



Ceramic Art Teaching Resource Sharing Platform Based on Classroom Behavior Analysis

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Abstract. Aiming at the problem of poor sharing effect of modern pottery teaching resources, this research proposes and designs a pottery teaching resource sharing platform based on classroom behavior analysis. In terms of hardware, the API sharing interface is designed, the information transmission master station is connected to the collection device through GPRS public network communication channel, and the structure of XML parser is designed to realize cross-regional resource sharing. In terms of software, the Grobeis criterion is used to pre-process the teacher-student interaction graph data and determine the resource center. The sharing center determined according to the classroom behavior of the interactive map and the ranking method of the remote sharing mode of resource library resources are established to realize the integration of teaching resources. The experimental results show that the maximum shared resource of the platform is 4500bit, which proves that the proposed method has a good resource sharing effect.

Keywords: Classroom Behavior Analysis · Ceramic Art · Teaching Resources · Sharing Platform

1 Introduction

The rapid development of Internet technology has provided new teaching means for traditional education. Teaching resource sharing technology has been widely used in various fields. Its application in ceramic teaching has effectively improved the limitations of traditional ceramic art teaching resource sharing. In the context of mobile Internet + education, a variety of learning based teaching resource platforms are in full bloom, including MOOC, micro classes, online open courses, etc. These platforms provide learners with a good autonomous learning environment. But educators often ignore the construction of another type of teaching resource platform, which is the data based teaching resource platform.

Year after year, day after day, data based teaching resources are increasing, and their storage, classification, sharing, and use are all topics that need special consideration at present: first, although all majors or teachers now save these teaching achievements every year in the form of burning CDs or computer storage, this traditional data storage method has virus threats, hardware damage. The storage device is unstable, the space is limited and cannot be shared. Once the course is over, over time, these precious teaching resources will sink into the sea and no one will care about them. Second, the traditional way of storing data on hard disk or optical disk is basically privatized. Except that all teachers can obtain the teaching results of their subjects, other professional teachers and students cannot directly or timely obtain effective resources or information, resulting in the problem of asymmetric information resources in education, which leads to repeated waste of resources. Third, in terms of the transformation of teaching achievements, the evaluation, exhibition, competition and other forms each semester can not let more enterprises understand the works designed by the school, but at best it is only a small exhibition within the school. This situation directly leads to the fact that students' teaching resources are hard to see and unknown to outsiders, resulting in a huge waste of design resources, which is not conducive to the effective connection between teaching and the market. Therefore, building a shared platform for data based teaching resources is also a necessary means to further deepen teaching reform and speed up education informatization. Through sorting, summarizing and surfing the Internet of various teaching resources, a new open and shared network sharing platform can be formed.

At present, the heterogeneous data fusion algorithm based on BP neural network is proposed in literature [1]. This algorithm takes variable factors as input factors, obtains relevant data by screening factor variables, and combines neural network data fusion technology to fuse heterogeneous network information on this basis. The heterogeneous data sharing algorithm based on the twin neural network proposed in literature [2] uses the relationship based heterogeneous network information sharing model, uses the multitask twin neural network, approximates the similarity of the same and different nodes to low dimensions, and uses the multitask twin neural network to realize the deep sharing of multiple nodes. Literature [3] proposed a fusion method based on privacy protection. This method uses BGN encryption system to share the key, and shares the encrypted data to the perception platform through differential privacy awareness data. However, the current three methods are vulnerable to cross platform operations between different formats of information when exchanging different information, and the amount of computation is large, which tends to shorten the network life and lead to poor information exchange results. Therefore, a ceramic art teaching resource sharing platform based on classroom behavior analysis is designed.

2 Platform Structure Design

The ceramic art teaching resource sharing platform based on classroom behavior analysis provides users with better resource sharing services, integrates rich ceramic art teaching resources, improves the utilization rate of teaching resource sharing, and solves the problems in teaching resource storage. There are two design functions of the ceramic art teaching cloud sharing platform, one is to meet the needs of users for resource utilization, the other is to provide users with personalized cloud sharing service experience to

meet the needs of communication between users [4]. The basic functions of the platform design include resource browsing, resource query, resource download and other functions. Users can search the required resources in the platform according to the keywords of information. In order to meet the needs of user communication, the platform has added instant chat, personal space and other functions in the function design to meet the requirements of personalized learning of users. The function of community learning module is added to the functional design of the platform, and websites such as QQ space are introduced for teachers and students to use, which promotes students' enthusiasm for learning and strengthens the exchange of learning between teachers and students [5, 6]. Through cloud services, teachers and students can achieve two-way real-time interaction, and students and teachers can experience the fun of learning anywhere. The structural design of ceramic art teaching resource sharing platform based on classroom behavior analysis is shown in Fig. 1.

