Research on Scientific Teaching Supervision Based on Big Data Technology

Chunyan Dou[1,a], Zhenqiang Song[1,b]

[1]*Xinjiang Vocational & Technical College of Communications, Xinjiang, China*
[a]*3555817651@qq.com, [b]271466080@qq.com*

Abstract

In today's era of big data, there are more new changes in teaching supervision, and more new technologies are needed to improve its scientific level. Based on this, this paper explores the platform design of teaching supervision system based on big data technology, and specifically explores three aspects: system architecture, main system technologies and system module design, in order to promote the scientific and high-level development of teaching supervision, and provide reference for related work in the future.

1. INTRODUCTION

Teaching supervision is a key way to improve the teaching quality of schools at all levels. The scientific development of this work will help to achieve many goals such as standardizing the school teaching order, standardizing teachers' teaching activities and deepening the teaching reform. At present, with the further development of education scale, the traditional teaching supervision has been difficult to meet the actual needs, so it is necessary to introduce the current advanced big data technology to promote the innovation and scientific development of teaching supervision, so as to promote the steady improvement of education.

2. THE FRAMEWORK DESIGN OF TEACHING BIG DATA SYSTEM PLATFORM

2.1. Technical level

The system platform framework is a multi-level structure, each level and its corresponding functions are shown in Table 1.

Table 1: Hierarchical structure and functions of teaching supervision big data platform

No.	Level	Function
1	Data layer	Mainly used to store business data of schools
2	Storage layer	Provide storage and support for files and databases for the application layer
3	Application layer	Analyze the data and make corresponding reports
4	Access layer	Implement platform management and operation services

2.2. Application level

As can be seen from the information in Table 1, the main function of the teaching supervision system platform based on big data is to provide scientific teaching supervision and supervision management services. As supervisors at different levels undertake different tasks in the teaching supervision work, the system platform also analyzes the specific user applications during the design process.

For the teaching managers in the supervision work, the system platform will mainly realize the following functions: (1) Basic information management: This module is mainly responsible for inputting the basic information of teachers and students, information of supervision experts, information of courses offered by schools, etc. In order to improve the efficiency of information input, according to the actual needs, a large amount of information can be directly imported into Excel, so that managers and supervision experts can conduct targeted teaching supervision according to these

information at any time. (2) Teaching information management: The main function of this module is to integrate and analyze relevant information and evaluation indicators, and it has the function of consulting historical data. According to the analysis results, teaching managers can give feedback to relevant teaching supervision information in time, providing an important basis for decision-making for follow-up teaching supervision.

As for the supervising experts, besides the above contents, they can also inquire about the course development of the school in time through the platform, including the teaching time, the name of the instructor, the teaching place and content, etc., and can fill in objective evaluation on the system platform in time according to their own lectures.

3. MAIN TECHNOLOGIES APPLIED IN TEACHING SUPERVISION PLATFORM BASED ON BIG DATA TECHNOLOGY

3.1. Data integration technology

In today's era of big data, the amount of data information generated in teaching supervision is huge, which can be classified into two categories: internal export data and external evaluation data. Among them,

the internal export data usually comes from the data in various system platforms of the school. The external evaluation data mainly refers to the feedback information generated by the teaching supervision staff in the supervision work, etc. These data have a wide range of sources, complex data types and many heterogeneous data, so it is difficult to effectively integrate the data. Considering this problem, in the application of data integration technology, it is necessary to identify the attributes of data based on the perspective of metadata, and then classify, screen and preprocess the data, so as to convert the relevant data information into metadata in standardized XML format [1-2].

