Design and Construction of Independent Training Management System for Innovative Talents in Colleges and Universities under the Background of Internet Plus

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Abstract. Under the form of "Internet+Education", the traditional teaching management mode can no longer meet the needs of independent training of innovative talents in colleges and universities. In this regard, this paper puts forward a set of construction scheme of network integrated management system, and uses this as a medium to promote the deep-seated reform of innovative talent training system in the new period. The whole platform is B/S architecture, which consists of front-end interface and back-end server. The system combines data information with functional application to form a comprehensive application program with online teaching, personalized analysis, assessment and other functions. Practice has proved that the system can meet the practical application needs of students and teachers, and at the same time, it can create students' portraits with the help of K-means, Apriori, CART and other data mining models to realize personalized analysis, which improves the effectiveness of teaching management and provides necessary technical support for the transformation and upgrading of the independent training mode of innovative talents in colleges and universities.

Keywords: Internet + education; Independent training of innovative talents; User portrait; Data mining; Software application program

1 Introduction

In order to cope with the tide of the new scientific and technological revolution and industrial transformation, China will persist in taking innovation as the first driving force and talents as the first resource, and implement the innovation-driven development strategy in depth, injecting new kinetic energy into the all-round realization of Chinese modernization. [1] As an important part of the national innovation system, colleges and universities should focus on combining their own school-running mission with the national development strategy, give full play to the advantages of educational resources, and strive to cultivate a group of innovative talents with compound abilities, so as to provide the necessary talent protection for the implementation of the innovation-driven development strategy. However, at present, the traditional teaching

G. Guan et al. (eds.), *Proceedings of the 2023 3rd International Conference on Education, Information Management and Service Science (EIMSS 2023)*, Atlantis Highlights in Computer Sciences 16,
https://doi.org/10.2991/978-94-6463-264-4_104

concept is still the dominant mode of talent training in colleges and universities, and there are obvious shortcomings in teaching mode, curriculum setting, management mechanism and evaluation, which are difficult to meet the training needs of innovative talents in the new period and seriously restrict the training quality of innovative talents in colleges and universities. [2] In view of this, this paper holds that in the era of digital intelligence, facing the new demand of innovative talent training, colleges and universities urgently need to use the form of "Internet+education" to promote the digital and intelligent transformation and upgrading of college education management mode and reconstruct the innovative talent training system. [3] The comprehensive management system for independent cultivation of innovative talents in colleges and universities can reshape the educational practice process by relying on online teaching, virtual innovation practice and public communication space. And it introduces the "user portrait" system, which provides a new way for teaching management and evaluation, and then establishes a new paradigm for independent training of innovative talents in colleges and universities.

2 System construction

The development content of the management system for independent cultivation of innovative talents in colleges and universities is divided into two parts, one is the construction of the basic structural framework of the system, and the other is the development and deployment of application service modules. First of all, the system adopts B/S architecture design, and the front-end interactive interface relies on React framework to complete custom design and development. The back-end server is built according to MTV mode with Django framework. The basic development environment of the whole system will be deployed according to the conventional "LAMP" mode. [4] Among them, Linux CentOS 7.3.1611(64bit) is selected as the bottom operating system, Python is selected as the basic development language environment, version 3.10.2, and Pycharm 2019 is selected as the integrated development tool. Nginx-wsgi-django Web module is selected as the web server, and Mysql 5.7.31 is selected as the database server. Secondly, the application service module of the system mainly involves online login authentication, online teaching, user portrait, assessment and so on. The development process is also combined with the basic structural framework of the system, and the association and connection are completed under the specific data interface. [5] Among them, the construction of user portrait needs to rely on the data mining algorithm model in Python language. When the teacher user initiates the student user data analysis, the system will automatically extract, transform and load the student data according to the script command to form a data object that can be directly applied for analysis, and then input the pre-built data mining models such as K-means, Apriori and CART for data mining analysis.

3 Functional implementation

3.1 Student side

A. Online learning

The overall framework of the system is shown in Figure 1, and student users can log in and use the system directly through the client browser. The online teaching module includes pre-class preview, course learning, homework answering, simulation test and other links. Students can study anytime and anywhere according to the teaching plan or their own study habits, instead of sticking to the traditional fixed mode of classroom teaching. [6]

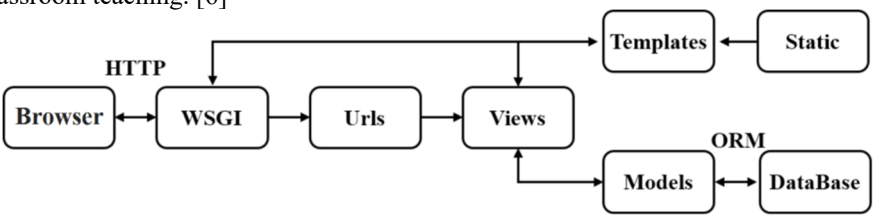

Fig. 1. The overall framework of the system

B. Virtual innovation practice

The system can integrate a large number of dynamic graphics, video images and Flash animations by using the advantages of computer application, and construct a large number of thematic simulation scenes, so that students can complete related tasks in situations, and strengthen their practical application ability, analysis and summary ability and innovative thinking through topic discussion, simulation drills and other forms. [7]

