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Research on Multi-Objective Optimization Model and Practice Path Selection in the Development of Civic and Political Education Theory System in the New Era

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Abstract Civic and political construction of the curriculum is the wind vane of the reform of higher education in the new era, and to build a high-level talent cultivation system, it is necessary to grasp the construction of the curriculum of civic and political construction, and solve the problem of professional education and civic and political education. This paper combines the current multi-objective optimization problem of civic education, puts forward the corresponding research assumptions, then determines the objective function and constraints of the model, takes the particle swarm algorithm as the solution algorithm of the multi-objective optimization model, and finally completes the task of constructing the model. In order to verify the practical effect of this paper's model in the development of the theoretical system of civic education, in this regard, the research program of the practical effect of civic education is designed, and the practical effect of this paper's model is verified and analyzed with the help of data analysis software. After a period of teaching intervention, it is found that there is a significant difference between the experimental group and the control group in the six dimensions of the practical effect of civic and political education, and its p-value is less than 0.05, which verifies the practical effect of the model in this paper and provides a reference for the development and construction of civic and political education theory system.

Index Terms particle swarm algorithm, multi-objective optimization model, objective function, ideological education

I. Introduction

The cultural collision and value game brought about by the deep development of globalization has pushed Civic and Political Education to the forefront of ideological struggle [1]. The importance of Civic and political education in the new era, as a key link in shaping young people's thoughts and leading social trends, is self-evident. With the acceleration of the globalization process and the development of information technology, student groups are facing unprecedented ideological impact and value choice, and the theoretical system of the new era of civic and political education presents diversified development needs. In terms of culture, Civic and political education needs to be combined with the inheritance and innovation education of Chinese excellent culture. In terms of international politics, Civic and political education in a pluralistic society needs to deepen the central idea of Marxism under the integration into the international dialogue circle, and update the theoretical content and support system of education in the light of current affairs. In the personal aspect, the deepening of networking and personal development needs to personalize online and offline ideological and political education. In the social aspect, ideological and political education should be committed to serving national governance and synergizing the community of human destiny [2]-[6]. Synergizing the goals of these four aspects requires exploring their practical paths.

In today's complex and changing world, whether it is engineering construction, resource allocation, decision-making or various problems in daily life, we are often faced with multiple goals that need to be considered and optimized at the same time. These objectives may be interrelated, constrained, or even in conflict with each other [7]. How to find a balanced solution among many objectives to maximize the overall benefits becomes a challenging task. The emergence of multi-objective optimization model is to solve the multi-factor, multi-objective situation existing in the real problem, through the comprehensive consideration of multiple objective functions, to seek the optimal solution, which is widely used in the fields of engineering design, resource management, enterprise strategic decision-making, portfolio optimization, environmental management and so on [8]-[11]. The use of such models in ideological education can not only optimize the allocation of ideological resources, but also adjust the education strategy under the turbulent situation, providing support for the development of the theoretical system of ideological education. However, the choice of the practical path of the model needs to optimize the feasibility of the abstract qualities of Civic and Political Education in practice, as well as the conflict issues such as the unity of education under the individualized needs [12], [13].

Through the description of the multi-objective optimization problem, the assumption conditions of the multi-objective optimization model oriented to the development of the theoretical system of Civic and Political Education are elicited, and the constraints, objective function, and optimization solution algorithms of the multi-objective optimization model are set up by combining with the actual situation of the development of the Civic and Political Education of the current new era. After completing the construction of the multi-objective optimization model for the development of the Civic and Political Education Theory System, the Civic and Political Education Practice Research Program is formulated, which provides a detailed description of the research samples, data acquisition, and data processing methods, and the Civic and Political Education Practice Performance of the Multi-Objective Optimization Model is explored in depth under the theoretical support of the research program.

II. Research on the Theoretical System of Civic and Political Education

II. A. Multi-objective optimization model

II. A. 1) Description of the problem

Fig. 1 shows the schematic diagram of Pareto optimal solution. Multi-objective optimization problem refers to a problem consisting of multiple independent and conflicting optimization objectives, and tries to make the optimal decision after mutual trade-offs and trade-offs among the optimization objectives [14], [15]. A multi-objective optimization problem generally consists of n decision variables, q optimization objectives and l constraints. The multi-objective optimization problem can be formulated as:

$$\min[f_1(x), f_2(x), ..., f_n(x)] \tag{1}$$

$$s.t.\begin{cases} lb \le x \le ub \\ Aeq * x = beq \\ A^* x \le b \end{cases} \tag{2}$$

where $f_i(x)$ is the objective function to be optimized, the variable x is the decision variable to be optimized, the constants lb and ub represent the lower bound constraints and upper bound constraints of the variable x, respectively, and $Aeq * x = beq$ is the linear equation constraints of the variable x and $A * x \le b$ is the linear inequality constraints of the variable x.

