International Journal for Housing Science and Its Applications
Publish August 10, 2025. Volume 46, Issue 4 Pages 4359-4367

https://doi.org/10.70517/ijhsa464282

Research on Teaching Management Mode Based on Dynamic Planning Algorithm under Intelligent Allocation of Educational Resources in Big Data Era

Shige Ren[1,*]
[1] College of Art and Media, Chongqing Metropolitan College of Science and Technology, Chongqing, 401320, China
Corresponding authors: (e-mail: xxiguaner@163.com).

Abstract This paper proposes a hierarchical co-construction mechanism and a digital resource sharing management framework, and realizes the integration and dynamic scheduling of educational resources in various regions with the help of cloud computing platform. Aiming at the uncertainty and multi-objective conflict problem of resource allocation, Fuzzy Interval Linear Programming (FILP) and Chance Constrained Programming (CCP) are introduced to deal with parameter ambiguity and constraint probability relaxation. Playing the key role of dynamic programming (DP), the problem of educational resource allocation is decomposed into a recursive optimization process through multi-stage decision-making models and state transfer equations, so as to realize intelligent allocation that maximizes the overall benefits. Relying on the cloud computing platform to count the status quo of educational resource allocation in higher education institutions, the model in this paper is utilized to practice dynamic resource allocation. The results show that in the dynamic allocation of educational resources in 2 categories of teachers and funding, the satisfaction degree of vocational higher education institutions is 81.82% and 81.67% respectively, and the satisfaction degree of general higher education institutions is 83.33% and 86.00% respectively. The accuracy of this paper's model is greater than or equal to 90% in 6 times of the resource allocation test, and the running time is no more than 30s.

Index Terms fuzzy interval linear programming, opportunity constrained programming, dynamic programming algorithms, multi-stage decision making, educational resource allocation

I. Introduction

Currently, various countries and regions of the world are facing the problem of educational resource allocation [1]. Educational resources refers to the general term for all resources such as facilities, equipment, tools, human resources, financial resources and information resources that serve for teaching, including schools, teachers, students, teaching materials, teaching equipment, networks and other information resources [2]-[4]. These resources play an indispensable role in improving teaching effect, promoting students' development, improving teaching environment and optimizing teaching quality [5], [6]. And the optimal allocation of educational resources can improve the quality of teaching, promote the balanced development of education, improve the economic efficiency of education, and then promote the progress and development of society [7], [8]. With the continuous progress of science and technology, especially the wide application of digital technology, artificial intelligence and big data, the way of obtaining, distributing and using educational resources is undergoing profound changes [9]-[11]. Intelligent teaching resource allocation can effectively enhance the utilization efficiency of educational resources, alleviate the problem of educational equity, and promote the inclusive and intelligent development of education [12], [13].

In this context, teaching management has subsequently become a subject of widespread concern. Teaching management is an important part of intelligent teaching in education, and the application of big data technology can make teaching management more scientific and efficient [14]. By integrating and analyzing the data of teaching resources, teachers and students, it can help schools to make scientific education development strategies [15], [16]. At the same time, big data can also help schools carry out educational assessment and quality monitoring, timely identify and solve problems, and improve the teaching management level and comprehensive competitiveness of schools [17], [18].

Realizing intelligent and efficient allocation of educational resources helps to meet the complex and changing dynamic management needs. This paper integrates cloud computing technology and dynamic planning algorithms to construct a dynamic planning resource allocation model. Fuzzy interval linear planning and opportunity constraint planning methods are introduced to enhance the credibility of the allocation results. The dynamic planning algorithm is the core to maximize the allocation benefits. Through the practice of educational resource allocation in higher education institutions, the application advantages and value of this paper's intelligent configuration model are verified.

II. Modeling and methodological research on intelligent allocation of educational resources

This chapter is based on the dynamic planning algorithm, combined with cloud computing technology, to construct the model and method system of optimal allocation of educational resources.

