



Cloud Computing-Based Sharing Platform for High-quality Teaching Resources of Higher Vocational Physical Education

Xin He^(✉) and Hongjie Cao

Chongqing Vocational Institute of Engineering, Jiangjin 402260, China
17830660127@163.com

Abstract. In order to solve the problem of high packet loss rate during data transmission of the existing educational resource sharing platform, a sharing platform for high-quality teaching resources of higher vocational sports based on cloud computing is proposed and designed. The method first introduces blockchain technology to build a shared information hierarchy model, omits some intermediate links of shared information transmission, and establishes a trusted measurement, storage and reporting mechanism on the encrypted storage technology of physical protection. Then confirm the integrity test value of physical education quality teaching resources in higher vocational colleges, improve the trusted cloud computing mechanism, and finally calculate the matching degree of each demand corresponding to the tasks in the cloud system and the nodes of physical education quality teaching resources in higher vocational colleges, and integrate all data in the shared model into the central database to share high-quality teaching resources. The experimental results show that compared with the comparison method, the proposed method has the lowest packet loss rate in the process of data sharing and has greater application value.

Keywords: Cloud Computing · Teaching Resources · Sharing Platform

1 Introduction

As an important part of vocational education, higher vocational education is facing increasingly severe challenges and opportunities. As an important part of physical education quality, the task of higher vocational physical education is becoming more and more serious. How to improve the quality and level of physical education in higher vocational education has become a hot issue concerned by the education circle and the society. However, due to the asymmetry of teaching resources among higher vocational colleges, the uneven teaching level of teachers, the diversification of students' learning styles and the individual needs, there are some difficulties and challenges in higher vocational physical education.

With the continuous development of computer technology and network technology, most colleges and universities are using network technology to improve the teaching

quality of colleges and universities, develop their own teaching resource management system with full functions and distinctive characteristics, or set up their own electronic library. These high-quality teaching resources provide students with a learning platform for after-class review and self-study [1, 2]. In this context, the establishment of an efficient, convenient and shared teaching resource platform has become a necessary condition for the reform and improvement of physical education teaching quality in higher vocational colleges. Many scholars have conducted research on this issue. As mentioned in reference [3], in order to achieve resource integration and sharing, a study was conducted on the construction of a cloud based English digital resource library for higher education. This method first gives the Functional requirement of the higher vocational English digital resource library system from three aspects: Functional requirement, performance requirements and operational requirements, then analyzes the overall technical architecture and network topology of the education cloud platform where the higher vocational English digital resource library system is located, and finally designs and implements the core module of the higher vocational English digital resource library system based on the optimization strategy proposed in this paper, And provide some important and representative interfaces and source code. A streaming data sharing method for the Internet of Things is proposed in reference [4]. This method proposes a data stream reuse algorithm on the Storm fast data platform to identify the intersection of reusable tasks and streams from existing data streams, so as to form a combined data stream and ensure the equivalence of its output streams. Then, it proposes a de merge algorithm when the data stream is deleted and a defragmentation algorithm for partially reused data streams. Finally, it uses experiments to prove the progressiveness of the proposed method. Although the above two methods have a certain promoting effect on the integration and secure sharing of educational resources, they still cannot guarantee the accuracy of data sharing, and their packet loss rate is still high.

Based on this, the research on the sharing platform of high-quality teaching resources of higher vocational sports based on cloud computing is carried out. First, blockchain technology is introduced to establish a shared information hierarchy model, and a trusted measurement, storage and reporting mechanism of physical protection encryption storage technology is established. Then determine the integrity test value of physical education quality teaching resources in higher vocational colleges, improve the trusted cloud computing mechanism, and finally calculate the matching degree of each demand corresponding to the tasks of the cloud system and physical education quality teaching resources nodes in higher vocational colleges, incorporate all data into the central database, and share high-quality teaching resources. It is hoped that the sharing effect of educational resources can be improved through this study.