After the metadata is obtained, the data dictionary of all kinds of supervision information can be further constructed based on the data dictionary of the system platform itself, and the standardized metadata processing of all kinds of data information can be realized. After the processing is completed, the new data can be converted into standardized format, and the efficient storage of internal and external data can be realized. At the same time, in order to eliminate the redundancy of XML format files in the database, XCiot compression system is adopted to compress such files [3-4], and its basic process is shown in Figure 1.
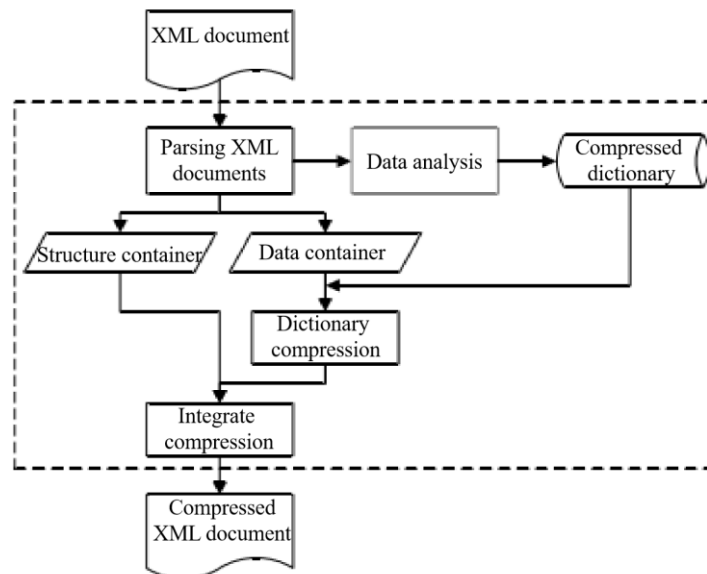

Figure 1: Basic flow chart of XCiot compression

3.2. Spark Streaming related technology for real-time supervision

In the actual teaching supervision work, in-class lectures are a common link, but the objects selected by teaching supervisors in-class lectures are not specific, but rather have strong randomness. In view of this situation, in order to fit this model, it is necessary to give full play to big data technology and realize

intelligent recommendation of in-class lectures. In order to achieve this goal, it is usually necessary to obtain online teaching data and give message feedback based on Spark Streaming related technology. On this basis, the goal of intelligent recommendation can be achieved through standardized processing and integration of all kinds of data information [5].

Specifically, the application of Spark Streaming related technology is divided into the following steps.

The first step is to create an implicit scoring model. In the teaching data information of schools, the distributed data collection tools are implanted to identify and process these data information, extract relevant teaching information, and then input these information into the Spark Streaming system to filter the data. After the filtering is completed, the data information related to teachers' teaching, students' learning and the specific state of the classroom can be obtained, and then the scoring data model is created by using Shark tools.

The second step is to introduce machine learning library Matplotlib, which has preset AIS function of alternating least squares algorithm, and its function is to train intelligent models. The specific application steps of this function are as follows: (1) k factors with hidden vector characteristics are constructed through the teaching data information of schools; (2) Using the inner product of k-dimensional vector as the scoring value to get an approximate score; (3) According to the formula $R \approx UVT$, the implicit factors are decomposed and calculated, and the recommended model after training is obtained. In this formula, R represents the grading matrix of teachers' lectures; U represents the matrix of implicit characteristics of supervision to teachers' teaching, and V represents the attribution matrix of various implicit characteristics in the teaching process. On this basis, the feedback function of teaching supervision is further obtained as follows:

$$f = \sum_{(i,j) \in k} (R_{i,j} - u_i^T v_j)^2 + \lambda(||u_i||^2 + ||v_j||^2)$$

On this basis, the K-means method is used to cluster the attribute characteristic matrix V in the above teaching process. When there is no obvious change, it is proved that the operation has reached the expected goal. Finally, a real-time recommendation list can be formed according to the final calculation result, so as to ensure that the supervision work can be carried out more scientifically.

3.3.   Related technologies of constructing weighted comprehensive evaluation model

In the supervision work, there are many evaluation indexes of course teaching quality, including basic teaching skills, teaching demonstration, teaching preparation, teaching objectives, teaching contents, teaching implementation, teaching methods, emotional education, teaching effect, teaching personality and so on, and these indexes must have different weights. However, in the actual evaluation work, the subjective consciousness of supervisors will affect the weight of each index and the accuracy of evaluation. To solve this problem, it is necessary to introduce the concept of global function and fully consider the influence of subjective consciousness. The formula is as follows.

In this formula, W_j is the weight of the main evaluation index; Y_{ij} represents the single evaluation value obtained by the weight index; P represents the subjective evaluation trend vector parameter of evaluators, which mainly comes from the past style of supervisors and evaluators, the dynamic evaluation scores of evaluators, and the trend vector parameter given by cross-comparison by introducing relevant teaching evaluation requirements and interference parameters. Before the evaluation results are submitted, the system platform will give a reference value of P, and the supervisors and evaluators will consider whether to enter the final evaluation score according to the reference value and their own evaluation situation. In this way, the subjective evaluation link will have a higher degree of objectivity and credibility.