II. A. Mechanism for Optimizing the Allocation of Digital Educational Resources in Cloud Computing

The management of digital educational resources allocation in schools based on cloud computing is a systematic and engineering work, which should be carried out with reference to the following links.

II. A. 1) Stratified co-construction mechanism

Construction of regional and cross-regional cloud service centers, each school is responsible for the construction of regional cloud service centers, presenting transparent technical interfaces to the outside world in the form of a private cloud, and together with other regional cloud service centers, forming a cross-regional cloud technology center, ultimately integrating a portion of the school's digital education public resource cloud.

II. A. 2) Construction of the digital development environment

The regional cloud service center should be able to provide builders with a rapid and effective development, deployment and communication environment, including digital resource standard specification management services, resource construction log services, personalized communication management services, data mining and analysis services, resource push services and client-side collaborative development tools.

II. A. 3) Mechanisms for managing the sharing of digital resources

Cloud computing-based digital educational resource platform often contains huge digital resources, so it is extremely important to establish a scientific and effective resource monitoring, evaluation and incentive mechanism, which should be able to control the content and copyright of various educational resources by a third party, assess the effectiveness of the use of educational resources using the evaluation system indicators, and promote the further improvement of the quality of the construction of digital educational resources through incentives based on the evaluation results. Improvement of the quality of the construction of digital educational resources through incentives based on the evaluation results.

II. B. Modeling Ideas

II. B. 1) Fuzzy Interval Linear Programming (FILP)

In order to solve the uncertainty of the model parameters and the non-uniformity between the multi-objective planning objective functions, the uncertainty factor expressed in the number of intervals is handled by introducing a fuzzy interval linear programming model, and the affiliation function λ is introduced to harmonize the conflict between the multi-objective functions. The model is summarized as follows:

Objective function:

$$Max\lambda^{\pm} \tag{1}$$

Constraints:

$$C_g^{\pm}X^{\pm} \geq f_g^{-} + \lambda^{\pm}\left(f_g^{+} - f_g^{-}\right) \quad g = 1,2,\cdots,m \tag{2}$$

$$C_h^{\pm}X^{\pm} \leq f_h^{+} - \lambda^{\pm}\left(f_h^{+} - f_h^{-}\right) \quad h = m+1,\cdots,n \tag{3}$$

$$A_i^{\pm}X^{\pm} \leq B_i^{\pm} \quad i = 1,2,\cdots,k \tag{4}$$

$$X^{\pm} \geq 0 \tag{5}$$

$$0 \leq \lambda^{\pm} \leq 1 \tag{6}$$

Among them:

$$C_g^{\pm}X^{\pm} = Maxf_g^{\pm} \quad g = 1,2,\cdots,m \tag{7}$$

$$C_h^{\pm} X^{\pm} = M \inf_h^{\pm} \quad h = m+1, \cdots, n \tag{8}$$

where $C_g^{\pm} \in \{R_1^s\}^{l\times t}$, $C_h^{\pm} \in \{R_2^s\}^{l\times t}$, $A_i^{\pm} \in \{R_3^s\}^{l\times t}$, $X^{\pm} \in \{R_4^s\}^{l\times t}$, R_e^s denotes a series of intervals $\left(e \in [1,2,3,4]\right)$, f^-, f^+ are the lower and upper bounds of $f^{\pm}$ respectively, $\lambda^{\pm}$ is the affiliation function in fuzzy decision making. The larger $\lambda^{\pm}$ is, the more reliable the calculation result is; on the contrary, the smaller $\lambda^{\pm}$ is, the less credible the calculation result is.

II. B. 2) Constrained Chance Planning (CCP)

In the planning and allocation of resources, there is a certain probability that the constraints cannot be satisfied because the data obtained from the prediction may have some deviation from the actual data. In this case, the introduction of opportunity constraint planning, allowing the decision can be made to a certain extent does not meet the constraints, that is, in a certain probabilistic sense to achieve the optimal, so that the solution results are reasonable and credible. The planning model is shown below:

Objective function:

$$Max\overline{g} \tag{9}$$

Constraints:

$$\Pr\left\{g(x) \ge \overline{g}\right\} \ge \beta \tag{10}$$

where x is an n-dimensional decision variable, $\Pr(\cdot)$ is the probability that the event holds, and $\overline{g}$ is the minimum value of the objective function $g(x)$ taken at a confidence level of at least β.