2 Sharing Platform of High-quality Teaching Resources for Higher Vocational Sports

The characteristics and necessity of high-quality physical education teaching in vocational colleges include the following points:

- (1) Reasonable curriculum: The curriculum of physical education in vocational colleges should be based on students' learning characteristics and needs. It should not only meet the requirements of students' basic physical fitness and professional knowledge, but also take into account the development of students' personalities and the improvement of their comprehensive qualities.
- (2) Diversified teaching methods: High quality physical education teaching in vocational colleges should adopt various teaching methods, such as explanations, demonstrations, etc., combined with practical operations and interactive exchanges, to stimulate students' interest in learning, promote students' independent learning and innovative thinking, and achieve the effect of applying what is learned.
- (3) Strengthening practical operation: Vocational physical education teaching should focus on practical aspects, practicality oriented, and consolidate students' physical fitness through practice, cultivating professional skills and innovative abilities.
- (4) High quality teachers: PE teaching in higher vocational colleges needs high-level professional teachers who not only have solid professional knowledge and rich practical experience, but also have good teaching ability and interpersonal communication communication ability, which can stimulate students' enthusiasm and interest in learning and lead students to success.
- (5) Complete professional facilities: Vocational physical education teaching requires comprehensive professional facilities and laboratories, including experimental equipment, venue facilities, laboratories, multimedia classrooms, etc., to provide students with a good learning environment and promote the improvement of teaching effectiveness.

The necessity of high-quality physical education teaching in vocational colleges lies in that physical education is the foundation for students' physical and mental health development. Vocational physical education teaching can improve students' comprehensive literacy and professional competitiveness, and help them better adapt to future career requirements and social development needs. At the same time, high-quality physical education teaching in vocational colleges can also promote the development and promotion of sports, and cultivate more sports talents with professional qualities and a sense of social responsibility for society.

In the process of handling specific business logic, access to the underlying database is required. However, the following problems exist in the higher-level physical education quality teaching system:

- (1) It is not user-friendly. Users may have to log in to multiple websites in order to get the resources they want, requiring multiple access rights, or even being unable to use the resources that exist.
- (2) The backend services require costly maintenance.
- (3) The capacity of the system cannot be dynamically changed according to the demand of access. It is easy to overload the system or to run the system empty.
- (4) Repetitive use of resources is not possible, and an ideal balance between expenses and revenues cannot be found. Since this is the case, can there be a way to access all the servers and find the needed resources on those servers by just one access terminal and sending one access request? The answer is yes, and using cloud technology, all of the above requirements can be achieved.

Based on the characteristics of cloud computing, the following idea can be realized by introducing it into the platform for sharing high-quality teaching resources in higher education sports: higher education institutions in a certain region, specifically a city, a province or a country, can join together to build a unified cloud platform, integrate the computing resources of each institution into a public pool of computing resources, establish a unified interface through the cloud computing network, and deliver it to the “cloud committee”. The cloud platform can be managed by the “cloud committee”. The teachers and students of joint higher education institutions can access the resource pool through such a unified interface and get the required teaching information. The resource management centers of these institutions can also upload their own special resources to this public resource pool [3, 4] for students and faculty members of each higher education institution to share. It is only necessary to pay a small fee according to the usage, and do not need to care about the construction of these hardware servers. Thus, the sharing of teaching resources is realized and the “information silo” is eliminated. Students can get more learning resources, and education units can realize online publishing and online interactive teaching more quickly. Education units do not need to consider the construction investment of basic platform and software, and just concentrate on the development of courseware and production of learning resources, and leave everything else to the cloud platform.

2.1 Hierarchical Model of Shared Information

Since the shared information is randomly distributed in the network environment, it makes the information sharing process more complicated and cumbersome, which affects the security of information sharing. This study introduces blockchain technology to build a shared information hierarchy model in order to improve the security of information sharing [2, 5], which lays a solid foundation for the subsequent encryption of shared information attributes.

The hierarchical model of shared information based on blockchain technology is shown in Fig. 1.

As shown in Fig. 1, the application of blockchain technology divides the shared information into five layers- physical layer, blockchain definition layer, network layer, collaboration layer and application layer, and the definition of each layer and its specific functions are shown below:

(1) Physical layer

This layer refers to the physical environment of the demand side of the shared information, which informs the demand side requirements and sends them to the blockchain definition layer [6–8];

(2) Blockchain definition layer

This layer takes the responsibility of defining the tasks of the collaborative layer, such as block structure, digital signature, information transmission, and consensus mechanism. Information sharing needs to involve multiple aspects of information data, and there are large differences between the information and the needs for security are very different. The normalization of different information can be achieved through the processing of the blockchain definition layer, which is the necessary level

