students think hybrid teaching improves their learning enthusiasm, 2.12% more than last semester; 93.24% of students like hybrid teaching mode, increased compared with last semester 2.1%; 92.8% of the students are very satisfied with the online submission of homework, teaching evaluation

and discussion, an increase of 6.16% over the previous semester; 94.1% of the students think that part of the course learning on the Internet is very valuable, an increase of 3.9% over the previous semester [5].

The simulation results and improved results are shown in Fig. 3 and Fig. 4.

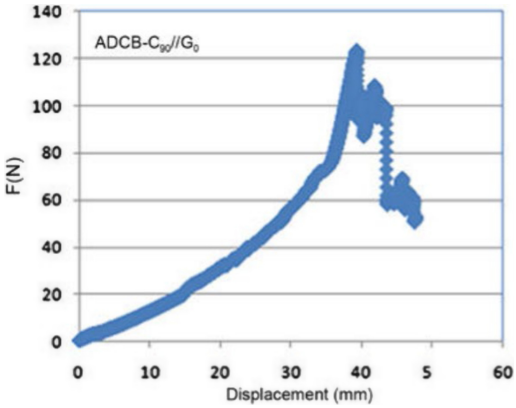

Fig. 3. The simulation results for hiberd helix teaching

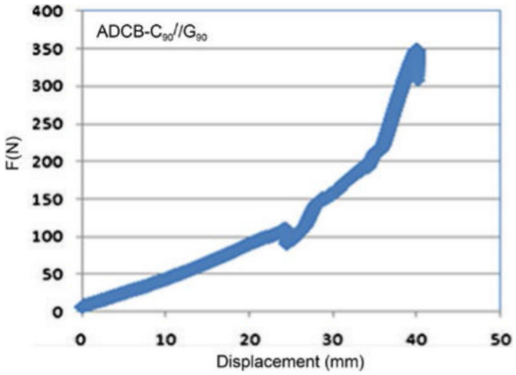

Fig. 4. Improved simulation results

5 Application of Data Mining Technology in Network Teaching

In front of this paper, through the analysis of the characteristics and problems of network teaching, expounds the necessity of the application of data mining technology in network teaching. The network teaching platform and teaching management system have relatively systematic teaching record data and log files, which makes the application of data mining feasible [6].

(1) For students. Through the data mining of online learning behavior, student performance and other information, we can recommend to students, help to improve their

learning behavior, learning resources and learning tasks, and recommend good learning experience and learning strategies to students, so as to improve the effectiveness of online learning [7]. (2) For teachers. Through the analysis of students' interest in learning, learning trajectory, and students' evaluation of course schedule, content arrangement and teaching methods, we can provide more objective feedback information to teachers, so that teachers can better optimize teaching strategies, improve teaching process and improve curriculum development; organize teaching content and reconstruct teaching plan according to students' learning status, so as to optimize the effect of network teaching. (3) For system developers. Through data mining feedback information, gradually improve the development of network course teaching system platform functions, make the teaching system elements organic combination, background management more intelligent, more scientific and operable, convenient for teachers, course managers and students.

5.1 Data Preprocessing of Behavior Analysis

In order to make the data mining process more effective, it is necessary to provide a clean, accurate and complete data set for it [8, 9]. The collected source data is often prone to data redundancy, incomplete data and noise, so it can not be directly used for data mining. In order to effectively carry out data mining, the following data preprocessing can be carried out on the source data set:

(1) Missing data processing. For the missing attribute values in the data set, you can choose manual filling, single value filling, class mean filling, mathematical inference and other methods to complete the data items; for some data that cannot be completed, you should delete the corresponding records. For example, for students with incomplete examination results, the data should be supplemented completely after checking the results; for students who are suspended, dropped out or transferred from school in the table, the corresponding records should be deleted by ignoring tuples.

(2) Data conversion. Typical transformation methods include: reorganizing classified variables, transforming symbolic variables into numerical variables, and mathematical transformation (including data standardization, deriving new variables, etc.). The specific conversion method depends on the specific task of data mining, the data mining algorithm and technology used. For example, K-means clustering algorithm is not suitable for dealing with discrete attributes; for association mining algorithm, interval quantization is needed for the attribute value corresponding to each tuple of the original data set, and finally transformed into discrete attributes. After the completion of data conversion, according to the purpose and task of mining and the selection of mining algorithm, according to the method of attribute selection, the original data table is transformed into the target data table [10, 11].

5.2 Establishment of Behavior Analysis Model and Application of Results

In the analysis of network learning behavior, the analysis goal determines the selection of data mining algorithm and the establishment and application of model [12]. For example, to analyze the relationship between students' online learning behavior (such as test

times, pass points, etc.) and online learning effect, we can choose mining algorithms such as association rules and decision tree, to understand the association between various learning behaviors and their impact on learning performance through association or decision rules, and to predict the learning effect of different learning behaviors; Cluster analysis can be used to analyze the learning characteristics of different learning behavior groups. Through cluster analysis, we can understand the learning commonness of students in the same learning behavior group and the difference of performance among different group [13].

The purpose of data mining is to discover the knowledge and rules hidden in the data, and to apply the mining results to solve or improve the related problems. For example, the results of association analysis and cluster analysis in the above example can be used to improve the following shortcomings of online teaching:

1. Relevance analysis is helpful for teachers to recommend learning behaviors, learning resources and learning tasks that can help students improve their learning effect; by recommending successful learning experiences to students, it can guide students to formulate effective learning strategies, so as to improve their learning ability and improve the efficiency of online learning [14, 15]. 2. Through cluster analysis, the classification model of students' characteristics is established, which is helpful for teachers to find students' potential learning problems and help students correct their learning behaviors in time [16]. it is also helpful for students to check their own shortcomings and determine the direction of their efforts by comparing with the classification model. In addition, we can also do a good job in the early teaching design through clustering analysis of students' characteristics, so as to provide reference for personalized teaching. According to students' different mastery of knowledge points and different demands for knowledge and teaching resources, the teaching structure, teaching links and teaching resource design of online courses should be adjusted in time to provide personalized teaching contents and learning resources recommendation for different types of learning groups, so as to realize hierarchical teaching; To provide learners with what they want quickly and effectively, so as to teach students in accordance with their aptitude [17].

6 Conclusions

Because the mixed teaching mode has changed from passive listening to class to active learning, students' reading ability, teaching information acquisition, analysis and processing ability, and oral expression ability have been enhanced. The results show that 93.7% of the students think that the hybrid teaching mode improves their learning ability; 76.2% of the teachers think that the hybrid teaching mode improves the teaching effect compared with the traditional teaching mode.

In order to understand the promoting effect of the mixed teaching mode reform on the teaching effect, this study makes a horizontal and vertical comparative analysis on the written examination results of the second batch of mixed teaching mode reform courses. The final examination of the school uses the question bank to produce questions and the flow to judge papers, so the final examination results can reflect the learning effect of the students to a certain extent. The data shows that in the 30 courses with final examination, the average score and pass rate are higher than that of the control class, 22 courses, accounting for 73%.

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