II. B. 3) Dynamic Programming (DP)

Dynamic planning organically combines current and future stage gains on the basis of separating the current stage from the future stage. Thus, the choice of the best decision for each stage comes from the overall consideration. Specifically, for a multi-stage decision-making problem, dynamic programming can be divided into several stages based on time or other characteristics, and each stage has several states and decision strategies. The system moves from one stage to the next according to some rule with the aim of obtaining the best strategy for each stage combination. Equation (11) is the state transfer equation of dynamic programming and is the most important component of dynamic programming.

$$S_j = T\left(S_{j-1}, x_{j-1}, j-1\right) \quad j = 1, 2, \cdots, l \tag{11}$$

where S_j denotes the state at stage j and there are l stages; x_j denotes the decision variable at stage j; and the function $T\left(S_{j-1}, x_{j-1}, j-1\right)$ is the transfer function.

II. B. 4) Common equations for dynamic programming

Solving a K-stage optimization problem with dynamic programming, the set of strategies U obtained from the search can be denoted as:

$$\left\{u(x_1), u(x_2), \cdots, u(x_N)\right\} \in U \tag{12}$$

where $u(x_n)$ denotes the policy for the nth state:

$$u(x_n) = \left\{u_1(x_n), u_2(x_n), \cdots, u_K(x_n)\right\} \tag{13}$$

where $u_k(x_n)$ denotes the set of decisions of the nth state at the kth stage.

Dynamic programming relies on the value function to evaluate the merits of a strategy and thus search and select the optimal solution to the whole problem. The value function $I_k\left(x_n; u_1, u_2, \cdots, u_k\right)$ of a strategy for the nth state at the kth stage can be expressed as:

$$I_k\left(x_n; u_1, u_2, \cdots, u_k\right) = \sum_{i=1}^{k} w_i\left(x_{nk}, y_{nk}\right) \tag{14}$$

where (x_{nk}, y_{nk}) denotes the coordinates of the decision made in this state at the kth stage, and $w_i(x_{nk}, y_{nk})$ denotes the evaluated value of the coordinates of the ith stage as (x_{nk}, y_{nk}), and different ways of constructing the value function affect the size of the value.

When solving a specific problem, dynamic programming optimizes the solution by finding the strategy that maximizes the value function:

$$f_k(x_n) = \max_{\{u_1, u_2, \cdots, u_k\}} I(x_n; u_1, u_2, \cdots, u_k) \tag{15}$$

where $f_k(x_n)$ denotes the maximum function of the nth state at the kth stage, according to the principle of optimization, the above equation is deformed as:

$$\begin{aligned} f_k(x_n) &= \max_{\{u_1, u_2, \cdots, u_k\}} \left[I_k(x_n) \right] \\ &= \max_{\{u_1, u_2, \cdots, u_k\}} \left[\sum_{i=1}^{k} w_i(x_{nk}, y_{nk}) \right] \\ &= \max_{\{u_1, u_2, \cdots, u_k\}} \left[w_k(x_{nk}, y_{nk}) + \max_{\{u_1, u_2, \cdots, u_{k-1}\}} \sum_{i=1}^{k-1} w_i(x_{n(k-1)}, y_{n(k-1)}) \right] \\ &= \max_{\{u_1, u_2, \cdots, u_k\}} \left[w_k(x_{nk}, y_{nk}) + \max_{\{u_1, u_2, \cdots, u_{k-1}\}} \left[I_{k-1}(x_n) \right] \right] \\ &= \max_{\{u_1, u_2, \cdots, u_k\}} \left[w_k(x_n, y_n) + f_{k-1}(x_n) \right] \end{aligned} \tag{16}$$

From the above equation for the nth state of K stages there are:

$$\begin{cases} I_1(x_n) = f_1(x_n) = w_1(x_n, y_n) \\ I_{k,k=1,2,\cdots,K} = w_k(x_n, y_n) + \max_{\{u_1, u_2, \cdots, u_{k-1}\}} \left[I_{k-1}(x_n) \right] \end{cases} \tag{17}$$

The above equation is the basic recursive solution formula for the dynamic programming algorithm.