In the optimization problem shown in Fig. 1(a), the optimization directions of the objective functions f_1 and f_2 to be optimized are contradictory to each other, i.e., after the optimization has been carried out to a certain extent, the optimization of a certain objective function needs to be achieved at the expense of the other one, and then the solutions A and B are said to be non-inferior, which are also called Pareto optimal solutions of the multi-objective optimization problem. Pareto optimal solution. And from the figure, we can see that solution C is not better than and inferior to A and B in any optimization objective f_1, f_2 in at least one of the objectives, so solution C is said to be dominated by solutions A and B. This domination relationship can be expressed by the formula as follows:

$$\forall i \in \{1,2,...,n\}, f_i(A) \le f_i(C), \wedge \forall k \in \{1,2,...,n\}, f_k(A) \le f_k(C) arrow A \succ C \tag{3}$$

Since multi-objective optimization is an optimization process in which multiple objectives check and balance each other, and each optimization objective is in competition with the other, the final optimal solution is a solution set that is not unique. In that solution set, the decision maker can make further decisions according to his decision tendency. In Fig. 1(b), the comparison shows that the distribution of the solution space represents the degree of superiority or inferiority of the solutions, and the frontier consisting of the optimal solutions is called the Pareto frontier.

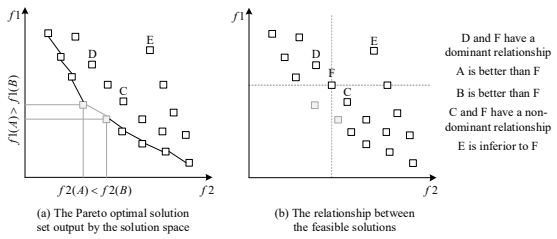

Figure 1: Schematic diagram of the Pareto optimal solution

II. A. 2) Model assumptions

In response to the problem of the development of the theoretical system of Civic and Political Education in the new era, a multi-objective model is built for this purpose. In order to exclude irrelevant factors in the process of model abstraction, and to make the established model easy to solve and process, the following assumptions will be introduced:

(1) It is assumed that there is no adjustment of students in each class before and after the optimization of the theoretical system of civic and political education.

(2) The optimization of the theoretical system of Civic and Political Education must be for teachers specializing in Civic and Political Education.

(3) The number of classes per teacher is fixed.

(4) In the process of optimization of the theoretical system of Civic and Political Education, the case of the teacher to be assigned as the teacher of a certain class is not taken into consideration, and the teacher's personal intention is not taken into account.

(5) Misjudgment of the optimization of the theoretical system of Civic and Political Education by special circumstances such as teachers' vacations and substitutions is not taken into account.

(6) The influence of class size on the optimization of the theoretical system of Civic and Political Education is not taken into account (in practice, the difference in class size in the same school is small).

II. A. 3) Objective function

Through reviewing relevant literature and in-depth research on the issue of faculty allocation, the objective function of this topic on the development of the theory system of Civic and Political Education in the new era has the following two objectives. Details are as follows:

Reduce the discrete degree of the overall new era of Civic and Political Education and establish the following objective function:

$$Min \quad F_1 = \frac{1}{M}\sqrt{\sum_{j=1}^{M}\left(\sum_{i=1}^{N} Z_{ij}X_{ij} - \overline{Z}\right)^2} \tag{4}$$

Reduce the overall instructional matching variance by specifying that the closer P_{ij} is to 0, the more reasonable the instructional matching between i teachers and j classes. Then the following objective function is established:

$$Min \quad F_2 = \frac{1}{M}\sum_{j=1}^{M}\left(\sum_{i=1}^{N} P_{ij}X_{ij}\right) \tag{5}$$

Formula (4) and formula (5) are solved separately when the programs obtained are more one-sided, due to the teacher allocation model in this paper aims to simultaneously achieve the fairness and rationality of the allocation of teacher resources, so the objective function of the teacher allocation model in this paper comprehensively consider the two objectives, to get the following formula:

$$\begin{cases} Min\left(\dfrac{1}{M}\sqrt{\sum_{j=1}^{M}\left(\sum_{i=1}^{N} Z_{ij}X_{ij} - \overline{Z}\right)^2}\right) \\ Min\left(\dfrac{1}{M}\sum_{j=1}^{M}\left(\sum_{i=1}^{N} P_{ij}X_{ij}\right)\right) \end{cases} \tag{6}$$

Where, i denotes the teacher number, j denotes the class number, M denotes the total number of classes, N denotes the total number of all teachers to be assigned, $\overline{Z}$ denotes the average of all teacher-class combination resources, P_{ij} denotes the degree of variation in instructional matching when the i th teacher is teaching in the j th class. It is stipulated that the closer P_{ij} is to 0, the more reasonable the instructional match between the i teacher and the j class.