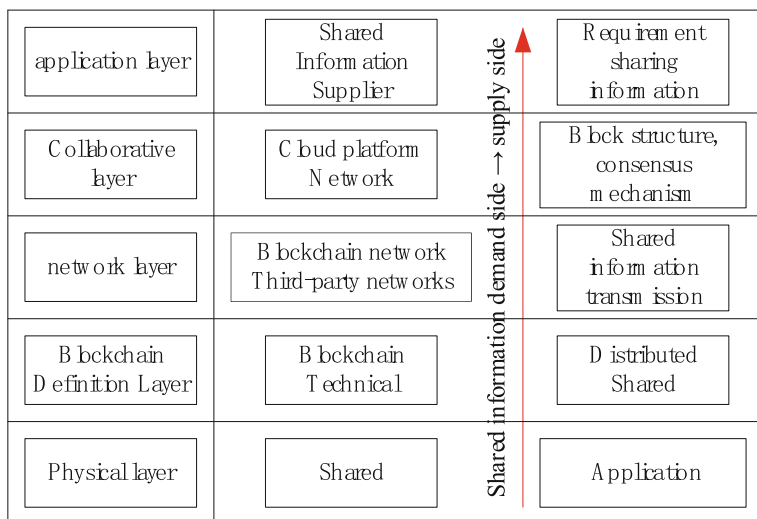


Fig. 1. Shared information hierarchy model

for the shared information to enter the network layer. The formula for normalization of shared information is

$$Y_i = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}} \quad (1)$$

In Eq. (1), X_i and Y_i respectively represent the shared information before and after normalization processing; X_{\min} and X_{\max} represent the minimum and maximum values of shared information, respectively.

(3) Network layer

This level bears the task of sharing information transmission and is a key level of information sharing. In information sharing, this level requires certain authentication of information sharing demanders, suppliers, and shared information to ensure the security of information sharing behavior;

(4) Collaborative layer

This level undertakes tasks such as shared information storage, management, coordination, and decision-making, and records shared information sources, abstracts, security requirements, and other information in the blockchain. It operates and stores shared information through network platforms;

(5) Application layer

After receiving the requirements from the demand side, this level confirms and analyzes the shared information requirements, extracts corresponding shared information based on the requirements, integrates it, and provides feedback to the physical layer.

In the hierarchical model of shared information, shared information is not defined according to information related business processes. This approach can omit some intermediate links in the transmission of shared information, simplify the process of

information sharing, and thereby reduce the probability of shared information being attacked.

2.2 Trusted Cloud Computing System

Trusted cloud computing is an important information security technology for the storage of high-quality teaching resources in vocational physical education. Trusted cloud computing is based on physically protected password storage technology, and the trust mechanism is nested in mainstream computing storage platforms [9–11] to achieve overall storage and call security. In data storage optimization, it is necessary to first design a storage measurement model, which ensures the integrity of metadata throughout the entire storage process under the measurement function of the model. During this process, a reporting mechanism for trusted measurement storage is designed based on trusted cloud computing, as shown in Fig. 2:

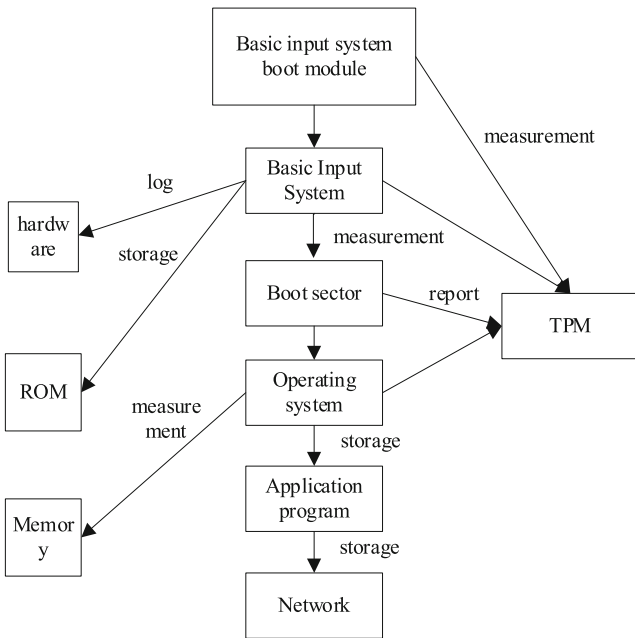


Fig. 2. Trusted metric storage reporting mechanism

In Fig. 2, it is mainly based on the integrity of high-quality physical education teaching resources in vocational colleges as a reference, and it is necessary to calculate the hash value and store it in the internal structure [12], and complete the storage on the storage platform. In order to save space, it is necessary to extend the calculation method of hash values and store the extended values in the configured registers to complete mutual correlation verification. During this process, an element needs to be inserted to obtain the ideal hash and offset. The situation of inserting the element is shown in Table 1:

Table 1. Insert Elements

Hash bucket	Hash value	Address	Optimal bucket	Shifting
Hash bucket 1	J (h1)	112	3	2
Hash bucket 2	–	–	–	–
Hash bucket 3	–	–	–	–
Hash bucket 4	J (h2)	111	5	2
Hash bucket 5	J (h1)	102	2	1
Hash bucket 6	J (h4)	113	3	0
Hash bucket 7	J (h3)	105	2	2

In Table 1, the specific hash bucket numbers are selected for searching and shifted backward in order until the search is achieved and the integrity test values of meta-high school physical education quality teaching resources are obtained.

2.3 Cloud-Based System

The cloud-based system is mainly the time utilized from awareness to end, i.e., the time span. The optimal span mainly refers to the minimization of the running time to achieve the optimal span, and also to be able to enhance the quality of service in the cloud.

- (1) Resource sharing: Cloud systems fully utilize existing computing resources and achieve resource sharing through virtualization technology, improving the efficiency and utilization of computing resources.
- (2) Elastic scaling: Cloud systems can automatically scale computing resources according to business needs, improving the efficiency and elasticity of computing resource utilization.
- (3) High reliability: The cloud system adopts multiple nodes and backup mechanisms, improving the reliability and availability of the application system.
- (4) High security: The cloud system adopts professional security mechanisms and encryption technology to protect the security of user data, effectively preventing the risk of network attacks and data leakage.
- (5) Easy to manage: The cloud system adopts automated management technology, which can achieve automated management and monitoring of computing resources, improving resource utilization efficiency and management efficiency.

The necessity of cloud based systems lies in the fact that with the rapid development of information technology and the continuous increase in information volume, the computing and storage capabilities of traditional single computers can no longer meet business needs. Cloud based systems provide enterprises and individuals with an efficient, convenient, reliable, secure, and economical mode of using computing resources. Cloud based systems can help enterprises achieve low-cost IT resource management and operation, improve business competitiveness and innovation capabilities; At the same

time, cloud systems can also promote information circulation, optimize resource allocation, and provide strong support for the sustainable development of the economy and society.

(1) Economic principles:

As users are billed for computing services, there is a very significant gap in the cost to be paid for various types of services. In order to ensure that the interests of both users as well as cloud services are maximized, an optimal allocation of limited higher-level sports quality teaching resources is required.

(2) Load balancing:

In the context of cloud computing, there are obvious differences in the computing efficiency and performance of virtual machines, and there are also differences in the index preferences for tasks and higher-level physical education quality teaching resources. The main purpose of carrying out load balancing is to comprehensively improve the utilization rate of high quality teaching resources of senior sports in the system.

(3) Minimum sharing time:

Set the research objective as the minimum sharing time of higher-level physical education quality teaching resources, and introduce the corresponding matching factors as well as load balancing degrees in different tasks and higher-level physical education quality teaching resources, respectively.

Set the non-negative objective function that represents the solution objective. Among them, the solid annealing process and the combinatorial optimization problem have certain similarities, and the main advantages are as follows:

(1) Performing complex region search:

The algorithm is more suitable for searching in complex regions and obtaining regions with higher region values in them.

(2) Good parallelism:

Through the good parallelism of the algorithm to effectively solve a variety of nonlinear problems.

(3) Use of object function for search:

The objective function is directly converted into the fitness value to determine the scope and direction of the next search step.

Since the physical states slowly progress to low-energy states, in order to obtain better results, the simulated annealing algorithm mainly selects the states containing important contribution rates in the process of sampling.

Set the randomly generated small displacement changes and the resulting brand new state to j , mark it as an important state, and set the particle solid to first represent the position of state i as the initial state with energy of E_i . The next state of the solid is i and j , and the factor ratio corresponding to the probability ratio of the two states can be expressed as:

$$p(t) = \begin{cases} (E_i - E_j) \\ \frac{1}{Z(t)} \exp\left(-\frac{E_j - E_i}{k_B(t)}\right) \end{cases} \quad (2)$$

Set random number A as a numerical value formed by a random number generator, with a value range of $[0, 1]$. Since p represents a value less than 1, assuming $p \geq A$, it means that i remains in its current state.