III. Practice of allocating educational resources based on dynamic planning algorithms

This chapter takes the educational resource allocation of higher education institutions in a specific region as an example, applies the constructed model for dynamic planning and resource allocation practice, and analyzes the practical effects of the model and methods in this paper.

III. A. Status of education resource allocation

Human resources play a key role in the whole process of education management and are the most valuable and central resources. The allocation and use of material and financial resources are all for the service of human resources, and at the same time, human resources are also needed to maximize their advantages to achieve the purpose of “making the best use of talents and materials”.A city is a second-tier city in a large education province, with a number of general colleges and vocational colleges and universities. However, due to the limitation of the city's development level, there are obvious deficiencies in the allocation of educational resources in the relevant higher education institutions. This paper takes the resource allocation in the education management process of higher education institutions in City A as an example to verify the effect of the constructed model in the optimization of resource allocation.

III. A. 1) Current status of human resources allocation

Table 1 shows the current situation of human resource allocation in higher education institutions in City A. It includes the analysis of the student-teacher ratio, the analysis of the academic structure of teachers and the analysis of the structure of teachers' titles in higher education institutions in City A. It provides a comprehensive understanding of the current human resource allocation in the process of higher education management in the city.

Student-teacher ratio refers to the ratio of the number of enrolled students to the number of full-time teachers in the school. Since teachers occupy an important position in schools, and the quantity and quality of school teachers are the key factors related to school development, teaching management, and students' learning, the analysis of student-teacher ratio is an important indicator to measure whether the level of school operation is qualified or not. In order to prevent the phenomenon of waste of resources and give full play to the value of resources, China stipulates that the student-teacher ratio in institutions of higher education is 22:1. As can be seen from Table 1, with the support of national policies and the efforts of local education departments, the student-teacher ratio in institutions of higher education has been decreasing year by year. Among them, the student-teacher ratio of vocational institutions of higher education decreases to 24.18:1 in 2024, and the student-teacher ratio of general institutions of higher education decreases to 23.66:1 in 2024.However, due to the imperfections in the teaching force still existed because of the large population base and the relative stagnation of economic development of City A, the student-teacher ratio is still at about 24:1 or 23:1, which is higher than the nationally stipulated student-teacher ratio of 22:1, indicating that City A has not introduced the number of teachers, and the number of teachers is still at the same level. It shows that there is still a lot of room for development in City A in terms of introducing the number of teachers and allocating teacher resources.

Teachers are important educational resources and the core to realize the optimal allocation of educational resources. Reasonable allocation of teachers' resources, upgrading teachers' academic level and improving teachers' teaching level are the key links to achieve the goal of developing the country through education. In the whole link, the most direct and effective way is to help and require teachers to improve their academic level, because the improvement of academic qualifications also represents the improvement of the knowledge structure, and only teachers with high academic qualifications can transfer more knowledge to students and help them learn and progress. Therefore, to study the intelligent allocation of educational resources in institutions of higher education, it is necessary to pay attention to the analysis and study of the academic structure of teachers. In recent years, City A, in accordance with national requirements, encourages in-service teachers to upgrade their academic qualifications, and upgrades the academic level of in-service veteran teachers through specialization, on-the-job examinations, and overseas study; at the same time, for new teachers, it raises the recruitment requirement that they must have full-time postgraduate education or above. Analyzing Table 1, although in recent years City A attaches importance to the assessment of the academic level of in-service teachers and newly recruited teachers, and the number of higher education institutions with bachelor's degree or above is climbing year by year, there still exists the phenomenon of teachers with low academic qualifications. Among them, the proportion of undergraduate teachers in vocational institutions of higher education in 2024 will be only 79%, and the proportion of undergraduate teachers in general institutions of higher education in 2024 will be 92%, and both types of institutions have not reached the level of full coverage of undergraduate education and above stipulated by the state, which indicates that City A needs to continue to continue to make efforts in the level of teacher selection.

