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Research Article

Optimization Method of Art Design Resource Scheduling for 6G Network Environment in Colleges and Universities

Meng Zhou[1] **and Dong Yang**[2]

[1]*Department of Art and Product Design, Yibin University, Yibin 644000, China*
[2]*Department of Law and Public Administration, Yibin University, Yibin 644000, China*

Correspondence should be addressed to Meng Zhou; 2003110001@yibinu.edu.cn

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In order to solve the problem of low flexibility margin of traditional art and design resource scheduling in colleges and universities, an optimization method for art and design resource scheduling in the 6G network environment has been designed. By determining the flexibility margin index of university art and design resource scheduling, the scheduling optimization model is established, the scheduling communication parameters are set for the 6G network environment, the delay of university art and design resource scheduling is perceived, the period of insufficient flexibility is searched, and elimination measures are taken to realize the optimization of university art and design resource scheduling. The experimental results show that the margin of the designed scheduling method is always higher than that of the experimental control group in the same scheduling period, which can solve the problem of low scheduling flexibility margin of traditional methods.

1. Introduction

The curriculum resources of art design specialty include internal resources and external resources. The internal resources mainly refer to the effective combination of classroom subject knowledge and professional skills. External resources mainly refer to the use of extracurricular practical training and practical training resources as supplementary resources for classroom teaching resources. However, with the increasing demand for art and design talents, the problem of resource scheduling in the training of college students is becoming more and more obvious. Coupled with the impact of the network environment, the construction, sharing, and dissemination of curriculum resources are very limited. In order to ensure that students majoring in art and design can accurately obtain teaching resources inside and outside the school, relevant resource scheduling methods have attracted extensive attention of scholars.

The development of mobile communication has the rule of "use generation, construction generation, and R&D generation." At present, although countries have not yet completed 5G deployment, they have already started 6G R&D. 6G will have three advantages: global signal coverage, faster transmission speed and higher intelligent level. The industry generally believes that 6G will go from the ground to the "sky" and integrate the ground wireless facilities with satellite communications to realize ubiquitous mobile communications. At that time, the signal will be seamlessly covered in the ground and air. Whether it is deep mountains, rainforests, deserts, or oceans, the signal can be searched. It is predicted that the theoretical download peak of 6G can reach 1 Tbps, and the network speed will be 500 times of 5G. At the same time, 6G wireless delay will be reduced to less than 100 microseconds, only 1/10 of 5G. In addition, the 6G data transmission speed is 100 GB/s. 6G can narrow the digital divide and further away from the interconnection of all things. 6G will be combined with computing and AI technology to achieve a higher level of intelligence.

In order to meet the requirements of art design resource scheduling in colleges and universities, an art design resource scheduling optimization method for a 6G network environment is proposed. By constructing the art design resource

scheduling model under the 6G network environment, calculating the marginal index of scheduling flexibility and analyzing the delay perception, the optimal scheduling of art design resources is realized, which provides a reference for the effective scheduling of internal and external resources of art design and further optimizes the teaching quality of art design courses.

2. 6G Network Environment

The core of the 6G network environment is 6G technology. 6G is the abbreviation of the sixth generation mobile communication system, which refers to the sixth generation mobile communication technology. It is the extension of 5G system and is in the development stage [1, 2]. Reducing the time delay effect is the goal of communication technology. The change of many communication technologies has brought about a significant increase in speed. The delay limit of 4G is 20 ms, while that of 5G is 1-10 ms. Although the delay is much lower than that of 4G, for some systems, such as driverless and VR/AR systems, the delay of 1-10 ms still does not meet the requirements. The 6G network reduces the delay to nanoseconds and enters the terabit era. Therefore, compared with 5G, the speed of the 6G network is increased by hundreds of times, which is basically close to the requirement of no delay, and achieves the real "online" goal [3]. 6G has a wider coverage. 4G network covers all people, thus forming the "Internet of people". 5G network combines the "Internet of things" with the "Internet of people." 5G seems to have exhausted everything by connecting people and things to the network, but there are still limitations. 6G makes up for the limitations of 5G in the following aspects: first, 5G is limited to the ground network, while 6G connects the ground network and satellites to form a network; second, the 5G network still has network blind areas in the sky, deep sea, desert, forest, and other places, while 6G network solves the coverage problem of these blind areas by combining a series of new technologies with satellites. The network coverage of 6G is wider than that of 5G, so that there is no dead angle in the network and the signal is fully covered. Therefore, this paper combines the advantages of the 6G network environment to optimize the art design resource scheduling in colleges and universities.