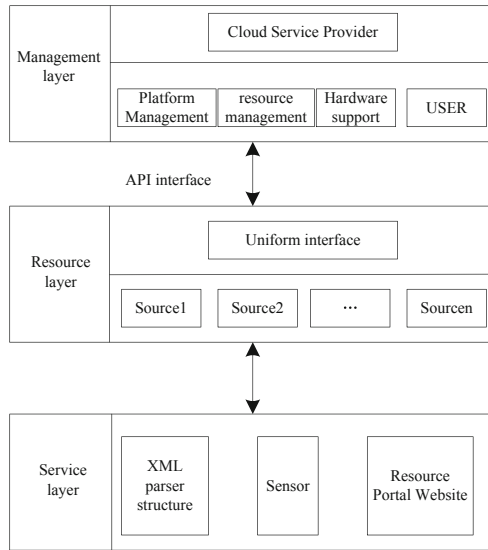


Fig. 1. Structure of ceramic art teaching resources sharing platform

The system platform is a service layer for users, which provides users with a resource sharing interface. Users can access, browse and download ceramic art teaching resources cloud sharing platform anytime and anywhere through mobile terminal devices such as computers and mobile phones. Users can download ceramic art teaching resources they need at any time and any place. The use of cloud platform in ceramic art teaching resources allows users of mobile terminals to access resources and improve users' experience. Cloud sharing services promote the sharing services of ceramic art teaching resources [7]. Users can query and visit ceramic art teaching resources through the website through the keyword search function, which is fast and accurate. The sharing service of the cloud platform can not only provide users with the function of resource access, but also provide users with personalized services. Compared with traditional resource

sharing platforms, the cloud sharing platform not only meets users' needs for resource access and download, but also provides the function of communication between users. It attaches more importance to the application of user interaction.

2.1 Sharing Management

The management layer manages the cloud sharing platform of ceramic art teaching resources. The cloud service provider provides the management layer with the architecture based on the Pass platform. The cloud service provider also provides the management layer with hardware equipment, storage and other services, and the cloud service provider is responsible for management. The managers of ceramic art teaching resources can easily manage platform resources, services and accounts through API management. The management of accounts is mainly to allocate legal and authorized authentication IDs, and users can access the resource pool by applying for IDs [8]. An API interface is designed in the sharing management layer, as shown in Fig. 2.

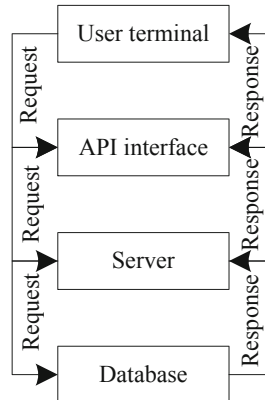


Fig. 2. Schematic diagram of API interface of management layer

In the resource management layer, applications and resources are decoupled through API interfaces, ensuring the stability of the front-end application system, so that it will not be disturbed by the back-end heterogeneous resource environment, nor affected by changes in the implementation technology. In this way, resource management and applications can be separated, while ensuring the stability of the management interface.

2.2 Shared Resource Layer

The resource layer is the key layer for the integration and summary of ceramic art teaching resources. The design advantage of the platform system is to improve the utilization efficiency of resource sharing, facilitate users' access to ceramic art teaching resources, make the storage of ceramic art teaching resources more secure, and save manpower and material resources [9]. The resource layer provides resource services for

the cloud sharing platform. It collects ceramic art teaching resources and stores them in the cloud resource pool in a virtual way. The teaching resources in the resource pool are shared by various institutions. Users submit their own resources to the resource pool for sharing with other users after being approved by the cloud platform.

The physical structure of the acquisition system used by the shared resource layer is shown in Fig. 3.