The title is a kind of evaluation standard for the teaching level of teachers, which is not only expressed in the level of education, knowledge and professional ability, but also in the performance results and ideological and moral aspects. Therefore, the level of the title represents the comprehensive level of teachers to a certain extent. To study the problem of intelligent allocation of educational resources in higher education institutions in City A, it is necessary to make a comparative analysis of the current structure of teachers' titles between general higher education institutions and vocational higher education institutions to understand the difference between general higher education institutions and vocational higher education institutions. Table 1 shows that the ratio of 4 types of titles in vocational higher education institutions is 1:1.5:3.5:4, and the ratio of 4 types of titles in general higher education institutions is 1:4:3:2, and the proportion of teachers with the title of associate professor or above in vocational higher education institutions is much lower than that in general higher education institutions, which indicates that there is still a big gap between the structure of teachers' titles in general and vocational higher education institutions in City A, and the requirement of balanced development of higher education has not yet been reached. This shows that there is still a big gap between the titles of teachers in general higher education institutions and vocational higher education institutions in City A, which has not yet reached the requirement of balanced development of higher education.

Table 1: Human resources allocation of colleges and universities in A city

Human resource index	School type	2020	2021	2022	2023	2024
Student-teacher ratio	Vocational colleges and universities	24.54:1	24.77:1	24.67:1	24.35:1	24.18:1
	Institutions of higher learning	23.37:1	23.56:1	23.85:1	23.77:1	23.66:1
Teacher education structure (Ratio of teachers with bachelor degree or above) (%)	Vocational colleges and universities	71%	72%	74%	77%	79%
	Institutions of higher learning	84%	88%	89%	90%	92%
Teacher title structure	Vocational colleges and universities	1:1:2:6	1:1:3:5	1:1:3:5	1:1.5:2.5:5	1:1.5:3.5:4

(Professor title: Associate Professor title: Lecturer title: Assistant professor title)	Institutions of higher learning	1:3:2:4	1:3:2:4	1:3:3:3	1:3:3:3	1:4:3:2

III. A. 2) Status of material resource allocation

In accordance with provincial standards, in principle, vocational institutions of higher education shall enroll no more than 40 students per class, general institutions of higher education shall enroll no more than 35 students per class, and the enrollment class size of schools with a large number of students shall not exceed 50 students. Table 2 city A city 2024 higher education institutions average size and average class size comparison. Table 2 reveals that City A still has some problems in controlling class size. In vocational higher education institutions, the average class size reaches 55-58 students; in general higher education institutions, the average class size reaches 47-49 students. The average class sizes of both types of institutions miss the provincial standard, indicating that City A still has a large number of students and few schools, and a lack of and irrational distribution of educational resources, requiring a more rational allocation of resources.

Table 2: Comparison of average class size and average class size

School type	Average school size		Average class size
	Number of schools	Average number of students in a school	Average number of students in a class
Vocational colleges and universities	9	10000	55-58
Institutions of higher learning	6	9870	47-49

III. A. 3) Status of financial resource allocation

Figure 1 shows the investment in education in City A from 2020 to 2024. Combined with Figure 1, it can be seen that the total investment in education in City A in the past five years has gradually increased from 780 million yuan in 2020 to 930 million yuan in 2024, showing a trend of steady growth, indicating that the city is continuously increasing its investment in education. In particular, the investment in general institutions of higher education has gradually increased from 470 million yuan to 570 million yuan, showing stable growth. However, the investment in vocational higher education institutions only increased from 310 million yuan to 360 million yuan, which is relatively stable without much change every year. This shows that although the total investment in education in City A is increasing year by year, the allocation of financial resources between the two types of institutions of higher education is not balanced, showing the pattern of emphasizing general institutions of higher education and neglecting vocational institutions of higher education, which requires the optimal allocation of financial resources.