3. Establishing the Framework of Art Design Resource Scheduling Optimization in Colleges and Universities

This paper selects the hierarchical scheduling mode as the optimization framework of art design resource scheduling in colleges and universities and takes the demand side resource objectives as the scheduling basis. Two hierarchical structures are established, which are the agent layer for response and the center layer for scheduling. The centralized scheduling method is adopted in the scheduling layer, and the distributed scheduling method is adopted in the response agent layer. The optimization framework of university art design resource scheduling is shown in Figure 1.

As shown in Figure 1, in the university art design resource scheduling center, the hierarchical scheduling framework for the integration of demand side goals and university art design resources from top to bottom is as follows: scheduling center layer, response agent layer, and demand side resource layer. The main functions of each layer in the framework are as follows: the dispatching center layer is used to ensure the safe and stable operation of multiple objectives. Collect the response data information of demand side targets, and supply side targets uploaded by the lower level through the dispatching center [4]. When there is a problem with the dispatching capacity of the dispatching center, the dispatching center shall timely make corresponding demand side response and adjust the demand side objectives according to the change of its communication rate or adjust the demand side objectives by directly sending communication signals. The response agent layer is used to optimize the scheduling of demand side and supply side objectives and communicate with the scheduling center. When the demand side responds, the response agent layer shall timely transfer the guidance of the dispatching center layer to the lower layer. The demand side resource layer is used to store university art and design resources. This layer provides data sources for the dispatching center layer and the response agent layer.

The main operation mode of the scheduling framework can be divided into two parts, which are the uplink of demand side target and supply side target response state and the dispatch instruction of the scheduling center [5, 6]. The specific processes of the two operation modes are as follows:

The former collects information from bottom to top according to the responsiveness information of demand side objectives and supply side objectives [7, 8]. In the collection process, it is necessary to measure and calculate the response capability, response time, and response rate of demand side targets and upload the calculation results to the corresponding agent layer [9]. Then, the response agent layer collects the response capability information of each corresponding demand side target and uploads it to the dispatching center through calculation to complete the uplink operation mode of the response status of demand side target and supply side target.

The latter issues instructions from top to bottom according to the issued response instructions. According to the dispatching center, calculate the response of the demand target, and send the calculation results to each corresponding response agent layer. The response agent layer calculates the response amount under specific conditions according to its own response ability and the constraints of the scheduling center and then sends the scheduling instructions to each demand side target, which executes the scheduling behavior according to the instructions.

4. Optimization Method of Art Design Resource Scheduling for 6G Network Environment in Colleges and Universities

4.1. Determine the Flexibility Margin Index of Art Design Resource Scheduling in Colleges and Universities. Before optimizing the art design resource scheduling of colleges and universities in the 6G network environment, it is necessary to determine the types of art design resources in colleges and universities. See Table 1 for details.

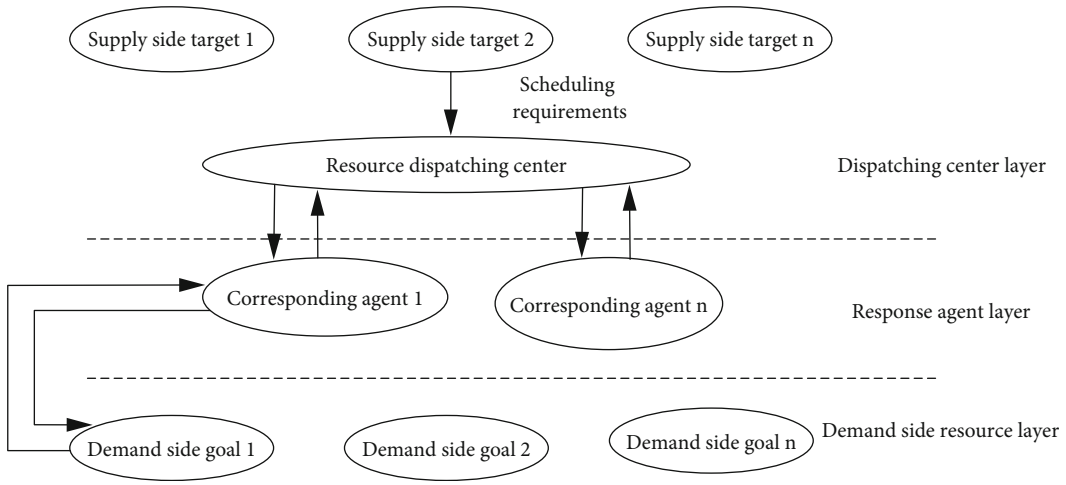

Figure 1: Framework of art design resource scheduling optimization in colleges and universities.

