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Multi-objective optimization regulation method and intelligent path planning of ideological and political education elements in physical education teaching

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ABSTRACT

Curriculum Civics reform in physical education should keep pace with the times and actively explore modern technical means. This study addresses the problem of regulating the elements of Civic and political education in physical education, and establishes a mathematical model of multi-objective optimization and regulation by comprehensively considering the various factors and constraints involved in the problem. In order to further optimize the regulation results, an improved two-population genetic algorithm is used to solve the model. Taking the physical education course of a university as an example to analyze, the design algorithm of this paper is compared with the experiments, and the improved two-population genetic algorithm completes the convergence in 300 iterations, and the degree of adaptability is improved by 2.04%, which has the characteristics of strong global search ability and fast convergence speed, which proves that the improved two-population genetic algorithm has a certain degree of superiority and validity. The utilization rate of the elements of ideology and politics education in the experimental solution results reaches 0.87, and other factors meet the actual needs of sports teaching, and the method of this paper can realize the intelligent regulation of the elements of ideology and politics education in sports teaching.

Keywords: mathematical model; multi-objective optimization; two-population genetic algorithm; intelligent regulation; Civic and political education

1. Introduction

Physical education, as an important part of school education, not only exercises students' body, but also plays a pivotal role in cultivating people's moral character, will quality, and the spirit of unity and cooperation. Incorporating the elements of ideology and politics into physical education can not only enhance the physical quality of students, but also cultivate their good qualities, laying a solid

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foundation for the cultivation of all-round development of socialist builders and successors [1-4]. The elements of ideology and politics in physical education are mainly reflected in the following aspects:

Cultivating patriotic sentiment, physical education courses stimulate students' love and pride for the motherland through organizing various sports activities, and cultivate students' identification with and loyalty to the country. Cultivate collective concept, physical education courses emphasize teamwork and collective honor, cultivate students' collective concept and team spirit in various sports activities, let students learn to collaborate with others and cultivate their sense of collective responsibility [5-8].

Promote healthy lifestyle, physical education program educates students to develop good sports habits and healthy lifestyle, advocates active participation in physical exercise, improves physical fitness, and develops students' self-discipline and health consciousness. Cultivate the sense of competition, physical education courses cultivate students' sense of competition and ability to overcome difficulties through competition and training, so that students can learn to face challenges and pressure, and cultivate their desire to win and courage [9-12].

Cultivate the spirit of unity and cooperation, the physical education program encourages students to help each other and cooperate with each other in physical activities, cultivates the spirit of unity and cooperation, and lets students know the importance of respecting others and unity and cooperation. Guiding the formation of moral concepts, the physical education curriculum guides students to form correct moral concepts and codes of conduct by cultivating the quality of sports optimism, honesty and trustworthiness and the spirit of fair competition [13-16].

In this paper, we carry out mathematical modeling on the problem of regulating the elements of ideology and politics education, discuss the main constraints and optimization objectives in the problem of regulating the elements of ideology and politics education, and describe the problem of regulating the elements of ideology and politics education in a complete way with a mathematical model. Aiming at the problem that the basic genetic algorithm is prone to fall into local optimization and the problem that the two-population genetic algorithm has limited global search ability and slow convergence speed, the two-population genetic algorithm is improved. The coding method, the generation method of multiple initial programs, the fitness function, the conflict detection and elimination method for the regulation of civic education elements are designed, and then the application of selection operator, crossover operator, mutation operator and immigration operator in the regulation of civic education elements are designed, so that the improved two-population genetic algorithm can be effectively applied to the solution of the multi-objective optimization model. The physical education course of a university is selected as the research object, and the performance of the improved two-population genetic algorithm is explored through the simulation of experimental data and algorithms, and the intelligent path planning results of the Civic and Political Education element are mined. Finally, the path of Civic and political construction of physical education containing three dimensions of students, teachers and schools is proposed.

2. Multi-objective optimization of regulation methods

The construction of curriculum Civics in sports teaching in colleges and universities should scientifically integrate and deploy Civics education elements to maximize the effect of curriculum Civics teaching. As a result, this chapter establishes a mathematical model for the regulation of the elements of Civics and Politics education, solves it using an improved two-population genetic algorithm model, and proposes a multi-objective optimization and regulation method for the elements of Civics and Politics education in sports teaching.