According to Formula (8), it can be seen that at low temperatures, the state with a small probability of acceptance and a large difference in current energy is mainly set as an important state; Under high temperature conditions, a new state with a high probability of accepting a significant energy difference from the current state is set as an important state.

Calculate the matching degree between the tasks corresponding to each requirement and the nodes of high-quality teaching resources in vocational sports, analyze the needs of different users, and add matching factors, then:

$$Match_{ij} = \frac{1}{\sqrt{\sum_{i=1}^5 (Tm_i - Vm_j)^2}} \quad (3)$$

In order to obtain the load balancing degree, a mapping sequence of X representative tasks and high-quality teaching resources for vocational physical education is set. At this time, the load balancing degree can be expressed as:

$$Load(X) = \sqrt{\sum_{i=1}^n \left(1 - C_1 \frac{Y_i}{Lv_i}\right)^2} \quad (4)$$

Calculate the computing ability of each high-quality teaching resource node of vocational physical education through weighted calculation, namely:

$$Lv_i = w_1 \times n(v_i) + w_2 \times p(v_i) + w_3 \times r(v_i) \quad (5)$$

In the context of cloud computing, in order to achieve high-precision and efficient sharing, a central database is established to integrate all data from the shared model into the central database, and to share high-quality teaching resources for vocational physical education according to certain classification standards. The composition of the high-quality teaching resource sharing platform for higher vocational physical education is shown in Fig. 3.

In Fig. 3, the logic of teaching senior sports quality teaching resources sharing platform is built on the basis of physical senior sports quality teaching resources, which provides additional services and functions such as common middleware, research database, teaching database, management database, database administrator and workflow manager on the physical grid by virtualizing various actual senior sports quality teaching resources on the physical layer, with servers, storage and actual network to provide abstract services for the sharing process, such as teaching resource exchange and cooperation, and the latest material mining for Civic Science and Technology, etc. Meanwhile, all grid resources above the physical resources are for modeling services and ensure that they are not integrated and invoked by other applications. The functions realized by each layer are described as follows:

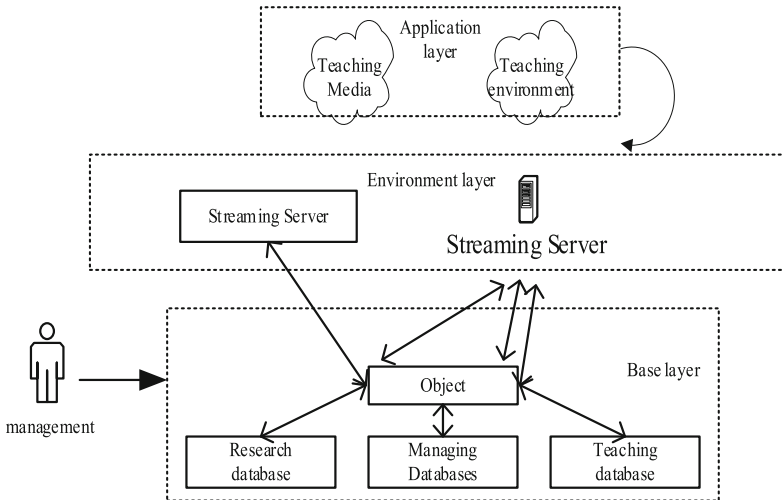


Fig. 3. High quality teaching resource sharing platform for higher vocational physical education

(1) Foundation layer

The foundation layer is mainly composed of the shared high quality teaching resources of higher education sports and the data of each system that provides data for the shared high quality teaching resources of higher education sports.

(2) Environment layer

It implements the specific application of the model and executes the operation command after receiving the search demand from the user.

(3) Application layer

It consists of two parts, teaching media and teaching environment, and is the interface part that feeds the results to the users.

In the case that the complexity and variation degree of shared requirements are not very large, the reuse of database is used, and the reuse number is large, and the reuse cost is larger; in the case that the complexity and variation degree of shared requirements are large, the reuse of knowledge is used, and the reuse number is small or unpredictable, and the reuse cost is unchanged. In general, the teaching and learning high quality teaching resources sharing platform developed by the structure can promote the effective use of high quality teaching resources in high level sports, and it makes the management of the model easy.