According to Table 1, after determining the types of art design resources in colleges and universities, the demand for flexibility of art design resource scheduling in colleges and universities is calculated [9]. Assuming that the expression is ΔPt^{du}, the calculation formula is as shown in

$$\Delta Pt^{du} = (Ct + 1 - Ct) + \eta uCt + 1 + \eta eCt + 1. \quad (1)$$

In Formula (1), Ct refers to the system cost of t period; $Ct + 1$ refers to the system cost in t period of the next day; ηu refers to the demand of the dispatching center for university art design resources; and ηe refers to the demand of the dispatching center for university art design resources. According to the description of the demand for flexibility of university art and design resource scheduling in Formula (1), the coordination rolling scheduling flexibility margin index is defined as the difference between flexibility supply and flexibility demand [10]. Assuming that the flexibility margin index of art design resource scheduling in colleges and universities is ΔPt^{mu}, the calculation formula is as shown in

$$\Delta Pt^{mu} = C - \Delta Pt^{du}. \quad (2)$$

Through Formula (2), we can determine the flexibility margin index of university art design resource scheduling.

4.2. Establishing the Optimization Model of Art Design Resource Scheduling in Colleges and Universities. According to the resource scheduling flexibility margin index obtained above, the delay aware task scheduling of university art design resources is integrated into the scheduling model. Before establishing the scheduling model, we need to analyze the delay perception task of university art and design resources. In the 6G network environment, due to the high dynamic and random characteristics of user scheduling, the scheduling should be real-time, irregular, and independent. Supposing that the multitarget perception task set is α, the single task in the task set is represented by $\alpha 1$, the arrival time of the task is represented by a, the 6G network length of the task is set as l, and the deadline for task completion is D [11]. Because the arrival time and deadline of multiobjective delay aware tasks can only be obtained after the user publishes the scheduling task and the CPU processing capacity of virtual machine for the 6G network environment is heterogeneous, the calculation equation of α is as shown in

$$\alpha = \frac{\alpha 1}{aD}. \quad (3)$$

Through Formula (3), the multitarget perception task set is obtained. Because the completion of the scheduling task needs to consume a certain amount of network resources, the resource consumption of the host CPU should be considered in the scheduling process. The resources consumed by virtual hosts are divided into idle resources and active resources, and the consumption of active resources is directly proportional to the working frequency. Assuming that the active resource consumed by the scheduling task is Z_1, the calculation formula is as shown in

$$Z_1 = v^2 \times f. \quad (4)$$

In Formula (4), v refers to the voltage of the main engine and f refers to the working frequency of the main engine. Since the voltage of the virtual host CPU is linearly related to the working frequency, the dynamic power H_d of the host is as shown in

$$H_d = Z_1 \propto f^3. \quad (5)$$

Assuming that the ratio of dynamic power consumed by the host to idle power is s, the power consumption H of the host is as shown in

$$H = Z_1 \times y \times f^3. \quad (6)$$

In Formula (6), y refers to the state of the virtual host. When the host is active, $y = 1$. When the host is idle, $y = 0$ [12]. According to the above analysis, the resource model consumed by the virtual host to complete the task set is as shown in

Table 1: Types of university art and design resources.

Serial number	Types of art design resources in colleges and universities	Content
1	Text	Related concepts Related literature Related questions
2	Picture	Related legend Legend analysis Related people
3	Video	Analysis of related courses Relevant case analysis Demonstration of related techniques
4	Courseware	Courseware 1 Courseware 2

$$tec = \int s \times Z_1 \times y \times a \times d. \tag{7}$$

Based on the above task model and resource consumption model, the optimization model of art design resource scheduling in colleges and universities is as shown in

$$\begin{cases} \max \quad T = \sum \dfrac{l}{ad}, \\ \min \quad tec = \sum \int s \times Z_1 \times y \times a \times d. \end{cases} \tag{8}$$

The model considers the completion rate of maximizing the task set and the minimization of resource consumption [13]. Through the scheduling of the model, it provides sufficient resources for the virtual host of the scheduling center and ensures that the scheduling task is completed before the deadline. Combined with the actual demand of art design resource scheduling in colleges and universities, the lower limit of output of the scheduling model is set to 70%.