2.1. Mathematical modeling

The Civic Education Element Regulation Problem is a constrained multi-objective optimization problem, so the model of the Civic Education Element Regulation Problem is a constrained multi-objective optimization model, in which the constraints can be illustrated by the constraint satisfaction model.

2.1.1. Resource pools. Define the set of basic elements in the scheduling problem:

Let the set of teaching tasks be: $W=\{w_1,w_2,w_3\ldots\ldots w_n\}$. The appropriate permutation of the elements of Civic Education in time and space is the purpose of solving the Civic Education Element Problem.

Let the set of time be: $T=\{t_1,t_2,t_3,\ldots\ldots,t_n\}$, with the attributes of weekly and lecture times.

Let the set of classrooms be: $R=\{r_1,r_2,r_3,\ldots\ldots,r_n\}$, with two main attributes: classroom capacity and teacher type, the number of students in the classroom should be less than the capacity of the classroom, but also to avoid the waste of resources, i.e., the classroom is too large.

Let the class set be: $C=\{c_1,c_2,c_3,\ldots\ldots,c_n\}$, the students attending the class are in the form of class, which generally refers to the administrative class in colleges and universities, and includes attributes such as college, major, and grade level.

Setting up a combined class collection: $G=\{g_1,g_2,g_3,\ldots\ldots,g_n\}$, two or more administrative classes taking the same course at the same time and in the same place.

2.1.2. Constraints model. If Civic Education Element t, is assigned to class subset g_i, then $a_i=1$, otherwise $a_{ij}=0$. Similarly, if Civic Education Element t_i is assigned to class c_i, then $b_i=1$, otherwise $b_{ij}=0$. Then two requirement matrices can be defined:

$$A=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1t} \\ a_{21} & a_{22} & \cdots & a_{2t} \\ \cdots & \cdots & \cdots & \cdots \\ a_{g1} & a_{g2} & \cdots & a_{gt} \end{bmatrix} \tag{1}$$

$$B=\begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1t} \\ b_{21} & b_{22} & \cdots & b_{2t} \\ \cdots & \cdots & \cdots & \cdots \\ b_{g1} & b_{g2} & \cdots & b_{gt} \end{bmatrix} \tag{2}$$

It is clearly seen that the A,B matrix determines the cohorting of classes and the assignment of Civic Education elements, that is, it describes in a mathematical sense the relationship between all current Civic Education elements and classes.

If we assume that the number of working days on the class schedule is d and the number of sessions in a day is s, and then introduce the class schedule matrix, the

$$\Delta=\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1d} \\ x_{21} & x_{22} & \cdots & x_{2d} \\ \cdots & \cdots & \cdots & \cdots \\ x_{s1} & x_{s2} & \cdots & x_{sd} \end{bmatrix} \tag{3}$$

Where $x_{ij}=1$ means that there is a class in the ird period of week i, otherwise it is considered free.

If classes are scheduled according to the schedule of Matrix A, and the current occupancy of teachers, classes, and classrooms are recorded in real time in the schedule matrix, then the classroom scheduling matrix ∇r and the teacher-class scheduling matrix ∇tc can be obtained:

$$\nabla r = \begin{bmatrix} \begin{bmatrix} x_{111} & x_{112} & \cdots & x_{11d} \\ x_{121} & x_{122} & \cdots & x_{12d} \\ \cdots & \cdots & \cdots & \cdots \\ x_{1s1} & x_{1s2} & \cdots & x_{1sd} \end{bmatrix} \\ \Delta_2 \\ \cdots \\ \Delta_r \end{bmatrix} \tag{4}$$

$$\nabla tc = \begin{bmatrix} x_{1111} & x_{1112} & \cdots & x_{111d} & & & \\ x_{1121} & x_{1122} & \cdots & x_{112d} & & & \\ \cdots & \cdots & \cdots & \cdots & \Delta_{12} & \cdots & \Delta_{1t} \\ x_{11s1} & x_{11s2} & \cdots & x_{11sd} & & & \\ \Delta_{21} & & & & \Delta_{22} & \cdots & \Delta_{2t} \\ \cdots & & & & \cdots & \cdots & \cdots \\ \Delta_{\grave{o}1} & & & & \Delta_{\grave{o}2} & \cdots & \Delta_{\alpha} \end{bmatrix} \tag{5}$$

where $x_{if'} = 1$ in ∇_r indicates that classroom r_i is occupied for period i' of week i', otherwise it is considered vacant. The $x_{ij'f'} = 1$ in ∇tc indicates that the teacher t_i has given the classroom c_i the i' th period of week i', otherwise it is considered absent.