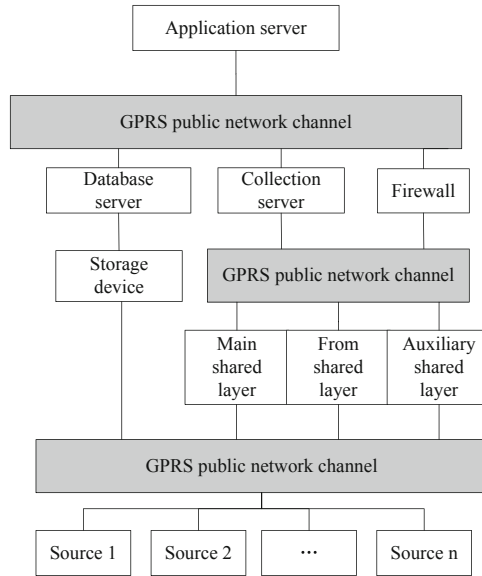


Fig. 3. Physical Structure of Acquisition System

As can be seen from Fig. 3, logically, the resource acquisition system is divided into the main sharing layer, the secondary sharing layer and the auxiliary sharing layer. The platform is connected to other application systems through interfaces. The acquisition master sharing layer mainly uses the GPRS public network communication channel, which supports the information interaction between the master sharing layer and the slave sharing layer, and is the connection between the information transmission master station and the acquisition equipment. GPRS public network communication is a 32-bit wireless module, which uses an embedded operating structure to provide an RS232 interface for the system, facilitate direct connection with serial devices, and realize rapid transmission of resources [10]. The auxiliary sharing layer has metering and statistics functions. It is divided into N terminal layers to be responsible for resource collection and realize resource interaction between different users.

2.3 Shared Service Layer

In order to facilitate the rational use of resources, a set of template mapping between resource database patterns is designed. XML analysis software is used to read, write,

count and report XML resources, which solves the problems of heterogeneous conflict and cross platform resource exchange in the process of resource exchange and resource processing, and realizes resource transmission at any time and anywhere.

XML parser structure, as shown in Fig. 4.

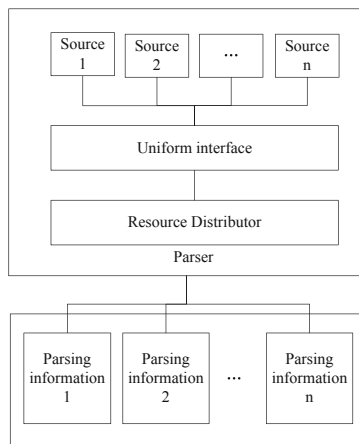


Fig. 4. XML parser structure

As shown in Fig. 4, in an XML document, the parser will scan the internal or external subset of the declaration to establish a syntax tree. The syntax tree stores the attributes in the XML validator and stores the syntax tree information in the array.

Redundant arrays are resources stored in different locations of multiple disks. These resources overlap evenly to improve the system performance. The system fault tolerance performance is improved by increasing the average time between disk failures. Use dual storage disk cabinets to store resources on local disks, and use the replication function of dual storage arrays to back up the stored resources to other storage arrays to ensure that resources will not be lost.

3 Platform Function Realization

3.1 Determination of Sharing Center Based on Interaction Map Classroom Behavior

In order to more intuitively see the comparison of teacher talk, student talk, technology application and silence behavior time share in ceramic art class, it is necessary to analyze the teacher-student interaction map. First, use the Grobeis criterion to preprocess the atlas data. The formula is:

$$g = \frac{\sum_{l=1}^{\beta} g_n}{\beta} \quad (1)$$

In formula (1), β indicates the quantity of data; l indicates the number of calculations. Using the i-FIAS analysis program matched with the i-FIAS interaction analysis system, the original code table is imported into the analysis program, and the corresponding teacher-student interaction map is obtained, as shown in Fig. 5.

