Digital Management of Educational Resource Allocation in Colleges and Universities Based on PSO Algorithm

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Abstract. The educational resources of colleges and universities(CU) are an important manifestation of the country's comprehensive strength. In order to make all aspects of the school better serve teaching, provide the people with high-quality, efficient, high-quality and high-level learning environment, and improve students' sense of autonomy, it is necessary to achieve scientific and reasonable allocation of educational resources in CU. This paper mainly uses digital modeling and system testing to compare and analyze the data of digital management(DM) of college education(CE) resource allocation. The experimental data shows that the CPU utilization of the database reaches a minimum of 12% when the response time is the longest, and exceeds 20% when the initial capacity is 50.

Keywords: PSO Algorithm, College Education, Resource Allocation, Digital Management

1 Introduction

China's higher education still faces many problems. Among them, a series of factors, such as backward information infrastructure, lagging DM and low level of informatization, restrict the rational distribution and efficient use of educational resources. This paper combines PSO algorithm to build a digital efficient classroom structure model based on PSO algorithm, and uses Matlab software to realize the establishment and optimization of online learning mode and the design of education distribution system, so as to provide scientific and reasonable management means for the development of CU.

There are many scholars studying PSO algorithm and DM of resource allocation. For example, some scholars use cloud computing technology to analyze the problems in the current management of CE resources [1-2]. Other scholars believe that the reconstruction of resource construction work mode is first reflected in the demand for digital resources [3-4]. In addition, some scholars pointed out that higher education information management needs to reform teaching methods and teaching concepts [5-6]. Based on this algorithm, this paper analyzes the allocation of CE resources.

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This paper first studies the educational resources of CU, and expounds the current situation, factors and reasons for resource allocation. Secondly, the PSO algorithm is proposed and described, and the improvement direction of the algorithm is analyzed. Then the DM modeling of educational resources is studied. Finally, the relevant data and conclusions are obtained through system design and experiment.

2 Digital Management of College Education Resource Allocation Based on PSO Algorithm

2.1 College Education Resources

Educational resources are an important part of the school's development process, including educational institutions, teachers and students, among which the most basic is teaching and research personnel. At present, the existing teaching equipment in CU in China is mainly based on traditional and backward multimedia classrooms. With the rapid popularization of computer technology and communication network technology and the trend of expanding the scale of higher education, various advanced teaching methods have been widely used in various fields and achieved remarkable results. However, due to the lack of unified planning and management, resources are wasted. Multimedia classrooms and the gradual popularization of digital campus construction are all problems and challenges that need to be faced in the process of the development of higher education informatization.

The relationship between supply and demand of educational resources is a dynamic process. Because CU have put forward new requirements for social and economic development and people's living standards at different stages, higher education must also be adjusted accordingly. There are great differences in the distribution of educational resources in CU at different stages and between different genders, mainly in three aspects. First, audience groups and regional development level. The second point is the limited conditions of the school itself and the limited capital investment. The third type is that students' personal factors and other problems lead to different situations in resource allocation. The needs of students of different types and ages should be taken into account when carrying out DM of distribution in CU. In the process of distribution of educational resources in CU, it is mainly decided by the school management and relevant departments, and the interests of all aspects will often affect the results of distribution. The distribution, management and service of educational resources are to ensure the teaching quality of CU and the needs of social development, as well as to promote the economic construction of schools. Therefore, if we want to realize the scientific and reasonable deployment and planning of higher education, we must strengthen the improvement of technical level in all aspects and enhance the comprehensive quality and ability of relevant managers to jointly complete the task of DM. The users of university education resources are mainly students, teachers and parents, among which students are the direct embodiment of the school's teaching quality and school running efficiency [7-8].

PSO can effectively realize the distribution and management of digital educational

resources. PSO algorithm establishes a learning matrix as the virtual data of the user, and performs different levels of superiors to each sub module according to each sub module, so as to realize the interconnection between the functional modules. The application of PSO optimization model in the management of educational resources in CU can solve the problems of insufficient funds and large number of students in some schools. It can also improve the overall quality of teachers and teaching quality. Through OPO system platform and IOSE framework design, various teaching activities and hardware facilities in the school can be scientifically and reasonably configured. At the same time, it can also facilitate communication between various departments. PSO algorithm is an adaptive management method. Its purpose is to treat the whole system as a whole system and coordinate and unify all parts. From a macro perspective, it can improve the efficiency and quality of resource allocation [9].