With the above description, the Civic Education element t_i is scheduled for up to one class per time (section i' of week j') can be expressed as:

$$\sum_{i=1}^{c} x_{ijif'} \le 1 \tag{6}$$

Similarly, class c_i is scheduled at time (i' rd period of week j') up to one class can be expressed as:

$$\sum_{j=1}^{i} x_{ijij'} \le 1 \tag{7}$$

For Classroom r_i at the time (i' rd period on Week i') also available:

$$x_{u'j'} \le 1 \tag{8}$$

Eqs. (6), (7) and (8) are given as only the plainest mathematical models in the problem of regulating the elements of Civic Education, and they are satisfied only by ensuring that there is no conflict between the elements of Civic Education, the students and the classrooms. The formula (7) guarantees that each class will have at most one lesson at each time and at the same time eliminates the phenomenon of conflict that may exist when more than one class participates in the same lecture. More constraints should be considered in the actual teaching process, such as the requirement for teachers to teach at multiple campuses when they have to teach between two adjacent lectures.

2.2. Optimization objectives

The soft constraints of the Civic Education Element Regulation Problem are the objective conditions that often need to be optimized in the process of considering the Civic Education Element Regulation of physical education.

1) course schedule lecture function f_1, the teaching effect of the physical education course is linked to the lecture of the class, try to arrange the course in the teaching effect is better in the lecture.

With a_{ij} to indicate the week i, the j th lecture priority, then there is a formula:

$$f_1 = \sum_{i=1}^{5}\sum_{j=1}^{5} c_{ij} a_{ij} \tag{9}$$

$$\text{among } c_{ij} = \begin{cases} 1 & \text{Lecture } j \text{ on Monday } i \\ 0 & \text{other} \end{cases} \tag{10}$$

2) Course weekly combination function f_2, for the weekly lecture number of large courses, should be arranged every other day, with a better dispersion of the course to have a good teaching effect.

With b_{ij} to indicate the weekly combination of courses prioritized, then there is a formula:

$$f_2 = \sum_{i=1}^{p} m_i b_k \tag{11}$$

$$\text{among } m_i = \begin{cases} 1 & \text{The number of weekly classes for Course } i \text{ is } \geq 2 \\ 0 & \text{other} \end{cases} \tag{12}$$

3) Teachers expect the conditional function f_3, scheduling needs to consider the teacher's request for class time and location.

Now only consider the requirements of the class time, with λ to indicate the degree of expectation, the value range of 0-1, the larger the value indicates that the higher the degree of expectation, then there is a formula:

$$f_3 = \sum_{i=1}^{p} \lambda_i \tag{13}$$

where λ_i represents the expected value of the class time desired by the instructor of course i.

4) Class schedule daily lesson time distribution function f_4, in order to avoid the weekly schedule is concentrated in some days, with the class daily lesson time distribution uniformity to try to ensure that the class every day the number of lectures in the class is relatively uniform:

$$f_4 = \sum_{i=1}^{M}\sum_{j=1}^{s} g_{ij} \tag{14}$$

where $g_i = \begin{cases} 1 & \bar{m}_i^{-2} \leq h_{ij} \leq \bar{m}_j^{-2} \\ 0 & \text{other} \end{cases}$ other $\bar{m}_i = \frac{m_i}{5}\bar{m}_i$ denotes the average number of daily lectures for class i, m_i denotes the total number of weekly lectures for field i, and h_{ij} denotes the number of class lectures for class i in week j.

2.3. Solution program

According to the established optimization objective and the established mathematical model, the improved two-population genetic algorithm is applied to the regulation of the Civic Education element in physical education.

In the basic genetic algorithm (SGA), the initial population is randomly generated, resulting in poor adaptation of the initial individuals and optimal solutions in a small uncertain range, which increases the number of iterations of the algorithm and the slow convergence rate. On the other hand, if the initial populations are all feasible solutions that satisfy the hard constraints, the similarity between individuals is high, and it is difficult to jump out of the local optimal solution after crossover and mutation operations, so that the algorithm is unable to carry out a global search, and the phenomenon of premature convergence occurs. However, the traditional Dual Population Genetic Algorithm (DPGA) still suffers from limited global search capability and slow convergence. In order to solve these problems, this paper creates an improved two-population genetic algorithm model (IDPGA).