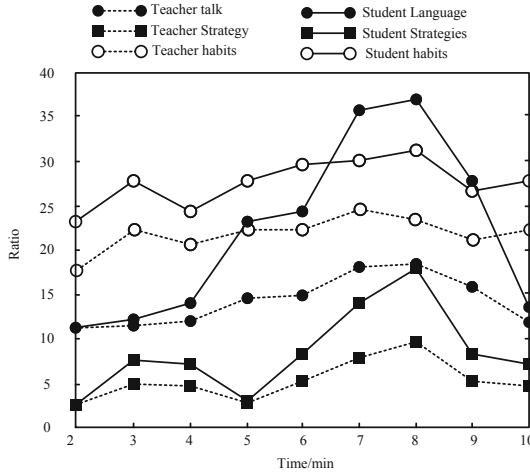


Fig. 5. Interaction map between teachers and students

In the teacher-student interaction map in Fig. 5, the ratio of teacher’s language five minutes before class is significantly higher than that of other behaviors, which indicates that teacher’s language is mainly used during this period. From the 5th minute to the 15th minute, the ratio of teachers, students and technology accounted for a certain proportion, indicating that teachers interacted with students through the use of technology during this period. From the 15th minute to the 23rd minute, the teacher’s language ratio is significantly higher than other ratios, which indicates that most of the time in this ten minute period is dominated by teachers’ teaching. From the 23rd minute to the 33rd minute, the teacher’s language, student’s language and technology ratio intersect in turn, indicating that the teacher-student interaction is very active during this period, and technology application also accounts for a certain proportion. From the 33th minute to the 36th minute, the ratio of silence beneficial to teaching is significantly higher than the ratio of teachers’ and students’ language and technical behavior, which indicates that students are mainly silent and self-study practice during this period. Between 36–40, the teacher’s language ratio, silence ratio and student’s language ratio intersect one by one, indicating that teachers and students are interacting during this period of time, while in the last period of time, the teacher’s language ratio is far greater than the student’s language ratio, indicating that teachers are summarizing the classroom at the last period of time.

Based on the results of classroom analysis, the ceramic art teaching resources sharing center was determined. First of all, the Resource Sharing Center integrates a variety of resource management technologies, adheres to the principle of resource centric in

technology selection, and does not blindly pursue the basic principles of advanced, fast, and clear order. For many fields of circular economy, especially in market regulation, the requirement for resource consistency is not high, and the key is integration. It pays attention to the high availability of resources and the scalability of the structure. Technical factors such as resource sharing in the large resource supply chain. Data visualization is also an important part of resource data processing. Its main purpose is to present the data integration in an easy to understand form on the circular economy integration platform, which is the specific expression of the integrated data. Then, the integrated resource can be processed on various resource receiving devices.

Based on this, the Content Center is determined as follows:

$$O = \frac{1}{\log(1 + \frac{m}{n})} \cdot \frac{1}{\sqrt{\sum_{m=1}^N m}} \quad (2)$$

In formula (2), m is the number of attribute values in the local ontology; n is the total number of all local noumenons; N is the total number of attribute values in all local ontologies. Through this formula, the sharing center of classroom behavior based on interaction map can be determined.

3.2 Integration of Teaching Resources

According to the determined sharing center based on the interaction map classroom behavior, the teaching resource integration mechanism is established by establishing the sequencing method of the remote sharing mode of resource library resources. The specific process is as follows:

Set the threshold and iterative adjustment parameters, and construct a complementary judgment matrix when the time is 0:

$$E(t) = (E(t)_{ij})_{m \times n} \quad (3)$$

In formula (3), $E(t)_{ij}$ represents the judgment matrix j at point i .

Obtain the minimum non negative deviations $a_{ij}^{(t)-}$ and $a_{ij}^{(t)+}$. Calculate the consistency index and optimal weight vector of the complementary judgment matrix according to the following formula:

$$\gamma(E) = \frac{\sum_{i < j} |e_{ij}^{(t)-} - e_{ij}^{(t)+}|}{n} \quad (4)$$

In formula (4), $e_{ij}^{(t)-}$, $e_{ij}^{(t)+}$ represent the minimum non negative and non positive deviation respectively. Output the complementary judgment matrix and consistency index, and sort the data to be integrated according to the value.

When two sorting arrays have the same dimension, the size difference between them is only a constant, which is compatible array. Only compatible arrays can perform

resource fusion. When merging qualified resources, the calculation result of resource fusion degree between heterogeneous networks is taken as the basis, and the formula is:

$$t_{ij} = \int_{M_j}^{M_i} \frac{1}{\sqrt{2\pi}\phi} \exp\left\{-\frac{1}{2}\left[\frac{M_i - M_j}{\sigma_j}\right]^2\right\} dM \tag{5}$$

In formula (5), M represents teaching resources; M_i, M_j represents the teaching resources j listed in i ; ϕ is a Normal distribution function. When the calculation result of the formula is close to 0, it indicates that the coincidence degree of these two resources is large, and the integration effect of these two resources is good.