After users log in successfully, they enter the user space. In this module, users can manage the high quality teaching resources of higher vocational sports and upload and download the high quality teaching resources of higher vocational sports. When the user requests the uploading of higher-level physical education quality teaching resources, the system will check whether the user has the right to upload, for example, the visitor can't do the uploading operation. Then through the setting of user uploading high quality teaching resources for higher level physical education, the system will match the uploaded high quality teaching resources for that user according to keywords in the system in order to prevent the duplication of high

quality teaching resources for higher level physical education, and check whether similar files exist.

3 Experiment

This experiment was conducted on a computer with a Windows 10 operating system and 2GB of memory. The computer has enough computing power and resources to carry out the research on distance education data sharing of physical education courses. Select the teaching data of a certain university's physical education course for research, obtain the educational data of its physical education course progress, and complete the acquisition of data samples. The specific situation of the experiment is as follows:

- (1) Collection of high-quality teaching resources for English courses in higher vocational institutions for higher-level sports:

Multiple maintenance points are set in the platform to collect information on abnormal behavior of the platform, so as to lay a solid foundation for the later maintenance work of the platform.

- (2) Platform data processing:

In order to better identify the abnormal behavior accurately in the massive data, it is necessary to carry out numerical as well as normalization operations for all the higher-level physical education quality teaching resources collected from the platform.

- (3) Platform data analysis:

Data analysis is an important process of automatic platform maintenance, mainly using some specific rules analysis to realize the analysis work of platform data and determine whether the platform needs to be maintained according to the analysis results.

- (4) Platform response processing:

Through the data analysis results of the platform, it can obtain the usage status of different users in the platform, and if abnormal behaviors are found in the platform, the platform needs to take corresponding response measures in time to ensure the stable operation of the platform.

With the above content set, the corresponding version and data manager can be selected and assigned to different network transmission nodes, and the version and data manager are assigned the number of nodes. Each working machine will be tested 100 times to analyze the aggregated bandwidth of different data storage structures under high load read and write. The test results are shown in Fig. 4:

In Fig. 4, tested under high load conditions, the metadata without storage structure optimization limits the amount of global aggregation bandwidth, and all of the aggregation bandwidth of customized courses, online teaching courses, and intelligent recommendation courses data storage structure is improved, which verifies the effectiveness of the method in this paper.

In order to further verify the advanced nature of the proposed method, reference [3] method and reference [4] method were selected as comparison methods to carry out comparative experiments. Test the packet loss rate of data transmission under the background of data transmission of different sizes, and get the comparison results as shown in Fig. 5.

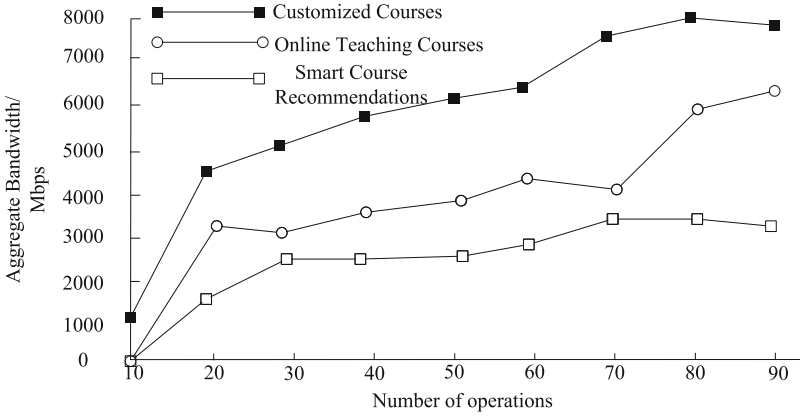


Fig. 4. Aggregation bandwidth of different data storage structures under high load read and write