2.3.1. Chromosome coding. The coding of genes and chromosomes is the basis of the genetic algorithm, as it is necessary to translate the factors involved in the regulation of the elements of Civic Education into a computer-understandable language. The decimal coding method was chosen to encode the elements of Civic Education, teachers, classes, courses, classrooms and time.

2.3.2. Generating initial populations. When generating the initial population, two different approaches are used: one population generates the initial population according to a randomized approach in order to make the initial solutions uniformly distributed in the solution space, thus facilitating the global search. The other population generates a higher quality initial population according to the specific problem in order to speed up the search for the optimal solution.

2.3.3. Adaptation function construction. Civic education element regulation problem has hard constraints and soft constraints, hard constraints must be complied with, the more soft constraints are satisfied, the higher the quality of the Civic Education Element Regulation Program. According to the optimization model of the civic education element regulation problem above, the fitness function construction is shown in Eq:

$$\begin{cases} F_{fitness}(i) = \omega_1 * f_1(i) + \omega_2 * f_2(i) + \omega_3 * f_3(i) + \omega_4 * f_4(i) \\ s.t.\ \text{Individual } i \text{ meets hard constraints 1 to 5} \end{cases} \tag{15}$$

Where $f_1(i), f_2(i), f_3(i), f_4(i)$ denotes the time period optimization degree function, class time distribution balance function, classroom utilization degree function, and the optimization degree function of the Civic Education element of the physical education course, respectively. $\omega_1, \omega_2, \omega_3, \omega_4$ indicates the weight of each optimization objective.

2.3.4. Conflict detection and elimination. A random function is used in initializing the population, so it is inevitable that conflicts will arise, violating the hard constraint rules. And the required optimal solution is free from conflicts. Taking the hard constraint that the same teacher can only teach one course in one classroom in the same time period as an example, we mainly test the teacher code and time code of genetic coding. The specific process is as follows:

Step 1: Outer loop i from 1 to the size of geneList, acquiring the teacher gene code and time gene code for the ind gene at a time.

Step 2: Inner loop j goes from $i+1$ to the size of geneList, obtaining the teacher gene code and time gene code of the j th gene each time.

Step 3: If the teacher gene code is the same and the time gene code is the same, it means that there is a conflict, i.e., the same teacher is teaching two classes at the same time in two locations. Then a new time is randomly generated to replace the old time of the ith gene, and continue to go back to step 1, and the outer loop starts from the first gene code in the geneList until this conflict is eliminated for that individual this time.

2.3.5. Selection Operators and Improvements. The selection operation is improved by incorporating the optimal individual retention strategy, where the optimal individuals in the parent population are directly retained to the offspring. The process of the improved selection operation is as follows:

1) Assuming the number of populations is N, for each individual x_i, its fitness is calculated to be $f(x_i)$, then the probability of each individual being selected in the population can be calculated according to Equation (16) $P(x_i)$:

$$P(x_i) = \frac{f(x_i)}{\sum_{i=1}^{N} f(x_i)} \tag{16}$$

2) Calculate the cumulative probability for each individual see Eq:

$$q_j = \sum_{i=1}^{j} P(x_i), j = 1,2,3,...N \tag{17}$$

q_j is referred to as the cumulative probability of the j nd individual, e.g. when there are 4 individuals whose probability of being selected is in the ratio of 0.1, 0.2, 0.3, 0.4, their cumulative probability is:

$$q_1 = \sum_{i=1}^{1} P(x_i) = P(x_1) = 0.1 \tag{18}$$

$$q_2 = \sum_{i=1}^{2} P(x_i) = P(x_1) + P(x_2) = 0.1 + 0.2 = 0.3 \tag{19}$$

$$q_3 = \sum_{i=1}^{3} P(x_i) = P(x_1) + P(x_2) + P(x_3) = 0.1 + 0.2 + 0.3 = 0.6 \tag{20}$$

$$q_4 = \sum_{i=1}^{4} P(x_i) = P(x_1) + P(x_2) + P(x_3) + P(x_4) = 0.1 + 0.2 + 0.3 + 0.4 = 1 \tag{21}$$

3) Spin the roulette wheel, i.e., randomly generate a number x from 0 to 1. When $q_{i-1} < x \le q_i$, it means that the i rd individual has been selected. Repeating N times of spinning the roulette wheel, then N individuals are selected to enter the subsequent genetic evolution operation to generate the next generation of population.