3.3 Sharing of Teaching Resources

On the basis of bionics principles, with ant colony as the optimization goal, and according to the distribution law of ant colony, the distribution of ant colony is constantly adjusted to achieve the goal of searching. Therefore, a platform sharing technology based on ant colony algorithm is proposed. The detailed process is as follows:

Step 1: Initialize the parameters, train the ceramic art teaching resource sharing process, and construct the ant colony adaptive function. In the shared platform, the input terminal contains only one neuron, which is responsible for the overall output of the neural network. The adaptive function input obtained from this can be expressed as:

$$a_{k+1}(t) = \sum_{k=1}^t w_k a_k(t) \tag{6}$$

In formula (6), w_k represents the weight of k ; $a_k(t)$ represents the input result at sampling time t . The corresponding output layer is:

$$b_{k+1}(t) = \begin{cases} 1 & a_{k+1}(t) > 1 \\ a_{k+1}(t) & -1 \leq a_{k+1}(t) \leq 1 \\ 1 & a_{k+1}(t) < -1 \end{cases} \tag{7}$$

The result obtained by formula (7) is equivalent to the overall output of the entire sharing platform. Through intelligent control of the sharing platform, the difference between the real input and the expected input of the platform is maximized, that is, the maximum stable state. With the entity resource type and resource data supply chain in this state as the only identification, a comprehensive and unique circular supply mode sharing data cloud is established.

Step 2: In a secure resource data cloud system, resource sharing is necessary. The processing method for shared resources is mainly to use resource data re encryption, which combines attribute based encryption sharing with resource re encryption, and makes full use of encryption algorithms to ensure the security of resource sharing. Therefore, a secure encryption resource sharing method is designed. In order to ensure the confidentiality of resources, resources are stored in the cloud after the client is encrypted by the user using the symmetric encryption method, as shown in Formula (8).

$$DP = (A_p, A_q, B_p, B_q) \tag{8}$$

In formula (8), A_p, A_q are finite non empty sets with encrypted identity and non encrypted identity respectively; B_p, B_q are finite time sets with encrypted identity and non encrypted identity respectively. In this way, unencrypted resources to be shared will not be exposed during data sharing.

Step 3: In the ant colony algorithm, set guidance parameters and adjust its convergence. When the guidance parameter value is greater than 1, the ant colony will expand the range and launch a global search; When the guidance parameter value is less than 1, the ant colony will shrink and concentrate on hunting. The guidance parameters are determined by the convergence factor, so the convergence factor can have a great impact on the improvement results of the ant colony algorithm. Based on this situation, a nonlinear convergence factor is proposed, and the expression formula is:

$$\lambda = \lambda_0 \cdot e^{\left(\frac{1}{\max d}\right)} \quad (9)$$

In formula (9), λ_0 represents the initial convergence factor; $\max d$ represents the maximum number of iterations; e is the derivative. At the initial stage of the algorithm, with the increase of the number of iterations, the convergence factor presents a nonlinear trend of slow first and fast later. At this time, the convergence factor decreases slowly, which also indicates that the proportion of iteration $a > 1$ is large, and then the Ant colony optimization algorithms also has a strong global optimization capability, which can obtain an efficient resource matching effect.

Step 4: In order to achieve uniform sharing, it is necessary to introduce different sharing radii in the shared nodes to reduce the number of “hot zone” problems. The formula for calculating the shared radius is:

$$r = 1 - \frac{W_0 - W'}{W_0} \cdot \frac{S_{\max} - S'}{S_{\max} - S_{\min}} \rho \quad (10)$$

In formula (10), W' , W_0 represent the initial and current energy of the node respectively; S' represents the distance between any two nodes; S_{\min} , S_{\max} represent the nearest and farthest distance of any two nodes in all nodes respectively; ρ indicates node density. The shared node uses the existing data to construct a new node, and takes it as the initial shared leader node. After the initial leader node is determined, broadcast the leader node message. The unselected leader node will no longer be in sleep state, and select the leader node with the lowest communication cost to complete the creation of the shared radius.

Step 5: Visually operate the resource database, extract the data of each resource to the general data center interface according to the data resource association database and the objectified circular sharing of ceramic art professors, visually load the circular integration data resource platform, combine the multi resource data into a tree like circular structure, and at the same time establish index mapping for each resource, establish resource sharing index for the platform, and complete resource sharing.

4 Experiment

4.1 Experimental Environment Setting

The simulation experiment is carried out with Cooja network simulator, which is carried out under Contiki operating system, uses the message authentication code generated by HMAC MDS algorithm, and authenticates the data source by combining tinyDTLS library. The topology used in the experiment is shown in Fig. 6.