4.3. Delay Perception of University Art and Design Resource Scheduling in 6G Network Environment. On the basis of establishing the scheduling model, this paper designs a scheduling optimization algorithm with resource delay sensing ability for a 6G network environment to realize the value of the above model. The 6G network environment uses terahertz (THz) band, and the "densification" degree of the 6G network environment will reach an unprecedented level. Because of the high frequency of 6G network environment and the wide range of bandwidth allowed to be allocated, the larger amount of university art and design resources data can be transferred per unit time. In this paper, the 6G network environment is used as the communication parameter of art design resource scheduling in colleges and universities. The specific communication parameters of art design resource scheduling for 6G network environment are shown in Table 2.

Table 2: Communication parameters of art design resource scheduling in the 6G network environment.

Serial number	Communication parameters of 6G network environment	Communication range
(1)	Communication speed: 20 Gbit/s	{0, 1}
(2)	Communication speed: 10 Gbps	{0, 1}
(3)	User experience rate: 100 Mbps	{0, 1}
(4)	Peak rate: 1G bps	{0, 1}

As shown in Table 2, it is the basic parameter of communication in the process of art design resource scheduling. The delay perception of university art design resource scheduling for the 6G network environment design is composed of two constraints, as shown in

$$\begin{cases} r_x \geq t_x, \quad x \in cpu, \\ scheduleTask \leq t. \end{cases} \tag{9}$$

In Formula (9), r refers to the number of virtual hosts in the dispatching center and *scheduleTask* is the scheduling function. Algorithm 1 means that in the scheduling center, the resource available of virtual host is less than the resource demand of scheduling task. Algorithm 2 indicates that if the university art design resources are scheduled on a virtual host, the scheduling function is used to ensure that the task is completed before the deadline [14, 15]. In the university art design resource scheduling optimization algorithm, all the scheduling tasks are waiting in the rolling window RH; until the task starts to execute, it is transferred from the rolling window RH to the virtual host. When the system receives the new university art design resources, the algorithm will reschedule the unexecuted and new arrived tasks in the rolling window; the implementation process of the algorithm is shown in Algorithm 1.

In Algorithm 1, when a new task arrives in the system, the scroll window will delete all the art design resource scheduling schemes of colleges and universities and immediately update the virtual host ready time and running status and schedule the new art design resources of colleges and universities to the virtual host with enough available resources to schedule tasks and form a new art design resource scheduling scheme of colleges and universities [16]. When the university art and design resources arrive at the virtual host, Algorithm 2 is executed, and the execution process is shown in Algorithm 2.

Through the implementation of Algorithms 1 and 2, under the constraint of delay perception in Formula (9), the university art and design resources are reasonably scheduled to the virtual host in the system, improve the resource scheduling efficiency according to different execution processes, and realize the optimization of university art and the scheduling of design resources.

Input: real time task set t;
Output: mapping between each task and virtual host, mapping between virtual host and physical host;
① RH; /∗ Scroll through the task set t ∗ /;
② When the new task T1 ∈ t reaches do;
③ Delete the mapping relationship between waiting task and virtual host in RH, and update the ready time of virtual host;
④ Task T1 is added to RH;
⑤ All tasks in RH are sorted by non decreasing deadline;
⑥ For task T1 belongs to RH do;
⑦end for;
⑧end whilr。

Algorithm 1: Execution process of the algorithm.

Function scheduletask
Input: task T, available virtual host set;
Output: mapping between task T and virtual host;
① The resource status of virtual host is calculated;
② Task t is assigned to a virtual host with sufficient resources and no tasks to be executed;
③ Arrival time of task t on virtual machine
④ Else / ∗ task completion scheduling results∗/
⑤ end if

Algorithm 2: Execution process of the algorithm.