X_{ij} indicates whether the i th teacher is assigned to teach the j th class, if yes then $X_{ij} = 1$, otherwise $X_{ij} = 0$.

II. A. 4) Constraints

According to the previous specific description of the problem of developing the theoretical system of Civic Education in the new era, the constraints of the faculty allocation model are as follows:

Each class can only have one lecturer in the relevant discipline:

$$\sum_{i=1}^{N} X_{ij} = 1, \quad \forall j \in M \tag{7}$$

The total number of classes carried by the i th teacher is recorded as s_i :

$$\sum_{j=1}^{M} X_{ij} = s_i, \quad \forall i \in N \tag{8}$$

II. A. 5) Model solving

For the multi-objective model established in this paper, the multi-objective is converted into single objective in the solution process, and the particle swarm algorithm is used to solve the above optimization model [16]. The specific process is as follows:

(1) Particle coding

The particle binary position and the matrix position of the particle are converted to each other by the following formula:

$$x_d = X_{ij} \quad d = (i-1) \times M + j \tag{9}$$

In Equation (10), d denotes the position in the binary code and M denotes the total number of columns of the matrix (total number of classes).

(2) Fitness function and constraints

The objective function is used as the fitness function of the algorithm, i.e., Equation (10), in which X_{ij} uses the matrix encoding X, due to the characteristics of the binary encoding used in the algorithm, the binary string is converted to the matrix encoding in the algorithm to solve the fitness value. I.e.:

$$Min \quad F = F_1 \times F_2 = \frac{1}{M^2}\left(\sqrt{\sum_{j=1}^{M}\left(\sum_{i=1}^{N} Z_{ij} X_{ij} - \overline{Z}\right)^2}\right) \times \left(\sum_{j=1}^{M}\left(\sum_{i=1}^{N} P_{ij} X_{ij}\right)\right) \tag{10}$$

where P and Z are calculated as follows:

$$P_{ij} = \left| \frac{(T^i - T_{\min}) / (T_{\max} - T_{\min})}{(C^j - C_{\min}) / (C_{\max} - C_{\min}) + h} - 1 \right| \tag{11}$$

$$Z_{ij} = \gamma_1 T^i + \gamma_2 C^j \tag{12}$$

Based on the constraints presented above, the constraints in the algorithm are expressed as follows:

$$\sum_{i=1}^{N} X_{ij} = 1, \quad \forall j \in M \tag{13}$$

$$\sum_{j=1}^{M} X_{ij} = s_i, \quad \forall i \in N \tag{14}$$

where $X_i = \begin{cases} 1 & \text{Teacher } i \text{ was assigned to teach Class } j \\ 0 & \text{Teacher } i \text{ has not been assigned to teach Class } j \end{cases}$, $i \in N, j \in M$, s_i denote the i th generation.

The constraints (13), (14) are overall constraints on all dimensions of the particle positions, not on the individual dimensions of the particles, in order to make the positions of the particles in each generation change in the constraints, thus making the particles change in the feasible solution space.

(3) Correction strategy of particle position and variation operation

Fig. 2 is a schematic diagram of the correction strategy, when updating the position of the particle x (the binary encoding string of the particle), the matrix corresponding to x is encoded as X, and the matrix encoding X corresponding to the particle position x is now used to introduce the correction strategy of the particle position. In updating the values of X_{ij}, use row_{ij} to denote the number of 1's contained in the first $i-1$ rows of the j th column of the matrix encoding, and col_{ij} to denote the number of 1's contained in the first $j-1$ columns of the i th row.