4) After one iteration of genetic evolution, the individual with the highest fitness value in the parent generation is noted as Individual x_{best}, which needs to be retained into the next generation population.

5) Calculate the fitness of each individual in the offspring population, select an individual y_{worst} with the worst fitness, kick it out of the population, and add the best individual x_{best} to the offspring population.

2.3.6. Cross probabilities and operations. In this paper, we introduce nonlinear adaptive sine crossover operator and adaptive cosine crossover operator for crossover probability P_c.

For population 1, whose main function is to perform global search, the adaptive sine crossover operator is used, see Eq:

$$P_{c1} = \begin{cases} \frac{P_{c\max} + P_{c\min}}{2} + \frac{P_{c\max} - P_{c\min}}{2} * \sin\left(\frac{f' - f_{avg}}{f_{\max} - f_{avg}} * \frac{\pi}{2}\right) & f' \ge f_{avg} \\ P_{c\max} & f' < f_{avg} \end{cases} \tag{22}$$

where $P_{c\max}$ is the maximum crossover probability, $P_{c\min}$ is the minimum crossover probability, f' is the better adapted of the two parent individuals to be crossovered, $f_{\max}$ is the most adapted individual in the population, and $f_{\arg}$ is the average adaptation of the population.

For population two, whose main role is to focus on the local search for optimal individuals, the cosine crossover operator is used in contrast to population one, see Eq:

$$P_{c1} = \begin{cases} \frac{P_{c\max} + P_{c\min}}{2} + \frac{P_{c\max} - P_{c\min}}{2} * \cos\left(\frac{f' - f_{avg}}{f_{\max} - f_{avg}} * \frac{\pi}{2}\right) & f' \ge f_{avg} \\ P_{c\max} & f' < f_{avg} \end{cases} \tag{23}$$

For the crossover operation, this paper adopts a single-point crossover, so that the crossover operation avoids the conflict of the elements of Civic and Political Education between classes, which in turn generates two new offspring.

After the crossover operation is completed, a competition mechanism is introduced, for the two parents and two children, the fitness values of these four individuals are calculated, and the two individuals with large fitness are selected to continue the subsequent operation of mutation by probability, which is beneficial to retain the higher quality individuals.

2.3.7. Variational probabilities and operations. Population two focuses on local search, so it adopts an ordinary variation probability P_{m2}, and the variation probability is generally taken between 0.005 and 0.1. While population one focuses on global search, a large variation operator is used, and the variation probability P_{m1} of population one is defined in Eq:

$$P_{m1} = \begin{cases} 2 * P_{m2} & f_{\max 1} - f_{avg1} > f_{\max 2} - f_{avg2} \\ 4 * P_{m2} & else \end{cases} \tag{24}$$

For the variation operation, after selecting an individual of the moderation program, the individual is classified by class code, and a [0, 1) number is randomly generated, and if the number is less than the variation probability Pc, the Civic Education element of the moderation schedule of a class is randomly selected, and a variation position is randomly selected under the schedule of that class, and a new class time is assigned to the course time at that position.

2.3.8. Migration between two populations. At each iteration, after both populations have completed selection, crossover and mutation operations, the optimal individuals in population one and population two are selected for exchange, respectively. After the exchange of the optimal individuals of both populations is completed, a random number num is generated to randomly select num individuals in population one to be exchanged with num individuals in population two.

3. Intelligent path planning results

3.1. Illustrative examples

The example solved in this paper is an example of the moderation of the Civic Education element of a physical education course based on data from the second semester of 2023 at a university. The number of weeks of class scheduling is 18, five working days a week, each working day is divided into five time slots, and one time slot is a class with two consecutive subsections. Two time slots in the morning, two time slots in the afternoon, and one time slot in the evening.

3.2. Parameterization

The parameters required for the solution process, the effect of the values of each parameter on the convergence of the individual objectives, can be determined qualitatively from the theory of improved two-population genetic algorithms as well as obtained by analyzing some experiments.