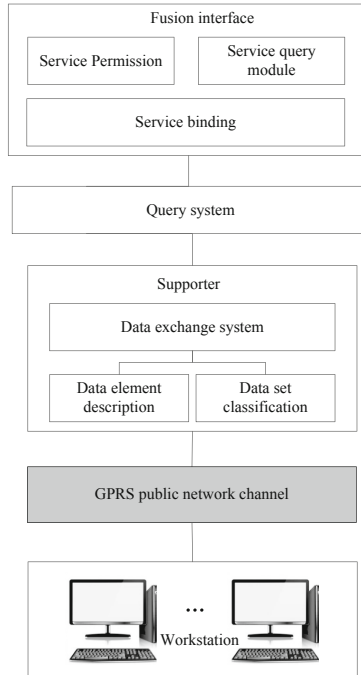


Fig. 6. Experimental Topology

During the experiment, the information delay is not taken into account. The previous trust value has the same importance as the newly generated trust value in the current trust value, so the weight factor is set to 0.5. In order to comprehensively evaluate the overall trust value of the node, without the wrong judgment caused by the high proportion of direct experience value, the decline of the overall trust value of the normal node caused by the misinformation of messages can be ignored during the simulation.

4.2 Source of Experimental Data

The application function in ceramic modeling design teaching is realized under the support of various software, mainly including 3ds max, Unity, After Effect and other software, which plays an important role in the setting of virtual scenes in ceramic modeling design teaching. 3ds max software is used in advertising production, film and television production, industrial design and other fields. It is based on 3D software, applied to ceramic modeling design, and made ceramic models with the use of modeling tools. You can also set simulated real lights to render decorative graphics for 3D ceramic modeling. Unity software can create 3D video games, realize 3D animation and other multiple interactive functions. Teachers can use this software to release ceramic teaching courseware to various platforms, which is convenient for students to learn. After Effect software is an important tool for making dynamic images. Teachers can produce post synthesis effects when they apply it to ceramic modeling design teaching. The use of ZBrush software can increase the depth, material, lighting and other special effects of ceramic modeling design pixels. To sum up, in 2D and 3D, we can see the functions of digital media software, which fully meets the teaching requirements of teachers in the production of digital interactive ceramic modeling design courses, realizes the simplification of courses, and solves the difficulties of traditional digital interactive ceramic modeling design. It improves the effect of teaching and learning.

Resources are divided into three categories, as shown in Fig. 7.

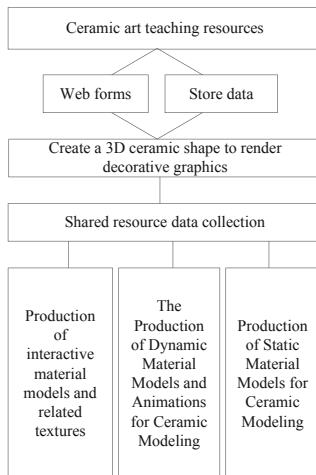


Fig. 7. Experimental Resources

The experimental resources are divided into the following three categories:

Class I: production of interactive material models and related maps. The application of digital interactive technology in ceramic modeling design requires that ceramic models can be observed from multiple angles. To meet the demand of multi angle observation, the real-time rendering model is mainly made by 3dmax, and maps of relevant models are made with the help of photoshop. In the 3dmax software, the model is made

according to the porcelain picture that needs to be made. In the demonstration process of ceramic modeling design under digital interaction technology, only one 3D model can be displayed and interacted at the same time, and the number of faces of the model is limited to about 10000. After that, the ceramic modeling map is designed according to the digital interaction technology.

Class II: the production of ceramic modeling dynamic material model and its animation. The production of ceramic modeling dynamic material model aims to enhance the atmosphere of the page. Most of the time, this dynamic material is located at the bottom of the page, so you only need to make simple model maps.

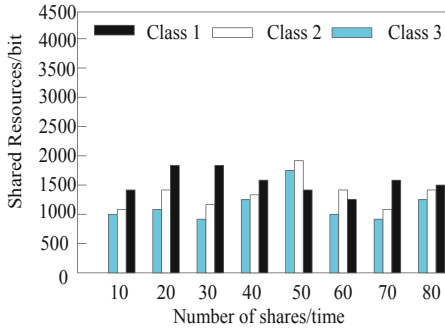
Class III: Production of static material model of ceramic modeling. Ceramic modeling static materials mainly refer to various pictures. In order to save memory, these pictures need to be sorted into a large picture. When a picture is needed, read out the required part from the large picture. Through text information retrieval in the engine, unnecessary consumption caused by heavy reading can be avoided.