2.2 PSO Algorithm

Particle swarm optimization is based on random search and swarm intelligence. Because of its global optimization performance, high robustness and fast computing speed, it is widely used to solve linear programming problems. Particle swarm optimization method. By combining genetic algorithm with mutation theory to assign parameters in the simulation of dynamic system optimization problems, PSO can converge to the optimal value in the shortest time. Then adjust the fitness and population size according to the difference between different individuals to improve the global search ability. Particle Swarm Optimization (PSO) is a model of random phenomena. In the process of searching, it uses the dependence of information within the population to classify. Particle Swarm Optimization (PSO) is a kind of swarm optimization algorithm, which uses existing information to classify individuals in a specific movement state by randomly searching for them. Add one or more parameters to PSO to adjust the global search process. Particle swarm optimization (PSO) introduces a large number of spatial structure functions with strong robustness and local optimal characteristics. PSO method has good application effect in optimizing wireless network performance [10-11]. Suppose a variable of the problem to be optimized is a, X is the number of particles in the particle swarm, and i adjusts its position and speed:

$$\mathrm{w}_i(s) = v * w_i(s-1) + d_1 p_1(q_i(s-1) - a_i(s-1)) + d_2 p_2(q_h(s-1) - a_i(s-1)) \tag{1}$$

$$a_i(s) = a_i(s-1) + w_i(s) \tag{2}$$

Wherein, d_1 and d_2 are promotion constants. W is the particle velocity. The system throughput is expressed by the formula:

$$\mathrm{t} = \sum_{k=1}^{b_{ms}} Y_k \log_2(1 + SINR_{k,i,l}) \tag{3}$$

Wherein, Y_k is the bandwidth allocated to the kth MS.. Adjusting the antenna tilt angle can change the total number of MSs available for service.

In PSO algorithm, we mainly study how to decompose a complex problem into several simple subproblems, and then solve the problem according to each subproblem. When solving the PSO algorithm, the input variable in the problem is generally mapped to the output variable, and then the operation is carried out. For a simple linear programming problem, we can solve it by establishing an appropriate simplified model. But for nonlinear programming, the objective function is transformed into a standard equation or the optimal solution is approximately applied to the actual process. The solution of PSO algorithm is an unsupervised method, which mainly includes two aspects. One is parameter estimation and optimization. The second is to change the relationship between the output information and the external environment by adjusting the input vector during the solution process [12-13].

If the output of a system is stable and the value is within a certain range, the state is called steady state. If the attenuation function of an input signal is not zero, it is called stability. When the system is in a stable or fluctuating period, its performance will tend to be stable. Therefore, we generally use it to evaluate the relationship between dynamic stability and static characteristics. An important application of PSO algorithm is to optimize the system so that it can run in the optimal state. Therefore, we can regard it as a global design. A good PSO algorithm can improve the running speed and reliability of the whole control system. Therefore, in any case, it is necessary to ensure that a certain number of input and output signals are related to the value of the objective function. Moreover, the effective control signals should be reasonably analyzed and processed to ensure their accuracy and stability.

2.3 Digital Management Modeling

The digitalization of education resource management is a complex and tedious system engineering. It requires not only a complete, scientific and reasonable set of data with strong operability, but also high accuracy and certain standardization of data. In the process of traditional information construction, due to the lack of ability to collect, sort out and analyze information, there are many problems in the current allocation of educational resources in CU in China. The first problem to be solved is the dispersion of information sources and the lagging management. The DM system mainly includes data model modeling and analysis and data mining. The application of PSO algorithm in the field of education and teaching can effectively solve the current backward situation of China's university construction and the problem of large amount of information but not comprehensive. At the same time, it is also conducive to improving the efficiency of communication between departments and timely feedback of relevant suggestions, so as to promote the rational allocation of resources and make it more in line with the development trend of the times. Finally, it can also realize the efficient digital campus system under the information management mode. The

digitalization of education resource management is to effectively integrate all kinds of student information among various departments, resources and curriculum arrangements within the school through the establishment of a complete system [14-15].