C. Public communication space

Under this function module, students can freely share and exchange their own learning experiences, and they can also ask questions from teachers for help in the learning process. Some codes of the function realization are shown below. [8]

```
class LeaveMessage(models.Model):
    nickname=models.CharField(verbose_name='name', max_length=16, null=True)
    content = models.CharField(verbose_name='mes', max_length=240, null=True)
    create_time = models.DateTimeField(verbose_name='time', auto_now=True)
    class Meta:
        db_table = 'leave_message'
        verbose_name = "mes"
        verbose_name_plural = verbose_name
```

3.2 Teacher side

Under the teaching system, teachers can use the "portrait of student users" engine to analyze and process the complex learning behavior data of student users, thus strengthening the understanding of students and improving the teaching management effect. In the actual operation process, when the teacher user initiates the student behavior analysis online, the system will automatically complete the steps of data collection, preprocessing, analysis mining and visual display. [9] Table 1 shows the main metrics of student users' online learning behavior.

Table 1. Main measures of online learning behavior

Behavior characteristics	Observational indicators	Numerical value
Basic information	Student number, name, department, and grade	
Online learning	Class and play time, course completion degree, homework completion degree, test scores	Time, times, and ranking
Innovative practice	Practice completion degree, practice performance, and team participation	Time, times, and ranking
Communication	Publication number and positive degree	Times and frequency
Other	Login time, cumulative time, and login frequency	

Taking K-means algorithm as an example, the system calls the cluster in Python sklearn class library according to the data input by users, constructs the clustering algorithm model, and automatically completes the operation. [10] Table 2 shows the system simulation test results, and the total sample data is 200. The optimal K value is determined by the error sum of squares (SSE) calculation formula, as shown in Formula 1, where C represents the category, p represents the data value and m represents the center of mass. [11]

$$SSE = \sum_{i=1}^{k} \sum_{p \in C_i} \left| p\text{-}m_i \right|^2 \tag{1}$$

Table 2. Cluster analysis results and statistics

Learning behavior characteristics	Cluster 1	Cluster 2	Cluster 3
Test score	62.913	51.504	32.281
Class time	41.964	31.584	25.321
Play time	69.251	62.934	40.515
Complete the homework	47.364	42.857	20.181
Complete the course	22.697	18.314	13.175
Complete the test	26.814	23.448	19.437

Complete the practice	23.687	17.1524	8.274
Number of students	64	126	10
Proportion	32%	63%	5%

The analysis results show that the students in cluster 1 perform well as a whole, and their behavior data values are higher than those in other clusters, so they are judged as excellent students. Cluster 2 students have the highest overall proportion and the learning effect is in the middle level, so they are judged as ordinary students. The overall learning effect of cluster 3 students is not ideal, and all behavioral characteristics are expressed at the lowest value, which is judged as poor students.

In addition, the teacher side can also evaluate the learning effect according to the characteristics of students' learning behavior. The platform supports automatic evaluation of students' learning effect with fuzzy comprehensive evaluation model. The evaluation criteria and simulation results are shown in Table 3. Among them, the formula for calculating the weight value of λ_{max} is shown in Formula 2. Each score is combined into a score judgment matrix, and each row element is normalized by column and then summed, and the obtained row vector is normalized twice to get the ranking weight vector W, and the corresponding weight value λ_{max} is calculated by sum product method. [12] The results show that the platform can realize online evaluation of e-learning effect and make up for the previous technical gaps.

Table 3. Evaluation criteria and simulation results

Standard layer	Measures layer	Weighted value	Item score	Score
Instructional C_1	Course completion degree	C_{11}=0.091	85	7.735
	Homework completion degree	C_{12}=0.164	74	12.136
	Practice completion degree	C_{13}=0.135	73	9.855
Interactivity C_2	Team participation	C_{21}=0.057	68	3.876
	Positive degree	C_{22}=0.116	74	8.584
Effectiveness C_3	Test scores	C_{31}=0.084	70	5.880
	Practical achievements	C_{32}=0.116	78	9.048

$$C = \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} \qquad \lambda_{\max} = \sum_{i=1}^{n} \frac{(CW)_i}{nW_i} \tag{2}$$

4 Conclusions

In order to improve the effectiveness of foreign language teaching in colleges and universities under the network teaching mode, this paper puts forward the construction scheme of online foreign language teaching system in order to promote the digital and intelligent transformation and upgrading of college foreign language teaching mode. The platform can integrate learning behavior data mining into the teaching management process, highlight the value and significance of students' online learning

behavior data, enhance the system function and service dimension, and promote the perfection of college foreign language education system. In the follow-up research, the system should further enrich the construction of teaching resources, optimize the application ability of data analysis module, and provide reference for the informationization and intelligent development of higher education.

Acknowledgments

Fund Project: 2023 Guangxi Higher Education Undergraduate Teaching Reform Engineering Project "Research on the Construction of Online and Offline Hybrid 'Golden Course' of" Pedagogy "under the SPOC Concept" (Project Number: 44) Phase Research Results

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