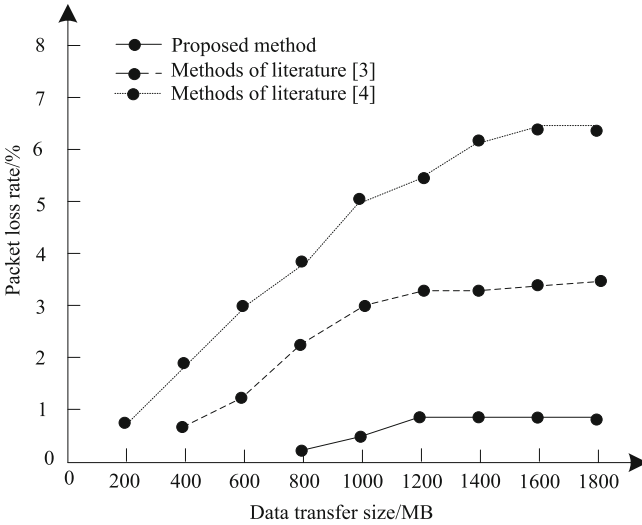


Fig. 5. Cloud platform cloud data transmission packet loss rate comparison knot

As shown in Fig. 5, with the application of the proposed method, the data packet loss rate is all less than 0.55%, while with the application of the two comparison methods, the data packet loss rate increases first and then becomes stable with the increase of the amount of transmitted data, and the packet loss rate is higher than 0.78%, which proves that the proposed platform has better data sharing effect.

4 Conclusion

The cloud-based platform for sharing high-quality teaching resources of higher-level physical education can provide a centralized, efficient and convenient information resource sharing platform for higher-level physical education teachers, help teachers

achieve interoperability of teaching resources and innovation of teaching methods, and improve the quality of classroom teaching and the cultivation of students' comprehensive quality.

In the future, the construction and improvement of this platform requires the joint efforts of educational institutions, technology enterprises and government departments to adopt an open, cooperative and win-win model to actively promote the sharing and optimization of teaching resources and the overall development of higher education physical education. At the same time, it is also necessary to further improve the security and reliability of the technical platform, strengthen teachers' training and technical support, and improve teachers' digital literacy and innovation ability, so that the platform can really become an effective means to promote the reform of higher vocational physical education and improve teaching quality. It is believed that through joint efforts, the cloud computing-based higher vocational physical education quality teaching resources sharing platform will play an active role in supporting and helping to promote the development and progress of higher vocational physical education, as well as to achieve the goals of educational equity and quality education.

References

1. Feng, J., Zhang, W., Tsai, S.-B.: Construction of a multimedia-based university ideological and political big data cloud service teaching resource sharing model. *Math. Prob. Eng.* **2021**(Pt.52), 9907630.1–9907630.12 (2021)
2. Cao, Q.: Study on resource sharing strategy of E-commerce innovation and entrepreneurship education based on cloud computing. *Sci. Program.* **2021**(Pt.10), 8268000.1–8268000.8 (2021)
3. Wang, J., Li, W.: The Construction of a digital resource library of English for higher education based on a cloud platform. *Sci. Program.* **2021**(Pt.10), 4591780.1–4591780.12 (2021)
4. Chaturvedi, S., Tyagi, S., Simmhan, Y.: Cost-effective sharing of streaming dataflows for IoT applications. *IEEE Trans. Cloud Comput.* **9**(4), 1391–1407 (2021)
5. Zu, C.: Hadoop-based painting resource storage and retrieval platform construction and testing. *Complexity*, **2021**(Pt.16), 9933330–1–9933330–11 (2021)
6. Li, S., Zhu, J., Chen, Z., et al.: Double-layer energy management system based on energy sharing cloud for virtual residential microgrid. *Appl. Energy* **282**(Pt.A), 116089.1–116089.13 (2021)
7. Liu, S., Dai, Y., Cai, Z., et al.: Construction of double-precision wisdom teaching framework based on blockchain technology in cloud platform. **2021**, 911823–911834 (2021)
8. Shekhar, C.A., Sharvani, G.S.: MTLBP: a novel framework to assess multi-tenant load balance in cloud computing for cost-effective resource allocation. *Wirel. Pers. Commun. Int. J.* **120**(2), 1873–1893 (2021)
9. Yang, Q.: Cloud music teaching database based on opencl design and neural network. *Microprocess. Microsyst.* **82**, 103897.1–103897.5 (2021)
10. Wang, F.: Enlightenment of physical education teaching experiment based on cloud computing to the current physical education reform. *Sci. Program.* **2021**(Pt.9), 6607539.1–6607539.11 (2021)
11. Gharehpasha, S., Masdari, M.: A discrete chaotic multi-objective SCA-ALO optimization algorithm for an optimal virtual machine placement in cloud data center. **12**(10), 9323–9339 (2021)

12. Liu, S., Li, Y., Fu, W.: Human-centered attention-aware networks for action recognition. *Int. J. Intell. Syst.* **37**(12), 10968–10987 (2022)
13. She, X.-B., Huang, S., Liu, C.-Q.: Web resource priority collaborative filtering recommendation based on deep learning. *Comput. Simulat.* **39**(002), 431–435 (2022)