3.4.   Data visualization technology based on data relevance

Teaching evaluation based on teaching supervision platform of big data can get a series of related data information, but these data information are too abstract to be displayed directly. Therefore, it is necessary to apply data visualization technology based on data correlation to convert these data information into scatter diagram, scatter matrix diagram, adjacency matrix, etc. for display, so as to visually show the correlation among all kinds of data to supervisors. At present, indirect volume rendering is an effective way in data visualization technology. This method includes two stages. The first stage is to extract the isosurface from the data set according to a specific threshold. There are several algorithms to do this task (Marching Cubes algorithm is mostly used in practice). On the other hand, it is also possible to improve the isosurface extraction by developing a special algorithm based on the specific features of a specific data set. Then use 3D image engine or other tools to visualize the polygon surface model, such as the grid model of LightningChart [6-7].

3.5.   Data mining technology

The main function of this technology in the system is to mine the information with potential value from the school teaching data recorded by the system through the blessing of intelligent algorithms, and analyze and calculate these information to find the law of these information, so as to seek the corresponding basis for the provision of school teaching data. In data mining, TF-IDF algorithm is mainly used to mine and integrate similar data information, and its calculation formula is as follows:

$$w(i,j) = tf \times idf = \frac{Count(i,j)}{Size(j)} \times \log\left(\frac{N}{Docs(i,D)}\right)$$

After the calculation by this formula, the relevant key words with the calculation result greater than 0.01 will be unified and summarized, and finally the feature set of school teaching data information will be formed, thus realizing the effective allocation of various information resources and the integrated analysis of key data information.

4. MODULE DESIGN OF TEACHING SUPERVISION SYSTEM BASED ON BIG DATA TECHNOLOGY

4.1. Interface design

In order to ensure that all functions of the teaching supervision system platform based on big data technology play a full role, it is necessary to optimize the interface design, which is not only the key to realize human-computer interaction, but also the key to ensure that the system can attract users. Therefore, in the interface design, it is necessary to design the user interface in line with the three requirements of "concise color matching, clear function and prominent focus".

Specifically, the interface design should follow the following three principles. First, the principle of consistency, which mainly refers to the consistency between functions and text descriptions, and ensuring the regularity of text arrangement; The second is the principle of accuracy, which mainly refers to achieving harmony in color matching and highlighting key points with specific colors; The third is the principle of intuition, which mainly means that the main functions should be laid out simply, and users' operating habits of browsing from top to bottom and from left to right should be followed, so as to avoid the dispersion of functions and consume users' excessive operating time.

4.2. Implementation of login function

To implement the system login function, the core code is as follows:

```php
<?php
namespace Index\Controller;
use Think\Controller;
class index Controller extends Controller {
//Displays the login form
public function index() {
$this->display();
}
//Set login verification code
Public function verify() {
$config=array(
```

```php
'use Curve'=>false,
'font Size'=>15,
'length'=>4,
'image W'=>100,
'image H'=>30,
'code Set'=>'0123456789',
'reset'=>false,
);
$Verify=new \Think\Verify($config);
$Verify->fonttty='1.ttf';
$Verify -> entry();
}
```

After executing this code, the operator can enter the corresponding link in the browser and then enter the system login module, and enter his own user name and password according to the page prompt. After the input is completed, the system will verify whether the user name and password are correct, and if so, enter the operation interface; otherwise, the message box "User name or password is wrong, please login again" will be prompted. After successful login, operators can gradually realize the functions of each module.

4.3. Data statistical module

The statistics module can be subdivided into the following three parts, including data statistics, historical data analysis and problem feedback. Through the relevant data information in the basic database, the supervisor can get the teaching situation of the target course, and then the module will automatically classify and summarize all the data. Using MySQL tools, the system will automatically generate the analysis report of the target course. According to the data information listed in the report, and combining with his own work experience, the supervisor can put forward more targeted rectification opinions on the teaching situation of related courses and send them. At the same time, in order to further improve the timeliness of supervision, this module should also have the function of exporting data files, which can be exported according to the unit and sent to the target schools or teachers by e-mail or other means, so as to guide the optimization and improvement of teaching work.