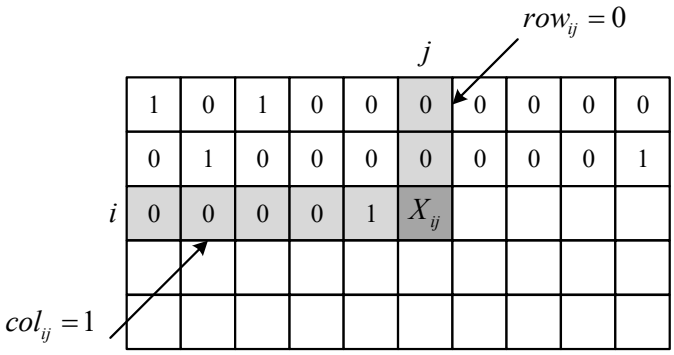

Figure 2: Schematic diagram of the correction strategy

In the matrix encoding of particles, all bits are corrected in the order of top-to-bottom by rows and left-to-right within rows [17], [18]. When $i>1$ or $j>2$, if $row_{ij}=1$ or $col_{ij}=s_1, X_{ij}=0$; when $i=N$, if $row_{ij}<1$, the position with a relatively large value of the velocity is selected among all the positions in the j th column of the matrix X_{kj}, such that $X_{kj}=1$ and satisfy $\sum_{j=1}^{M} X_{kj} \le s_k, k \in [1,N]$; when $j>M-s_i$, if $col_{ij}<s_i$ is in the j th column of matrix i row of the matrix, the position X_{ig} with a relatively large velocity value is selected among all the positions in the rows of the matrix, such that $X_{ig}=1$; and $\sum_{i=1}^{N} X_{ig}=1, g \in [1,M]$ other cases, it is computed by the particle swarm positional updating Eq. (15). Then the position correction formula expressed in matrix coding is as follows:

$$X_{ij}=\begin{cases} 0 & row_{ij}=1 \text{ or } col_{ij}=s_i \\ 1 & \text{The number of 1s in row } i \text{ or column } j \text{ is insufficient, and } v_{ij} \text{ is relatively large} \\ X_{ij} & \text{other} \end{cases} \tag{15}$$

The X_{ij} on the right side of the equal sign in Eq. denotes the particle matrix position corresponding to the binary position x_d obtained by updating the particle swarm position formula, and the X_i on the left side of the equal sign denotes the particle matrix position under the modified strategy. The modified particle positions are obtained by converting X_{ij} to x_d via Eq.

In practice, PSO algorithm is easy to fall into local convergence due to the decrease of population diversity during iteration, to avoid this situation, this paper uses the mutation operation to increase the population diversity in the algorithm. On the basis of the correction strategy, that is, in the range of taking the feasible solution, each bit of the particle position is set to the [0,1] interval of the random number of mutation, when the random number of mutation of a certain bit is less than the specified threshold, it will be mutated, if the current is 1, it will be mutated to 0, and if the current is 0, it will be mutated to 1. The intervention of the mutation operation makes the diversity of the particle population increase, and the algorithm enhances the ability of the search.

(4) Local search strategy

If the search space of the solution becomes large algorithm is easy to fall into the local optimum, it is difficult to search for the global optimal solution, so this paper adopts the local search strategy to improve the ability of the algorithm to explore the global optimum on this basis. In each iteration of the PSO algorithm, after all the particles in the population have performed the position update, correction and mutation operations, select the optimal part of the particles in the population and other random particles, and perform the following operations on the selected particle X0:

1) Let the optimal particle $X_b=X_\theta$, then the neighborhood of this particle is $S=G(X)$.

2) The termination condition of the local search is a set number of iterations or when S is empty, when the termination condition is satisfied, step 5) is executed, otherwise step 3) is executed.

3) Select a subset S' of S and calculate the fitness value of the particles in S' to select the optimal particle X_n.

4) If X_n is better than X_b, then $X_b = X_n$, the neighborhood $S = G(X_b)$, and perform step (2); otherwise $S = S - S'$, and perform step 2).

5) Output the optimal particle X_b, and the local search ends.

II. B.Research Design for Civic Education Practices

As can be seen from the description above, a multi-objective optimization model oriented to the theoretical system of Civic and Political Education is designed. In order to test the practical efficacy of the model in the process of Civic and Political Education, a practical research program for Civic and Political Education is formulated from the four aspects of the research object, questionnaire, experimental process, and data statistics. The details are as follows:

II. B. 1) Objects of study

This paper takes into account the actual situation of the current development of Civic and Political Education, and selects the freshmen of a key university in a city as the object of this research, totaling 40 research samples, and the research samples do not have differences, which is very good to ensure the validity of the results of the research.