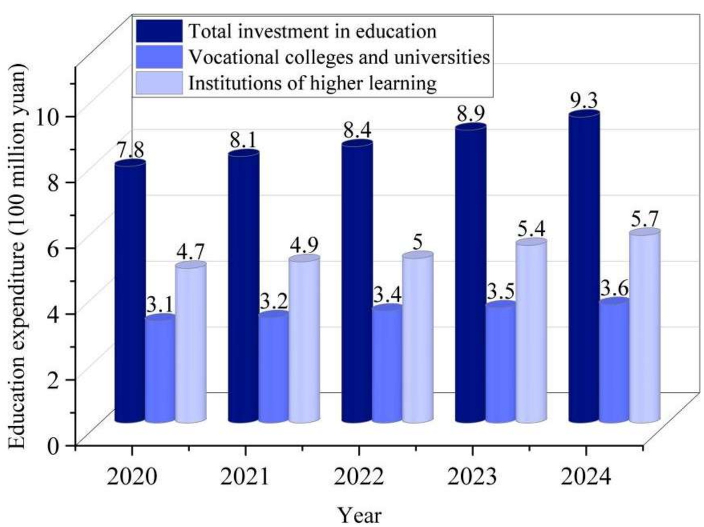

Figure 1: Education investment in City A from 2020 to 2024

III. B. Allocation of Educational Resources to Different Schools

Aiming at the problems existing in the status quo of educational resource allocation in A city, taking into account the economic development of each region of A city and the level of education, the model of this paper is used to carry out dynamic planning for the existing educational resources in A city, and the intelligent allocation of teacher resources and the intelligent allocation of financial resources for the 2 types of schools are carried out according to the results of the planning. Table 3 shows the results of intelligent allocation of educational resources. Observing Table 3, it can be found that after the dynamic planning and intelligent allocation of the existing resources using the model of this paper, the satisfaction degree of teacher resources of vocational institutions of higher education reaches 81.82%, and the satisfaction degree of financial resources reaches 81.67%; the satisfaction degree of teacher resources of general institutions of higher education reaches 83.33%, and the satisfaction degree of financial resources reaches 86.00%. After dynamic planning and intelligent allocation, the teachers' resources and financial resources of the two types of schools in City A show a relatively balanced allocation status quo, and the satisfaction degree of all resources reaches more than 80%, which is in line with the development needs of institutions of higher education.

Table 3: Results of intelligent allocation of educational resources

Resource allocation object	Total demand		Allocation quantity		Missing quantity		Satisfaction degree (%)	
	Teachers	Fund input (10^8 yuan)	Teachers	Fund input (10^8 yuan)	Teachers	Fund input (10^8 yuan)	Teachers	Fund input (10^8 yuan)
Vocational colleges and universities	550	6	450	4.9	100	1.1	81.82	81.67
Institutions of higher learning	450	5	375	4.3	75	0.7	83.33	86.00

The dynamic planning and intelligent configuration process of this paper's model for the two types of educational resources in one year is shown in quarterly time units. For the convenience of observing the configuration process, the overall dynamic planning and intelligent configuration process of this paper's model is plotted separately according to 2 types of schools. Figure 2 is the configuration process of vocational higher education institutions. Figure 3 is the configuration process of general higher education institutions. From the changes in resource allocation in Fig. 2 and Fig. 3, it can be found that this paper's model takes into account the resource requirements of different institutions when performing dynamic planning and resource allocation. For example, in the teacher resource allocation of vocational higher education institutions, due to the large teacher shortage, which reaches about 550 teachers, a teacher resource quantity of 150 teachers is arranged between the 1st quarter and the 2nd quarter. Meanwhile, since the teacher shortage in general higher education institutions is only about 450 teachers, the teacher demand is not as urgent as that in vocational higher education institutions, so only 93 people are scheduled for resource increment. Analyzing the funding resources, it can also be seen that the funding allocation for general higher education institutions is relatively smooth, showing a gradual increase of 110 million dollars; while the funding allocation for vocational higher education institutions is more volatile. It shows that the dynamic planning and intelligent allocation of educational resources using the model in this paper is in line with the actual situation of various types of institutions of higher education.