4.4. Supervision and management module

The supervision and management module can be subdivided into the following three parts: lecture task management, two-way interaction and teacher evaluation. Among them, the lecture task management is mainly used to collect the historical lecture records of

supervisors and the appointment records of supervisors, which reduces the communication time between supervisors and schools and teachers; The two-way interactive function is mainly built on the campus network of each school, or it can be directly based on the Internet to ensure that supervisors can communicate with schools online. Compared with the conventional offline mode, this mode fully takes into account the needs of online teaching and enhances the visibility and authenticity of teaching supervision. The teacher evaluation module can be used to grade the specific course teaching situation and give relevant suggestions. On the whole, the supervision and management module helps school teachers to improve their teaching level and classroom teaching quality, and its basic framework is shown in Figure 2.
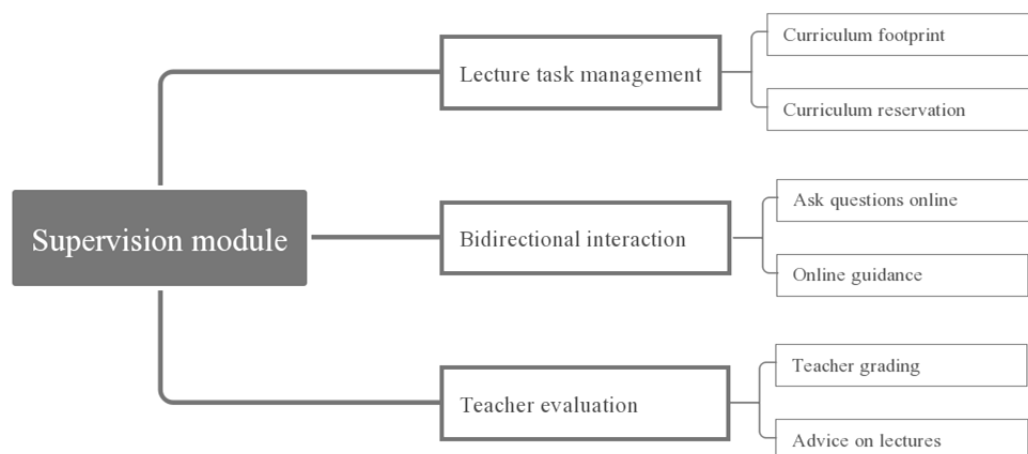

Figure 2: Basic framework of the supervision and management module

5. ACTUAL TEST RESULTS OF THE SYSTEM

After the preliminary design of the system is completed, the interface test is carried out first. Test the layout, color matching and control placement of the interface function modules of the main system platform to ensure that they can meet the user's usage habits. Through the investigation and feedback of some teaching supervisors and teachers in the target schools, it can be seen that about 95% of the respondents think that the interface design of the system platform is reasonable and can meet their usage habits. On this basis, testers deployed a number of different hardware environments to test the management system. The test results show that the system performs well in different hardware environments, and there are no serious bugs, which proves that it basically meets the use requirements.

6. CONCLUSION

On the whole, combined with the actual needs of the current teaching supervision construction and previous relevant experience, this paper preliminarily discusses the construction method of teaching supervision system platform based on big data. Through the functions of this platform, it will help to promote the scientific development of teaching supervision, and the advanced technologies in the platform will also promote the teaching reform and construction. Of course, in the future work, it is still necessary to continuously optimize and innovate to further improve the operability, advancement and interactivity of the platform.

REFERENCES

[1] Li Ruili, Jiang Hailin.(2022)Research on the Effective Path to Improve the Informatization Level of Postgraduate Education Supervision under the Background of Big Data.University,(01):30-33.

[2] Yin Xueyan.(2021)Application Analysis of Big Data in Teaching Supervision.Electronic Technology,50(08):208-209.

[3] Li Qing.(2021)Key Technologies of Teaching Supervision and Evaluation Information Feedback Platform Based on Big Data[J].Information Technology and Informatization,(06):188-190.

[4] Li Jian, Qi Ji, Hu Yating, et al.(2021)Research on the Development of Two-level Supervision Information Platform of Colleges and Universities under the Background of Large-scale Enrollment Based on Big Data Technology.Computer Knowledge and Technology,17(12):28-32.

[5] Kang Hongyu, Liu Ximing, Xie Yaochen, et al.(2021)Construction of Teaching Supervision System Platform in Colleges and Universities under the Background of Big Data.Health Vocational Education,39(06):3-5.

[6] Liu Huan.(2020)Research on Monitoring and Evaluation Method of Education Supervision Based on Big Data Analysis.China Computer & Communication,32(18):253-254.

[7] Yang Bo, Yu Debao, Gao Wei.(2020)Implement Precise Supervision Based on Big Data.Beijing Education,(07):32-33.