II. B. 2) Questionnaire

By reviewing the relevant information on scale development, adopting Likert five-level scale, taking the six-dimensional elements of Civics as the specific boards, writing the questionnaire on the basis of reviewing a large amount of literature and consulting with experts in the relevant fields, organizing the questions of the questionnaires in the relevant fields, and moderately modifying the individual questions, the questionnaire on Civic and Political Education Practices was finally formed, which includes learning interest, culture and spirituality, aesthetic awareness, health awareness, patriotism, ideal beliefs, which is based on these six parts, with a total of 43 questions. The questionnaire includes learning interest, cultural spirit, aesthetic consciousness, health consciousness, patriotism, idealism, and the questionnaire is based on these six parts, with a total of 43 questions. A five-point Likert scale was used, where 1 was "very disagreeable", 2 was "not compliant", 3 was "uncertain", 4 was "compliant", and 5 was "very much compliant".

The most commonly used method to test content validity is to ask experts in related fields to make judgments on whether there is a match between the scale's items and the object of study and the content of the study. In the preliminary stage of this study, through studying a large amount of literature, information and relevant policy documents, we conducted a preliminary exploration of Civic Education based on the multi-objective optimization model to pave the way for the subsequent research. Secondly, experts were consulted through open-ended questionnaires to seek their opinions, and were asked to make evaluations of the scale's questions, rationality, and logic. Secondly, the scale was tested before the formal teaching experiment was conducted, and the scale items were deleted and modified according to the requirements of relevant academic research, finally forming a scale that meets the needs of the study. After the above measures, the scale used in this study has good content validity. The most common way to test the content validity is to ask experts in related fields to make a judgment on whether the scale items are consistent with the research object and the research content. In the early stage of this study, through studying a large amount of literature, information and relevant policy documents, we conducted a preliminary exploration of the implementation of sports ideological education in elementary school sports to pave the way for the subsequent research. Second, experts were consulted through an open-ended questionnaire to solicit their opinions, and were asked to make evaluations of the scale's questions, rationality, and logic. Secondly, the scale was tested before the formal teaching experiment was conducted, and the scale items were deleted and modified according to the requirements of relevant academic research, finally forming a scale that meets the needs of the study. After the above measures, the scale used in this study has good content validity. Construct validity refers to the extent to which a test actually measures the structure or quality of the theory it is intended to measure, or the extent to which test scores are indicative of a structure or quality of a psychological theory. The structural validity of a questionnaire is determined by the correlation matrix between the dimensions. The structural validity of a questionnaire is determined by the correlation matrix between the dimensions. The structure of the questionnaire requires the correlation between dimensions to be between 0.10 and 0.60. The above table shows that the scale has a good structural validity. Reliability analysis, also known as reliability testing, is usually expressed by Cronbach's consistency coefficient. From the above table, it can be seen that the reliability value of each dimension is more than 0.8, among which the reliability value of physical character dimension is 0.866.

II. B. 3) Specific processes

Select 20 students from the sample as the experimental group, while the remaining 20 students as the control group, by the same teacher for a period of 12 weeks of teaching activities, two classes per week, 40 minutes per class, in

which the experimental group for multi-objective optimization based on the Civic and Political Education, the control group for the conventional Civic and Political Education activities in the 12 weeks of teaching, the students to conduct a questionnaire test, a comparative analysis of the two groups of students in the pre- and post-treatment of the teaching Compare and analyze the differences in educational effects between the two groups of students before and after the teaching, and then argue the hypothesis and conjecture.

II. B. 4) Mathematical and statistical methods

In this study, the experimental data were analyzed using SPSS25.0 statistical software, and all data were first tested for k-s normality. If they conformed to normal distribution, paired samples t-test was used for before and after comparisons within groups, and independent samples t-test was used for comparisons between groups; if they did not conform to normal distribution, nonparametric tests were used. All data were expressed as mean ± standard deviation (M ± SD) on a standardized basis, with the significance level taken as $P < 0.05$ and the very significant level taken as $P < 0.01$.

III. Analysis of Empirical Research on Civic and Political Education in the New Era

III. A. Model depth probe analysis

III. A. 1) Parameterization

Particle swarm algorithm is used to solve the optimization model of new era Civic Education. Initialize the parameters of the algorithm, dynamic weights $\omega \in [0.4,1.6]$, learning factor $c_1 = c_2 = 4$, chaotic variables $\lambda = 3.5$, number of chaotic searches $\hat{T} = 7$, in order to determine the optimal number of populations N, set $N = 100,200,300$ respectively. In the following, the optimization model of this paper is solved by combining the corresponding research data and particle swarm algorithm.