3.2.1. Population size. Experimental groups 1 to 3 were tested with population sizes: 200, 150, and 100 respectively, and the results of 5 runs were randomly recorded for each group of experiments. The experiments do not limit the number of evolutionary generations until the end of the program when there is a joint solution (a solution without conflicts), and the time to obtain a joint solution based on the experiment is used as a measure of the efficiency of the algorithm.

The effect of population size on the efficiency of the regulation of the elements of ideological education is shown in Figure 1. It can be seen that selecting a larger population can significantly

improve the efficiency of the algorithm, and the larger the population, the higher the efficiency of the genetic algorithm. However, it cannot be increased without limit, for this thesis Civic Education Element regulation program, after several tests, it is proved that the efficiency is higher when the population size is between 100-250, and the average time of Experiment 1, Experiment 2, and Experiment 3 are 158.2s, 243.8s, and 350.2s, respectively. Here in this paper a population size of 200 is used.

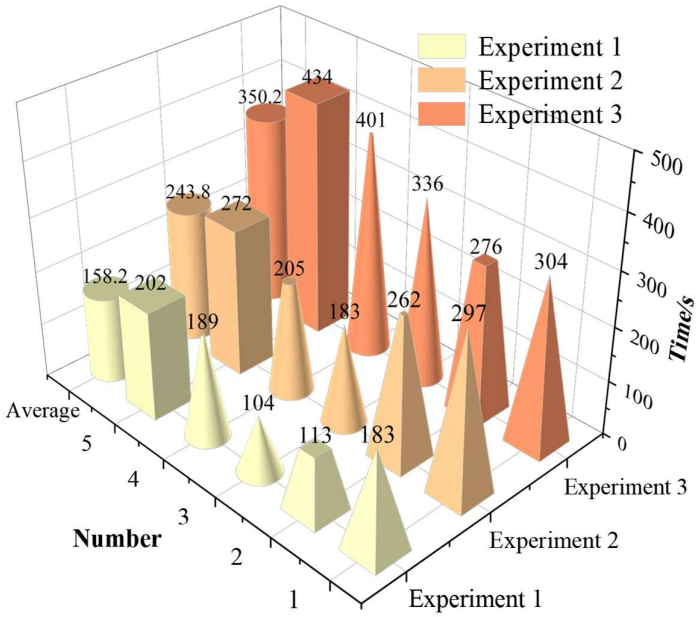

Fig. 1. The affection on the regulatory efficiency of the population size

3.2.2. Crossing probabilities. The size of the crossover probability determines the frequency of the crossover operation; the higher the frequency, the faster it can converge to the most promising optimal solution region. Therefore, a larger crossover probability is generally chosen, but too high a crossover frequency may also lead to premature convergence and not be able to perform a better global search. The general value of the crossover probability is between 0.4 and 0.9, and this paper focuses on multiple experiments with crossover probabilities of 0.8, 0.7, and 0.6 (corresponding to Experiment 1 to Experiment 3).

Taking 5 samples from each group of experiments, the results of the influence of the crossover probability on the modulation efficiency of the elements of ideological education are shown in Figure 2. It can be seen that the impact of different cross-probability experimental results, although there are differences, but there is no theoretical large differences. After comparison in the next experiment on the cross probability of 0.8, its average time spent is the shortest, 173.4s.