4.4. Realizing the Optimization of Art Design Resource Scheduling in Colleges and Universities. Using the delay perception of university art design resource scheduling, the specific implementation strategy can be implemented according to the response characteristics of demand side target and the matching characteristics of supply side target on time scale. The time period of art design resource scheduling in colleges and universities is divided into the day before, day in 2 hours, and day in 30 minutes [17, 18]. The daily scheduling is performed once every 24 hours, which is used to predict the demand of the demand side target and the supply side target in the dispatching center and adjust the demand side target according to the prediction results. The daily 2-hour scheduling is executed every 2 hours. The scheduling center forecasts the supply side target every 2 hours and adjusts the demand side target according to the result; The midday 30 minute scheduling is executed every 30 minutes. The scheduling center forecasts the demand side target every 30 minutes and adjusts the demand side target according to the prediction results. According to the art design resource scheduling strategy of colleges and universities, on the basis of ensuring the smooth operation of the scheduling center, the objective function of the day ahead 24-hour scheduling optimization is set as shown in

$$W1 = \sum \left[\gamma 1(s) \cdot \omega 1(s) + \sum \left(\gamma 1'(s) \cdot \omega 1'(s) \right) \right]. \quad (10)$$

In Formula (10), $\gamma 1(s)$ refers to the execution time of a target schedule in the previous s period; $\omega 1(s)$ refers to the length of the target in the s period before the day; $\gamma 1'(s)$ refers to the communication time between multiple targets in the s period before the day; $\omega 1'(s)$ refers to the response adjustment power of the dispatching center in the s period before the day. The constraints of the day ahead 24-hour dispatching are to ensure the normal power operation of the dispatching center and to adjust the quantity constraints. The optimization function of day to day scheduling is set as shown in

$$\min W2 = \sum \left[\gamma 2(s) \cdot \omega 2(s) + \sum \left(\gamma 2'(s) \cdot \omega 2'(s) \right) \right]. \quad (11)$$

In Formula (11), $W2$ refers to the total scheduling input cost under demand side target response; $\gamma 2(s)$ refers to the minimum value of total resource consumption in s period of the day; $\omega 2(s)$ refers to the total power of the dispatching center in s period between Japan and China; $\gamma 2'(s)$ refers to the response funds paid by the dispatching center to the agent during the s period between Japan and China; $\omega 2'(s)$ refers to the agent's response adjustment power during the s period of the day. The constraints of the day ahead 24-hour scheduling are as follows: the scheduling of art design resources in colleges and universities is limited by the characteristics of the load itself. After obtaining the art design resource scheduling model, the model is solved. Due to the large scale of the model, this paper divides the model into two scheduling layers: up and down. The flexibility margin is associated between the scheduling layers. Through problem decomposition, the model is transformed into multiple asynchronous long problems to simplify constraints. The optimization method is used for basic

Table 3: Experimental environment settings.

Parameter	Explain	Setting up
NCmax	Maximum iterations of task	200
Kerthe	Task scheduler	2
Number of host resources	Number of virtual host resources	860
Task consumption resources	Task resource consumption	30
Host geographic distance	Physical host geographic distance	20
Host update frequency	Host update constant	0.2
Network weight coefficient	Network weight coefficient	0.3

optimization, and the flexibility margin is updated in time [19, 20]. Based on the initial solution of the model, the art design resource scheduling particles that do not meet the constraints are modified to make them meet the constraints as much as possible. If the flexibility constraint is still not satisfactory when iterating to the last generation, we can search for the period of insufficient flexibility through the art design resource scheduling optimization algorithm in colleges and universities and take elimination measures, so as to realize the art design resource scheduling in colleges and universities. So far, we have completed the design of art design resource scheduling optimization method for the 6G network environment.

5. Experiment

5.1. Experimental Preparation. This case study selects a pilot university to study the art design major in the university. The university art design resources used in this experiment are all provided by the pilot universities, and their contents, functions, and teaching methods are evaluated by the professional review and appraisal team. The applicability, academic leadership, etc. are reviewed to confirm that they can be put into use. In this experiment, hardware facilities include the following: TYR3583589 host computer and CPUE5500 @ 2.80 GHz. The software environment is Twerfag operating system and YRjkle integrated development environment. The specific contents and parameters of the experimental environment are shown in Table 3.