III. A. 2) Model Solution Analysis

The distribution of Pareto optimal solutions for different size populations is shown in Figure 3. The distribution of Pareto optimal solutions of different size populations is uneven, but the Pareto nondominated solutions of different populations are on the same Pareto frontier. In order to study the distribution of Pareto optimal solutions of different sizes, 50 nondominated solutions are randomly selected from each of the 10 statistical results, as shown in Fig. 4, where (a) ~ (c) are 500, 1000, and 1500, respectively. As the population size increases, the maximum size of the set of nondominated solutions increases accordingly, and their Pareto-optimal solutions are more widely distributed than in small-sized populations. The results of solving the optimization model with different size populations are shown in Table 1. As can be seen from Table 1, when N=300, the population size is larger, the particles within the population are more diverse, the external non-dominated solution set contains more feasible solutions, and the evaluation indexes are better than the remaining two except for the increase in time consumption. Compared to the remaining two, the optimal value of the model is 1.173 when N=150, which is reduced by 0.893 and 0.154, respectively. The optimal running time is 1.409 s, which decreases by 0.013 s and 0.003 s. As the population size increases, the algorithm takes more time, which increases by 0.842 s and 1.993 s, respectively. In cases where time-consuming requirements are not high, large-scale population solution models can be utilized to obtain more feasible solutions.

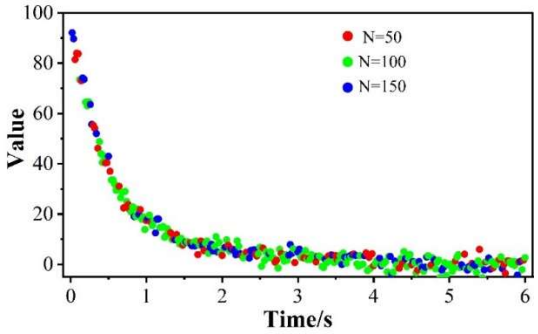

Figure 3: The distribution of Pareto optimal solutions for populations of different sizes

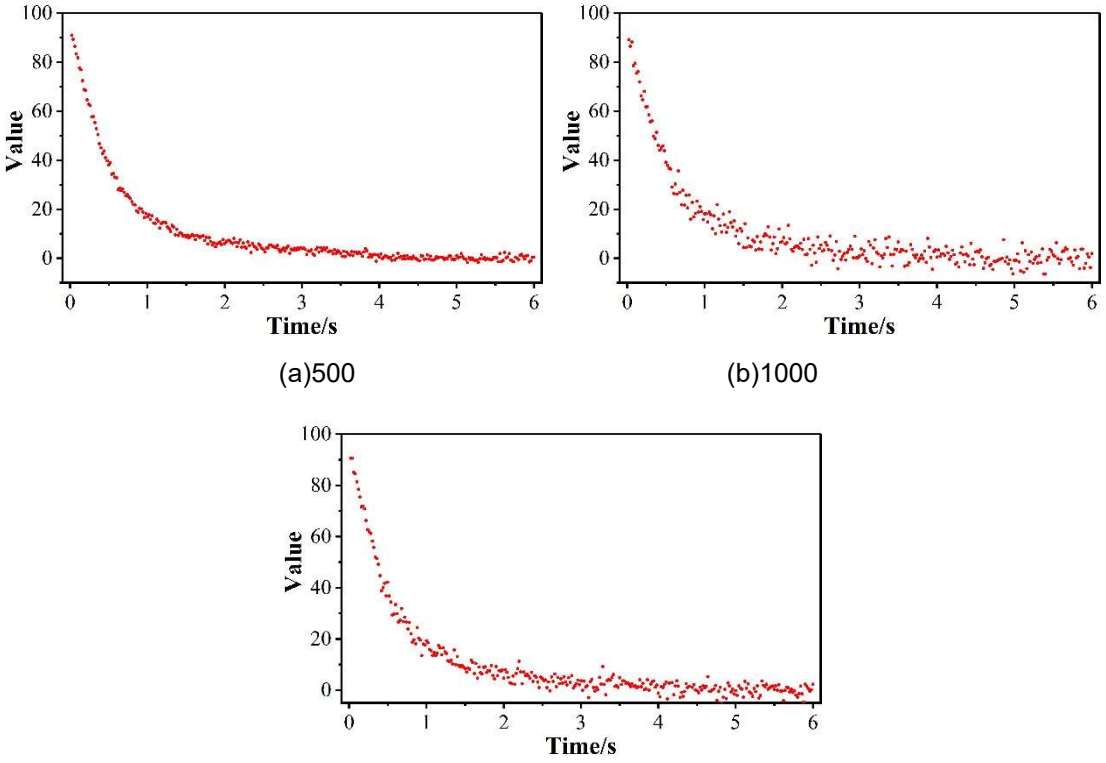

Figure 4: Random solutions in Pareto optimal solutions of different scales

Table 1: The results of solving the optimization model for populations of different scales