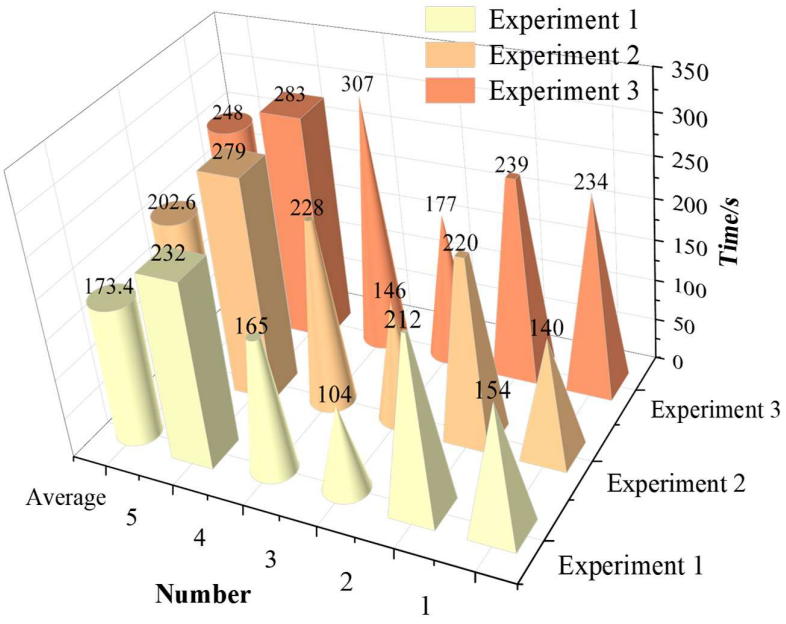

Fig. 2. The affection on the regulatory efficiency of the crossover rate

3.2.3. Probability of variation. Too large a mutation probability can easily cause instability in the genetic algorithm used for scheduling. For example, in a chromosome consisting of 100 genes, when the crossover probability is 0.1, it means that each chromosome will have an average of about 10 genes mutated during each evolutionary operation, so that a large number of mutations not only can't evolve good individuals, but on the contrary, it will make each chromosome extremely unstable, and a large number of illegal, i.e., conflicting, Civic Education Element regulation programs will appear.

The probability of variation is too small, which makes the global search difficult to be carried out, and because the probability of variation is too small, it is difficult to have a better pattern to be generated, which may lead to certain resources not being allocated reasonably or not being utilized in the actual program. Therefore, in the case of relatively tight resources for regulating the elements of Civic Education, it is often impossible or not easy to discharge the regulation program.

When the mutation operation is carried out in the algorithm of this paper, two genes are changed in each individual mutation once. This paper focuses on the mutation probability of 0.02, 0.005, 0.0002 for a number of experiments.

Taking five sampling results from each group of experiments, the effect of mutation probability on the modulation efficiency of the elements of ideological education is shown in Figure 3. The difference of experimental results of different variation probability is large, the average time of variation probability of 0.02, 0.005, 0.0002 is 315.2s, 160.4s and 485s respectively. 0.005 is adopted as the variation probability of this algorithm after comparison.

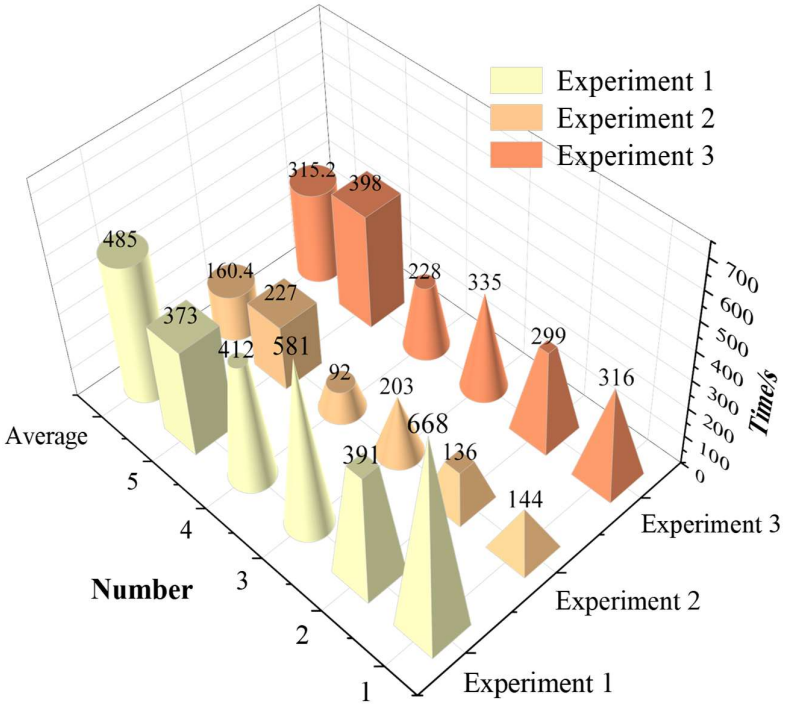

Fig. 3. The affection on the regulatory efficiency of the mutant rate

3.3. Experiments on solving effect

The IDPGA algorithm of this paper is compared with the standard genetic algorithm (GA) as well as the DPGA algorithm. In this case, the standard genetic algorithm, the selection operation uses the roulette wheel method, and the crossover and mutation operations use the stochastic two-point crossover method using the optimal individual retention method. The coding scheme, initialization population, scheduling conflict elimination, fitness function design and genetic algorithm related parameter settings in the relevant operations of the standard genetic algorithm and DPGA algorithm are consistent with this paper. The relevant values are the average results of several experiments conducted on the experimental data of the Civic Education Element Regulation.