First, we need to build a data sharing mechanism and a unified platform. Secondly, according to different colleges, departments and majors, a feasible plan that meets their own development characteristics and the needs of all parties should be formulated. Once again, the teaching activities of all schools and the teaching and research workflow of teachers are uploaded to the cloud database through the network, which is convenient for management and control. The distribution and utilization of educational resources in schools is a complex and systematic process, which involves many departments. Each function has its own functional module. Therefore, the establishment of the DM system of university education resources requires the analysis and design of each subsystem to achieve the ultimate goal of maximizing the overall interests.

The principles of DM of educational resources in CU are as follows. Scientific and reasonable. It is necessary to clarify the responsibilities of various departments, specialties and personnel in the distribution of educational resources, and make adjustments according to the actual situation so that they can play the largest role. People oriented concept. As a manager, we should pay attention to how students make corresponding solutions to problems in teachers' teaching process and learning activities and how to effectively solve these practical problems after taking measures. Systematic principle. The needs of different types and genders of student groups should be fully considered when formulating the school education resource allocation plan. It is necessary to realize information management and make digital teaching more colorful. Attention should be paid to the ability of information processing and feedback, data analysis and application. Through the use of different system software, all relevant contents will be integrated to form a complete, reasonable and effective digital scheme, and based on this, a complete, scientific, efficient and convenient management mechanism will be built. At the same time, we should also strengthen cooperation with other departments to achieve resource sharing and collaborative work.

Establish a complete database of educational resources. Through the systematic management of CE resource information, schools can make scientific, reasonable and feasible decisions when making relevant policies and regulations. At the same time, it can also provide an effective communication platform for all departments. In terms of system construction, reasonable planning, design and development shall be carried out according to the actual situation and needs of the school. At the same time, we should pay attention to the modularization principle of data acquisition function, which requires that all sub blocks should be closely connected with each other. The unified standard format and standardized operation mode are adopted for data entry. Establish a unified information platform and data center. The school education

resource management system is formed by sorting out and summarizing various documents and materials. Establish a university education resource database to manage all teaching materials. According to the curriculum and various teaching plan lists provided by various departments of the school, these documents are classified and archived according to different categories and published on the network for the convenience of relevant personnel to query and use. Unified planning of CE resources. And establish a perfect, scientific and reasonable network platform. Through the use of PSO to complete the school's teaching tasks and student information sharing, it can timely understand the curriculum arrangement provided by each department and the progress of each work. Establish and improve the information release system to realize the sharing among all departments of the school, libraries at all levels and other public network platforms. Through the DM analysis of university education resources, we can improve their use efficiency and service quality, and finally achieve the goal of optimizing the configuration of various teaching and research achievements and service system construction.

3 System Design and Implementation

3.1 Architecture Design

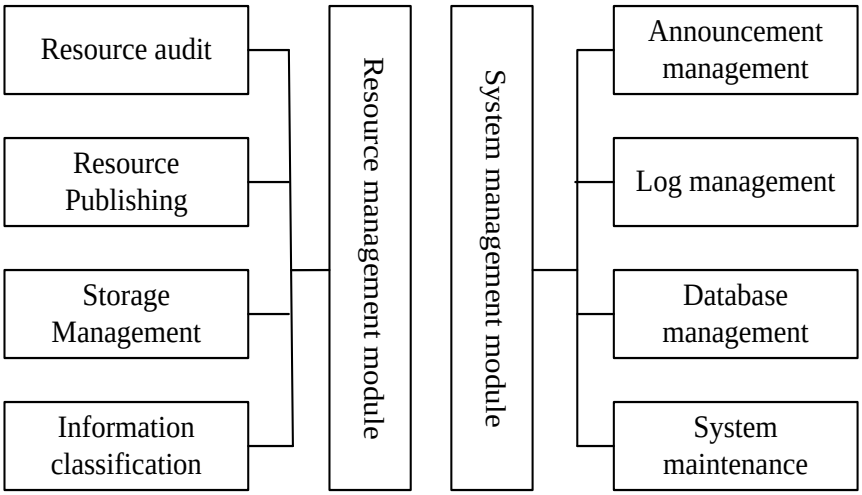

Fig. 1. Design of Educational Resource System Management Module

The design of digital textbooks follows the general teaching system design method, taking into account the characteristics of digital textbooks. The digital teaching resource management system in CU strictly follows the design standards of teaching software, adopts b/s three-tier structure model to build the overall framework of the

system, and adopts the overall direction of system construction. Although the b/s three-tier structure model is a whole, there are some internal links between them. But they are independent of each other because each layer uses different data. In order to reduce data redundancy and improve system operation efficiency, we transfer and use data between different levels to reduce duplication. The detailed design of each module of the system is shown in Figure 1.