Evaluation index	N		
	50	100	150
Dispersion degree	(5.506,2.006)	(6.041,1.327)	(5.711,1.173)
Degree of difference	(1.422,84.084)	(1.411,87.151)	(1.409,94.994)
Time consumption /s	1.271	2.113	4.106

In order to quantitatively represent the advantages and disadvantages of the PSO algorithm's performance in solving the multi-objective optimization model of Civic and Political Education in the new era, the algorithm is compared with three classical algorithms, namely, Genetic Algorithm (GA), Ant Colony Algorithm (ACO), and Simulated Annealing Algorithm (SA), and the results are shown in Figure 5. In the figure, each algorithm uses the same initialization parameters to solve the model, and the relationship between the optimal value of the theory of Civic Education and the total time is obtained. As seen in Figure 5, compared with the genetic algorithm, ant colony algorithm, simulated annealing algorithm, the Pareto frontier of this paper's algorithm contains the Pareto frontier of the other three algorithms, the Pareto optimal solution is in a dominant position, and the optimal solution value and the optimal time of this paper's algorithm's model is lower than that of other three algorithms, which fully validates the PSO algorithm's performance of the optimal model in this paper, and it also shows that The model in this paper meets the current standard of ideological education in colleges and universities.

III. B. Optimization model practice effect analysis

Under the role of the multi-objective optimization model of the theoretical system of Civics education for the new era, in order to compare the pre- and post-test differences between and within the two groups, the questionnaires of the two groups of students were used to carry out independent sample T-tests on the pre- and post-experiment data results of the students between the two groups according to the method of numerical homoscedastic statistics and paired sample T-tests on the pre- and post-experiment data results of the students in the two groups as a way of checking the differences of the impact of the practical effect of the post-experiment Civics teaching based on the multi-objective optimization model of the Civics teaching experiment after the practice effect of the impact of the differences.

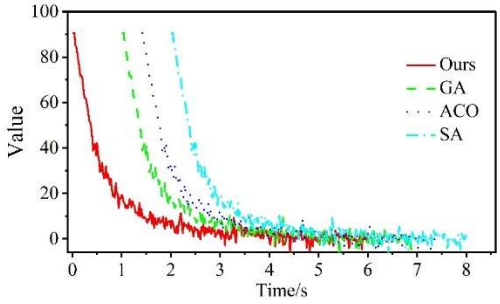

Figure 5: The Pareto optimal solution distribution of the algorithm and the classical

III. B. 1) Comparison of practice effects in the experimental group before and after the experiment

With the support of relevant research data, the practical effects of the experimental group before and after the experiment were analyzed differently, and the results of the differentiation analysis are shown in Fig. 6, where X1~X6 denote learning interest, cultural spirit, aesthetic consciousness, health consciousness, patriotism, and ideal beliefs, respectively. Based on the P-value in the figure, it can be seen that there are significant differences between the experimental group before and after the experiment in learning interest (P=0.004), cultural spirit (P=0.001), aesthetic consciousness (P=0.005), health consciousness (P=0.009), patriotism (P=0.011), and ideal belief (P=0.006), which indicates that under the action of the multi-objective optimization model, the students' Civic and Political Education practical ability is significantly improved.

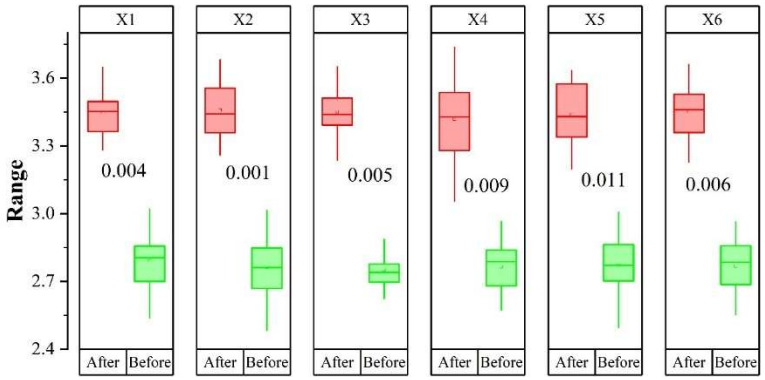

Figure 6: The practical effects of the experimental group before and after the experiment