In this study, these three types of resources were extracted as data samples, and their memory size was 80 GB, which was carried out in the experimental environment designed in 4.1. Heterogeneous data fusion algorithm based on BP neural network, heterogeneous data sharing algorithm based on double neural network and fusion method based on privacy protection were selected as comparison methods to carry out comparative experiments, and the practicability of the proposed methods was verified by comparing the sharing effects.

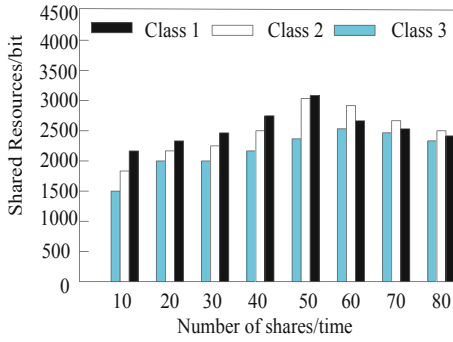
4.3 Experimental Results and Analysis

Compare the resource sharing effect of the four methods. The comparison results are shown in Fig. 8.

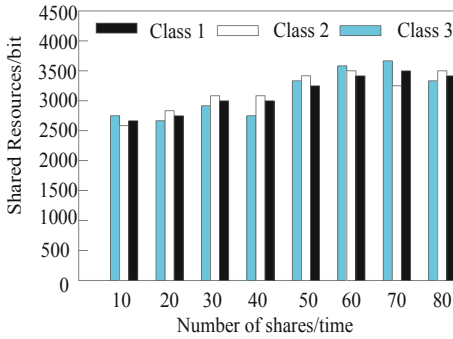
It can be seen from Fig. 8 (a) that the maximum shared resources of Class I, Class II and Class III using this method are 1800 bit, 1900 bit and 1700 bit respectively; from Fig. 8 (a), it can be seen that the maximum shared resources of Class I, Class II and Class III using this method are 3100 bit and 2500 bit respectively. As can be seen from Fig. 8 (c), the maximum shared resources of Class 1, Class 2, and Class 3 using this method are 3500 bit, 3500 bit, and 3700 bit, respectively. It can be seen from Table 8 (d) that the maximum shared resources of the first, second and third levels using this method are 4500 bit, 4500 bit and 4500 bit respectively, and their minimum values are also greater than 4000 bit. Thus, it can be proved that the proposed platform for resource sharing has the best sharing effect for the three types of resources. This is mainly because on the basis of hardware design, it adopts Grobeis criterion to preprocess teacher-student interaction data to determine resource center and sharing center, so as to achieve a high degree of integration of teaching resources and thus improve the effect of resource sharing.



(a) Heterogeneous data fusion algorithm based on BP neural network

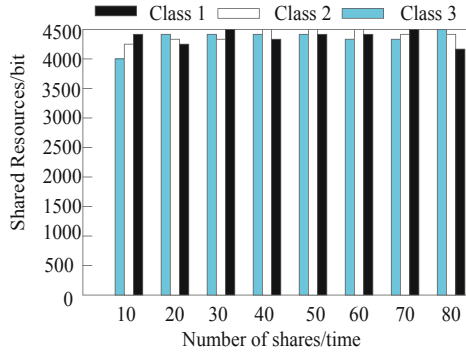


(b) Heterogeneous data sharing algorithm based on twin neural network



(c) Fusion method of privacy protection

Fig. 8. Comparison Results of Shared Resources by Different Methods



(d) Resource sharing platform for classroom behavior analysis

Fig. 8. (continued)

5 Conclusion

The informatization construction of ceramic art teaching resources is an inevitable trend of ceramic art development. The ceramic art teaching resource sharing platform is an important part of ceramic art teaching reform. There are many problems in the traditional resource sharing mode. The ceramic art teaching resource sharing platform designed based on classroom behavior analysis provides technical support. The experiment proves that this research platform can effectively improve the sharing efficiency.

The applied ceramic art teaching resource sharing platform based on classroom behavior analysis has produced positive effects in the application of ceramic modeling design, provided a new development direction for ceramic design teaching, improved the technical content of ceramic design, and strengthened the application of various high-tech.

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