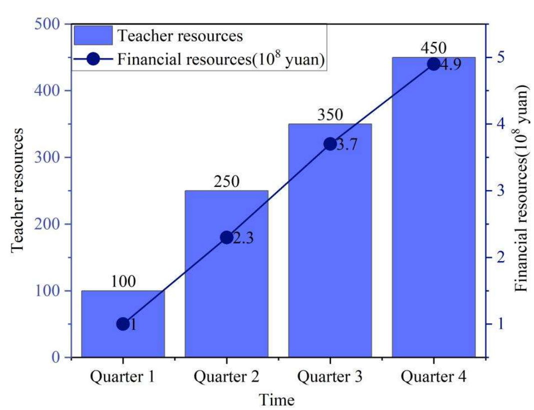

Figure 2: Configuration process of vocational colleges and universities

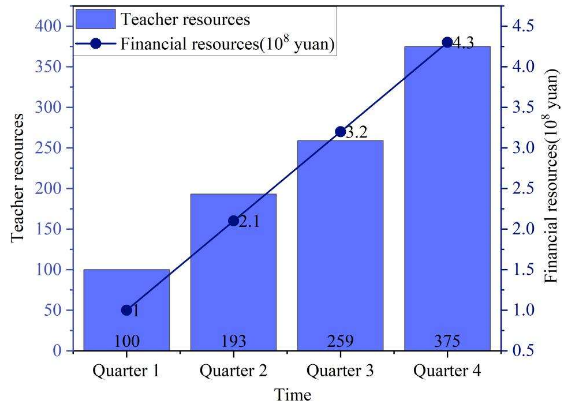

Figure 3: Configuration process of common institutions of higher learning

III. C. Comparison of dynamic planning-based resource allocation methods

In order to further determine the performance advantages of dynamic planning based resource allocation in this paper, the same type of multi-objective planning resource allocation method is selected as a comparison method for resource allocation accuracy and runtime based comparison. Table 4 shows the comparison results. In six tests, the accuracy of educational resource allocation based on dynamic planning algorithm in this paper is always kept at 90% and above, and the running time is not more than 30 seconds. In contrast, the accuracy of the comparison method decreases from 90% to 80% as the number of resource allocation times increases, and the running time increases from 30s to 48 seconds. The comparative analysis shows that this paper's educational resource method based on dynamic programming algorithm has higher accuracy rate of resource allocation and more stable and faster running performance. Resource allocation using the method of this paper can ensure that the needs of teaching management are met.

Table 4: Comparison results

Resource allocation times	Multi-objective planning resource allocation method		Dynamic planning resource allocation method	
	Accuracy (%)	Time spent (s)	Accuracy (%)	Time spent (s)
1	90	30	93	23
2	89	35	93	24
3	86	38	92	25
4	85	41	92	26
5	84	46	91	28
6	80	48	90	30

IV. Conclusion

This paper combines dynamic planning algorithm and cloud computing technology to realize intelligent allocation of resources in the process of education management. In the practice of dynamic allocation of educational resources, the satisfaction degree of teachers and financial resources of vocational higher education institutions and general higher education institutions exceeds 80%. And the model of this paper has a stable accuracy rate higher than 90% in six tests, and the running time is controlled within 30 seconds, which is better than the comparison method. The effectiveness of dynamic programming algorithms for resource allocation in education management is verified. In the future, the dynamic compensation mechanism of cross-regional resource linkage can be explored to improve the effectiveness of resource allocation in complex educational management scenarios.