III. B. 2) Comparison of practice effects in the control group before and after the experiment

After analyzing the comparative analysis of the practice effect of the experimental group before and after the experiment, this subsection will carry out an independent sample t-test on the practice effect of the Civic and Political Education of the control group before and after the experiment with the help of SPSS statistical analysis software, and the results of the independent sample t-test are shown in Figure 7. Based on the data performance in the figure, it can be seen that there is no significant difference (P>0.05) between the students in the control group before and after the experiment in terms of interest (P=0.057), cultural spirit (P=0.103), aesthetic consciousness (P=0.097), health consciousness (P=0.062), patriotism (P=0.081), and ideal belief (P=0.074), and it can be summarized that the traditional civic politics teaching mode is less effective in enhancing students' learning interest, cultural spirit, aesthetic consciousness, health consciousness, patriotism, and ideal beliefs, further indicating that the effect of traditional Civic Education practice is more general.

III. B. 3) Comparison of the effectiveness of practice in the two groups after the experiment

In the previous section, the practice effect of the experimental group before and after the experiment and the practice effect of the control group before and after the experiment were explored respectively, and the next step will be to analyze the difference between the control group and the experimental practice effect after the experiment, and the comparative analysis of the practice effect of the two groups after the experiment is shown in Fig. 8, where CG and EG denote the control group and the experimental group, respectively. It can be seen from the size of the P value in the figure that there are significant differences between the control group and the experimental group in terms of learning interest (P=0.002), cultural spirit (P=0.001), aesthetic consciousness (P=0.007), health awareness (P=0.003), patriotism (P=0.005), and ideal belief (P=0.006), indicating that compared with the traditional ideological

and political education model, the practical effect of ideological and political education based on multi-objective optimization model is particularly obvious.

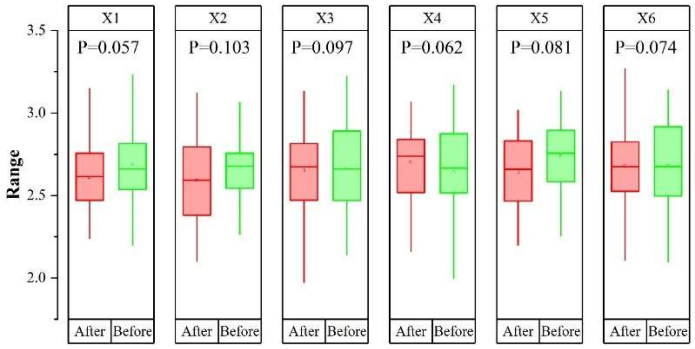

Figure 7: Independent sample t-test

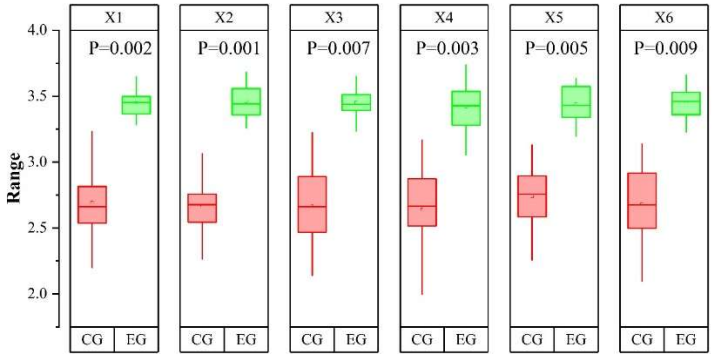

Figure 8: Comparison of the practical effects of the two groups after the experiment

IV. Conclusion

This paper uses the particle swarm algorithm to design a multi-objective optimization model for the development of the theoretical system of Civic and Political Education in the new era. In order to better set off the application value of this paper's model in the choice of paths for the practice of Civic and Political Education, a corresponding research program is formulated. Under the guidance of the research program, an independent sample t-test is conducted on the practical effect of the model in this paper. After a period of teaching experiments, it was found that there were significant differences between the experimental group and the control group in six aspects: learning interest (P=0.002), cultural spirit (P=0.001), aesthetic consciousness (P=0.007), health awareness (P=0.003), patriotism (P=0.005), and ideal and belief (P=0.006), indicating that the model in this paper has excellent practical effect in ideological and political education and has a guiding role in the development of ideological and political education in the new era.

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