The resource management module includes resource audit, resource sharing, storage management, resource classification and other functions. Resource audit plays an important role in the quality control of textbooks. Before resource approval, system users must pass system authentication and enter the system. After entering the system, click the Resource Management module to enter the resource approval function and view the resource information to be displayed.

3.2 System Test Environment

In order to make the test results more true and accurate, the configuration test environment of the system is discussed from three aspects: hardware environment, software environment and network environment.

Hardware environment mainly refers to the composition environment of hardware equipment such as client, server and network equipment. The server hardware environment is configured with 3.0 GHz or higher quad core processor, 6G or higher DDR3 memory, 4TB hard disk drive and 1024M independent graphics card. The customer's hardware environment is configured with a dual core processor of more than 2.8GHz, memory of more than 2G, hard disk drive of more than 1000G, and independent video card of more than 1024m. Network equipment: network adapter, network card and network cable above 100M.

The software environment consists of client and server: server software environment: Windows Server 2013 is used as the operating system, SQL Server 2013 Enterprise Edition is used as the database management system, and the university digital teaching resource management system is used as the server to install application software. Client software environment: use Windows XP and Win 10 as the operating system, and install IE 7.0 and higher.

3.3 Performance Test

The performance test is carried out on the basis of the analysis of load test, pressure test and capacity test. In the load test, the monitoring system can achieve the expected value under the given system load. The pressure test clearly tests the function of the system by applying a constant pressure to the system. Capacity testing is mainly used to find problems in the storage and management of system big data, and verify whether the testing requirements are met. The performance test tool used in this test is QALOAD.

4 Performance Tuning Process and Test Results

According to the performance requirements, this performance test does not include application settings, but mainly optimizes the middleware and database on the application server. The setting method is to exert pressure on the system until an error occurs in the system or the CPU utilization of the server reaches 75%. Identify bottlenecks and optimize the factors that affect them.

4.1 QALoad Test Results

First, use the qaload test tool to run cas to register credentials. We started to run 10 concurrent users, and then added 20 concurrent users every minute to pressurize the system. Record the CPU related data with 110130150 and 170 concurrent users, and the test results are shown in Table 1 after statistics and sorting:

Table 1. QALoad Test Results

	Application server	Database server	Error
110	77	15	3.5
130	76	14	3.2
150	77	17	3.9
170	79	19	4.5