Funding

This work was supported by Practical Research on the Construction of AI-generated Content and Image Processing Algorithms in Digital Exhibition Halls in the Context of Educational Reform.

References

[1] Fu, W., & Hashim, A. T. B. M. (2024). Researc h on the relationship between urban and rural educational resources allocation an d educational equity. In International Educatio n Forum (Vol. 2, No. 8, pp. 39-45).

[2] Chao, W. A. N. G., & Ke, X. U. (2025). A Study on the Integration Strategy of Intangible Cultural Heritage Resources and the Integration of Industry and Education Mode in Universities: Taking" Heqing Silver Forging Technique" as an Example. Journal of Gems & Gemmology, 27(1), 86-93.

[3] Navio-Marco, J., Ruiz-Gómez, L. M., Arguedas-Sanz, R., & López-Martín, C. (2024). The student as a prosumer of educational audio–visual resources: a higher education hybrid learning experience. Interactive Learning Environments, 32(2), 463-480.

[4] Berti, M. (2018). Open educational resources in higher education. Issues and Trends in Learning Technologies, 6(1).

[5] Savasci, H. S., & Tomul, E. (2013). The Relationship between Educational Resources of School and Academic Achievement. International Education Studies, 6(4), 114-123.

[6] Hedges, L. V., Pigott, T. D., Polanin, J. R., Ryan, A. M., Tocci, C., & Williams, R. T. (2016). The question of school resources and student achievement: A history and reconsideration. Review of Research in Education, 40(1), 143-168.

[7] Fallahi, N., & Abtahi, S. M. (2020). Designing an Optimal Resource Allocation Resource in Educational Organizations. Journal of New Approaches in Educational Administration, 11(41), 69-94.

[8] Cui, J. (2023). Optimal allocation of higher education resources based on fuzzy particle swarm optimization. International Journal of Electrical Engineering & Education, 60(2_suppl), 312-324.

[9] Huang, S. (2021). Design and development of educational robot teaching resources using artificial intelligence technology. International Journal of Emerging Technologies in Learning, 15(5).

[10] He, W., Liang, P., & Zou, G. (2016). Optimal allocation of higher education resources based on the pareto genetic algorithm. World Trans. Eng. Technol. Educ., 14(1), 190-197.

[11] Zhang, Y., & Wang, D. (2020). Integration model of English teaching resources based on artificial intelligence. International Journal of Continuing Engineering Education and Life Long Learning, 30(4), 398-414.

[12] Yuqi, Z. (2023). The Optimization Path of Higher Education Resource Allocation in China Based on Fuzzy Set Theory. 3 c TIC: cuadernos de desarrollo aplicados a las TIC, 12(1), 308-328.

[13] Muharlisiani, L. T., Mulawarman, W. G., Suwarni, S., Hutahaean, B., & Rahim, R. (2023). Designing a Decision Support System for Educational Resource Allocation. AL-ISHLAH: Jurnal Pendidikan, 15(3), 4216-4225.

[14] Yang, X., Zhou, J., & Wen, D. (2021). An optimized BP neural network model for teaching management evaluation. Journal of Intelligent & Fuzzy Systems, 40(2), 3215-3221.

[15] Diao, S. (2020, April). The reform of teaching management mode based on artificial intelligence in the era of big data. In Journal of Physics: Conference Series (Vol. 1533, No. 4, p. 042050). IOP Publishing.

[16] Liu, S. (2022). Teaching Management System and Algorithm Implementation Based on Big Data Fuzzy K‐Means Clustering. Mathematical Problems in Engineering, 2022(1), 8970414.

[17] Zeng, F., Xing, C., & Song, X. (2024). Optimizing educational dynamics: A big data approach to tailored teaching and enhanced student management. Journal of Computational Methods in Sciences and Engineering, 14727978251322294.

[18] Xin, X., Shu-Jiang, Y., Nan, P., ChenXu, D., & Dan, L. (2022). Review on A big data-based innovative knowledge teaching evaluation system in universities. Journal of innovation & knowledge, 7(3), 100197.