Research on Infiltration Teaching of Higher Vocational Mathematics Culture Based on Big Data

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Abstract. In response to the current information needs of higher vocational mathematics and cultural teaching, Hadoop framework and collaborative recommendation algorithms are used to apply these two technologies to the construction of a shared platform for higher vocational mathematics and cultural infiltration teaching. Then through experiment and comparison, let the same teacher conduct mathematics and cultural infiltration teaching in two different classes. The results show that by investigating higher vocational students’ interest in mathematics and their understanding of mathematics, the number of people interested in vocational mathematics classes increased by 14.6%, and the number of people interested in control classes only increased by 10%. At the same time, in the assessment of mathematics culture penetration knowledge points, the number of outstanding people in the experimental group was significantly more than that in the control group.

Keywords: big data; Hadoop framework; higher vocational education; mathematical culture penetration

Introduction
In the current informatization context, data is driving educational reforms. Typically, a large number of intelligent learning systems or intelligent learning robots have emerged in the context of informatization. These are all comprehensive innovations and attempts of current education methods. [1-3] It is precisely under this change in teaching methods that higher vocational mathematics teachers have begun to realize the role and value of combining modern information technology in teaching. Therefore, some teachers began to try to apply modern information technology to the classroom. With the importance of higher vocational mathematics culture to higher vocational education, many teachers began to infiltrate mathematics culture in mathematics classrooms, so as to allow students to better understand the history of mathematics. [4-6] But for a long time, the informatization teaching method based on the infiltration of mathematics culture in the higher vocational mathematics classroom is just a taste, and many are only at the theoretical or conceptual stage. In this regard, this article combines the current big data technology to propose a Hadoop-based mathematics cultural digital resource auxiliary teaching platform, and detailed design of the platform, hoping that through the design, better assist mathematics cultural teaching, improve comprehensive quality of vocational students.[7]

At present, there are relatively few documents about the penetration of big data in the teaching of
mathematics culture in higher vocational schools, and most of them are concentrated in the application of big data. For example, Chen Dexin (2019) proposed that the application of big data in modern education is for educational behavior or interest mining, thus providing a reference for intelligent education; Wang Jun (2019) proposed the application of big data to student behavior analysis to determine student preferences; [8-10] and in the application of mathematical big data, Huang Yulan (2017) proposed the role of big data in mathematical practice, and pointed out the direction of application, but did not propose a specific implementation technology path. As for traversing the problem of mathematics cultural penetration, few literatures mention research. Therefore, this research attempts to propose a Hadoop mathematics culture teaching resource sharing platform from the perspective of mathematics culture penetration, combined with the current massive mathematics culture videos and online learning websites. [11]

1. Proposed Method

1.1. Key technology

1.1.1 HDFS and MapReduce
In the Hadoop architecture system, Hadoop includes two core components. The first is the HDFS distributed file system. The system mainly stores all kinds of files in nodes, mainly composed of Name Node, Secondary Name, NodeData Node, and Client. The specific structure can be shown in Figure 1. Map Reduce is a parallel computing architecture, which is mainly responsible for parallel calculation and data processing.

![Figure 1. HDFS structure](image)

The Map Reduce framework is mainly a master-slave structure, which includes multiple slave servers and clients under a master server. The specific architecture can be shown in Figure 2.
In Figure 2, Job Tracker is the main server, which is mainly responsible for receiving client job information, scheduling and monitoring. Task Tracker is the slave server, which is mainly responsible for accepting job assignments from Job Tracker and regularly feedback node information to the master server. In addition, Task Tracker is also equipped with a task slot for Map and Reduce respectively.

### 1.1.2 Collaborative recommendation

In order to further dig out the massive mathematics cultural resources, thereby assisting higher vocational mathematics cultural teaching, the collaborative recommendation algorithm is introduced. The main purpose of collaborative recommendation is to find similar relationships between items, not to find similar relationships between users. Therefore, in the recommendation, a set similar to item i is often found first, and then based on the item i, the similarity value $S_i$ with other items is calculated through the similarity calculation formula, and finally the corresponding recommendation is given by the weight ranking method result. The similarity calculation formula is:

$$\text{Predict}(u,v) = \frac{\sum_j S_{ij} * \text{rate}(u,j)}{\sum_j S_{ij}}$$

### 1.2. Construction of overall architecture

The goal of this system is to allow higher vocational students to browse through web pages and promote the sharing of higher vocational mathematics teaching resources. Therefore, in the construction of the system, the Hadoop framework is used as the basic layer to realize the storage and analysis of system data, and then the system is built with SSH. Among them, Struts is mainly the view layer, used to connect the page, and verify the relevant data request and data passed by the view layer, and send the request to the back-end Action. Spring mainly implements instantiation operations through three-tier Java classes including Action, Service, and Dao, and finally stores all the data in the database. The Hibernate layer is mainly responsible for processing operations such as modifying, deleting and querying data. The operating structure is shown in Figure 3.
In the above architecture, the three-tier architecture idea of B/S is adopted. Students can access the system through the webpage. In the implementation of the framework, Java programming is used, My SQL is the database, and Tomcat is the server.