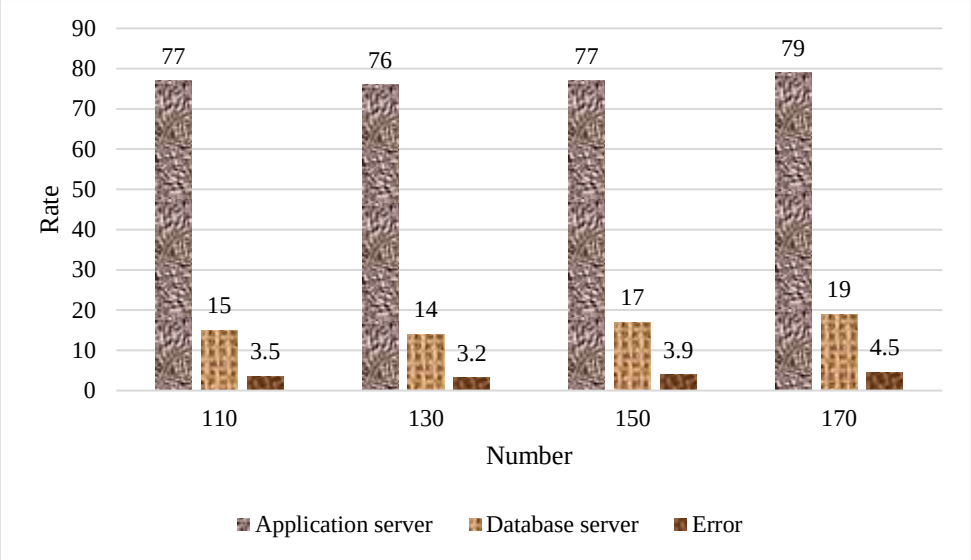

Fig. 2. QALoad Test Results

As shown in Figure 2, we can see that when the number of concurrent servers increases, the CPU utilization of the application server is adjusted accordingly, reaching more than 76%, and the overall utilization is on the rise. However, the CPU utilization of the database server is less than 20%. As the number of users increases, the error rate of the system increases gradually. According to the above test results, after detailed system analysis, the bottleneck of the system lies in the application server. Because this test does not include application settings, only weblogic middleware is optimized.

4.2 Test Results of System Utilization and Response Time

Through the function and performance test of the DM system of university education resources, the system has been greatly improved in many aspects, thus improving the quality of university resource management. Table 2 shows the system response time and CPU utilization within 300 user environments under different platforms:

Table 2. Test Results for System Utilization and Response Time

	Main program server	Database server	Response time
30	30	12	9.05
30	6	17	7.13

30	6	17	7.44
50	6	20	7.33
50	6	20	7.69
50	6	21	7.25

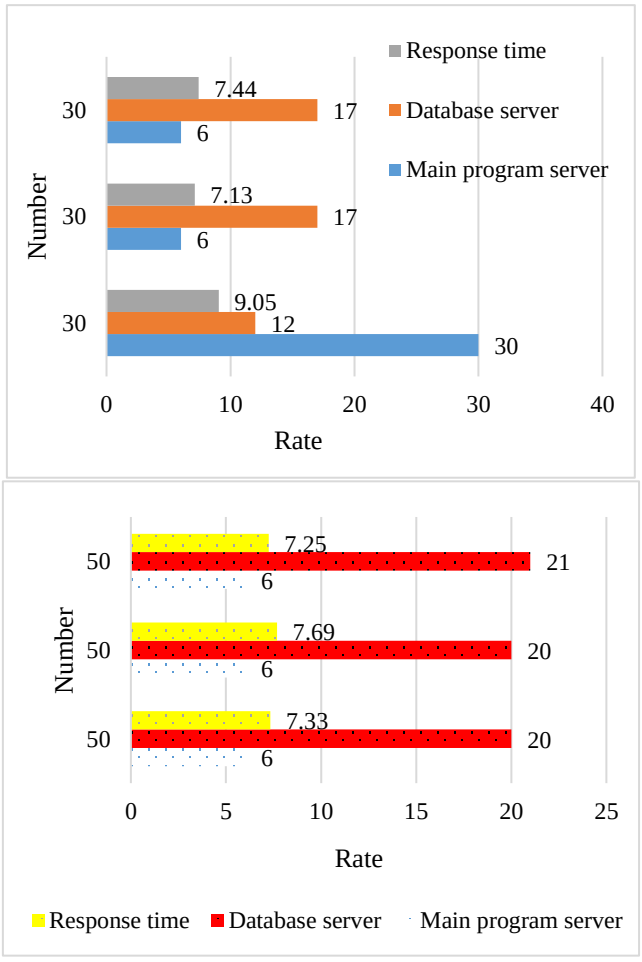

Fig. 3. Test Results for System Utilization and Response Time

As shown in Figure 3, we can see that the CPU utilization is also related to its response time. According to the data graph, when the response time of the system reaches more than 9s, the utilization rate of the main program CPU is 30% when the initial capacity is 30, and 6% when the initial capacity is 50.

5 Conclusion

From the perspective of the development and distribution management of educational resources, this paper conducts a systematic study on the construction of higher education in China, and has achieved certain results. Formulate detailed system planning for teaching, scientific research and administration in CU. Through the analysis of the efficiency and coordination of information transmission among various departments of the school, and the analysis of the working relationship among various subsystems, a reasonable, scientific, effective and feasible resource allocation system is determined. At the same time, the existing DM system should be optimized, upgraded and transformed. In addition, a comprehensive database of educational resources shall be established, and the system shall be updated and improved in a timely manner according to the changes of relevant data to improve the management level. Through the system design and experimental testing, the system response time and CPU utilization related data are obtained, reflecting that the system performance remains at a certain level.

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