According to Table 3, the scheduling cycle is set to 10 hours, and each hour is used as the test node. The traditional scheduling method and the scheduling method designed in this paper are used for comparative experiments. The experimental content is to test the scheduling flexibility margin of the two scheduling methods. The higher the scheduling flexibility margin is, the better the scheduling flexibility of the scheduling method is. The experimental results are recorded to judge the more flexible scheduling method.

5.2. Analysis and Conclusion of Experimental Results. Within 10 hours of the scheduling cycle, according to the calculation results of the flexibility margin index in Formula (2), the scheduling flexibility margin experimental results of the original art design resource scheduling method (control group) and the design method in this paper (experimental group) in colleges and universities are obtained, and the experimental results are sorted, as shown in Figure 2.

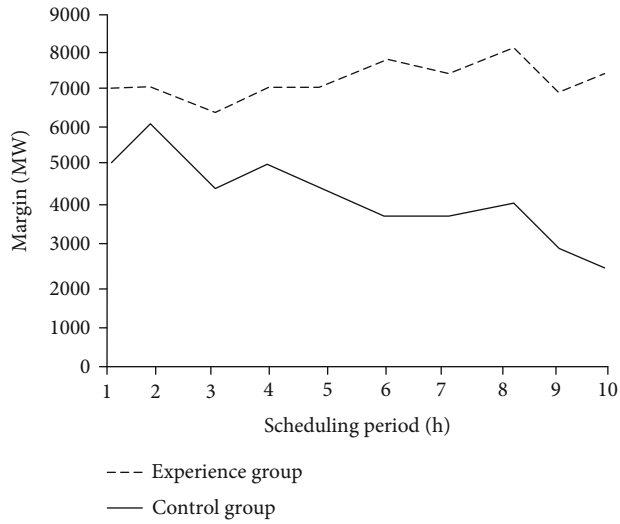

Figure 2: Comparison of dispatching flexibility margin.

The following conclusions can be drawn from Figure 2: the scheduling flexibility margin of the scheduling method designed in this paper is higher than 6300 mw, which is more flexible than the scheduling of control group, and can realize the optimization of art design resource scheduling in colleges and universities, which shows that the function of the scheduling method designed in this paper can meet the design requirements. The main reason is that this method considers the high dynamic and random characteristics of user scheduling in 6G network environment and reduces the impact of real-time, irregular, and independent characteristics of scheduling on scheduling flexibility.

In order to further verify the overall effectiveness of the proposed method, the art design resource scheduling time of the two methods is compared, and the test results are shown in Figure 3.

By analyzing Figure 3, it can be seen that the time required to schedule the art design using the proposed method in multiple iterations is less than that required by the control group, because the 6G network environment of the proposed method expands the coverage, shortens the time required for task scheduling, and improves the scheduling efficiency of the proposed method.

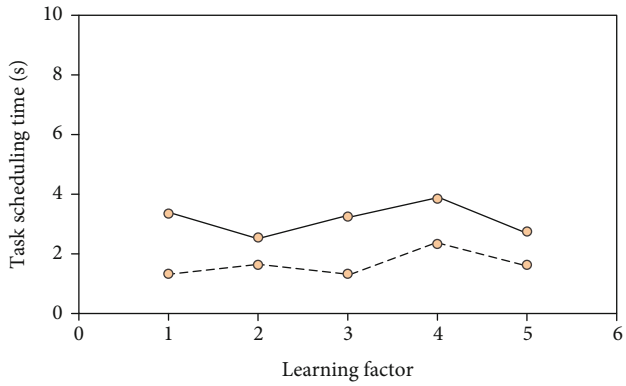

Figure 3: Task scheduling time.

6. Conclusions

Through the above research, it is proved that the design scheduling method has specific advantages in the scheduling of art design resources in colleges and universities. The art design resource scheduling method under the 6G network environment is the most practical and reliable means in art design resource scheduling in colleges and universities. It is reasonable to increase the application of design scheduling method in art design resource scheduling in colleges and universities. The experimental results show that this method takes design scheduling as the core, improves the scheduling flexibility margin, up to 6300 mw, and provides academic significance for the research in the field of art design resource scheduling in colleges and universities. The only deficiency of this paper is that there is no in-depth analysis of the genetic operator in the university art and design resource scheduling. I believe this can also be used as one of the future research directions in the university art and design resource scheduling. Hoping that through this study, we can contribute to the art design resource scheduling in colleges and universities.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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