2. Experiments

2.1. Research objects
Taking 7 classes of students in the first-year electromechanical technology department taught by the author as the research object, one class was randomly selected as the experimental group (a total of 43 people), and another class was selected as the control group (35 people).

2.2. Research methods
1) Questionnaire survey
Before and after the lecture, the students who participated in the experiment were surveyed about their interest in learning mathematics. 78 questionnaires are distributed each time, and students are guided in the survey. Through the survey, all the questionnaires before and after were recovered.

2) Teaching experiment
In order to verify the pros and cons of this system, the same teacher uses the same textbooks and different teaching methods to teach the mathematics culture infiltration class. The experimental group introduces the above-built big data sharing platform to the traditional teaching method for auxiliary teaching. Allow students to understand different knowledge points through the relevant mathematics culture recommended videos in the shared platform while learning mathematics knowledge, so as to achieve the purpose of understanding different mathematics knowledge of vocational students.

The control group used traditional teaching methods, that is, did not use a shared platform for teaching, only explained different knowledge points, and with the help of teachers' understanding of mathematics culture, the mathematics culture was penetrated into the classroom.

3) Experimental data statistics
During the experiment, the mathematics teacher counted students' interest in higher vocational mathematics and their understanding of mathematics culture.

4) Expert evaluation
After completing the experimental teaching, the expert group will test the mathematics and cultural understanding knowledge (10-point system) for the two groups of students.

3. Discussion

3.1. Big data sharing platform compares students' interest in learning mathematics

The experimental results show that through one semester of study, the number of people in the experimental class who are very interested in higher vocational mathematics has increased by 14.6%, while those of comparative and general interest have decreased by 7.6% and 6.5% respectively. Compared with the control class, the number of interested people increased by 10%, while the comparison and general interest decreased by 20% in total, which was much larger than the experimental class. The specific results are shown in Figure 4.

**Figure 4.** The influence of multimedia technology on learning mathematics interest

Through this big data mathematics cultural resource teaching sharing platform, students can watch related mathematics teaching resources more intuitively and more conveniently, and learn mathematics culture anytime and anywhere, thus having a stronger interest in mathematics. The reason for this very strong interest is that many students believe that the sharing platform converts the mathematics knowledge that was originally responsible for the introduction of culture and the practical application of mathematics, which makes them more interested.

At the same time, in the platform, with the help of the recommendation function, it is more accurate to recommend different mathematics knowledge and mathematics videos that assist the understanding of knowledge points for different students, so as to better attract students' interest in exploration.

3.2. Comparison of the influence of big data sharing platform on the teaching effect of mathematics culture infiltration

Take the examination on the understanding of mathematics knowledge by the students of higher vocational colleges, and get the assessment results shown in Table 1.

| Group          | Achievement   |
|----------------|---------------|
|                | Excellent (10–9) | Good (8.9–8) | Medium (7.9–7) | Pass (6.9–6) |
| Experience group | 10            | 20           | 8            | 2            |
| Control group   | 8             | 16           | 12           | 4            |

According to the above results, the overall score of the experimental group is significantly higher than that of the traditional control class. It shows that the big data-based mathematics culture infiltration teaching sharing platform used in this experiment is very suitable for vocational students, which can better assist students to understand different mathematical knowledge points.
4. Conclusion
In the information age, the current educational informationization has brought a huge change. In order to speed up the informatization of mathematics teaching reform, teachers also proposed different informatization methods, such as the application of multimedia and online teaching. However, with the advent of big data, strengthening the application of big data to higher vocational mathematics resources is a hot topic of current research. Therefore, the introduction of big data into higher vocational classrooms is a huge change in current teaching methods and a breakthrough. This article takes crunch mathematics culture as the research object. Based on the preliminary construction of the system, through experiments and comparisons, it is concluded that the effect of the big data mathematics culture infiltration teaching method is significantly better than traditional teaching methods, which can provide mathematics education in higher vocational education reference.

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