The fitness function values of the three genetic algorithms are shown in Figure 4. The standard genetic algorithm reaches convergence in about 600 generations. The DPGA algorithm enters convergence at about 480 generations, and although the convergence speed is medium, the value of the fitness function is much higher than that of the standard genetic algorithm. The improved two-population genetic algorithm designed in this paper enters convergence at about 300 generations, and it has the characteristics of fast convergence speed and strong global search ability, and the adaptation degree is improved by 2.04% on average compared with the DPGA algorithm, and there is a clear evolutionary trend in the adaptation degree, which indicates that the chromosome coding and the adaptation degree function designed in this paper can better reflect the demand for the modulation of the elements of the Civic and Political Education.

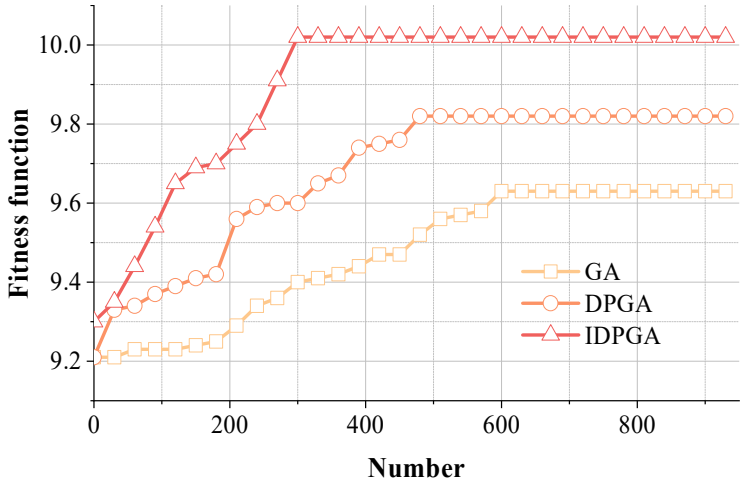

Fig. 4. The fitness function of three genetic algorithms

The fitness function values of the objective function are shown in Table 1. The average values of the fitness function of the genetic algorithm, the two-population genetic algorithm and the improved two-population genetic algorithm of this paper for the regulation objectives of the elements of the ideological and political education are 0.745, 0.772 and 0.842, respectively, and the fitness function of the improved two-population genetic algorithm of this paper is basically better than that of the standard genetic algorithm and the two-population genetic algorithm. Among them, the highest fitness function value is 0.914, which indicates that the IDPGA algorithm is more scientific and reasonable for the class arrangement of the elements of ideological education in physical education.

Table 1. The fitness function of the target function

	GA	DPGA	IDPGA
Reasonable daytime separation	0.672	0.783	0.831
For the class, daily uniform arrangement	0.684	0.837	0.914
In class, no more than 3 hours in week class	0.821	0.709	0.786
Reasonable planning class per week	0.684	0.882	0.837
Cross-matching	0.755	0.715	0.892
Gym time	0.824	0.674	0.769
Reasonable arrangement of the classroom	0.778	0.805	0.864
Average	0.745	0.772	0.842

3.4. Analysis of regulation results

To solve the results of the moderation of the elements of intellectual and political education (IPE) in physical education in a university, the results of the moderation of the elements of intellectual and political education are shown in Table 2. The utilization rate of the IPE element in this arrangement is 0.87, the number of occupied classrooms is 8, the classroom utilization rate is 0.83, the course desired time satisfaction is 0.82, the teacher desired time satisfaction is 0.85, the section superiority is 0.78, the class interval superiority is 0.81, and the uniformity of the distribution of class courses is 2.3. Based on the optimization objectives mentioned above, it can be seen that this IPE element regulation generated physical education schedule has a high degree of superiority, and the method of using this intelligent algorithm to regulate the elements of Civic and Political Education in physical education is feasible and effective.

Table 2. The regulatory results of the ideological and political education elements

Course name	IPE elements	Teacher	Class time	Venue point
Badminton	Element A	Teacher A	Tuesday 3-4	Gymnasium 102
Table tennis	Element B	Teacher B	Wednesday 7-8	Gymnasium 108
Gymnastics	Element B	Teacher C	Wednesday 9-10	Gymnasium 105
Football	Element A	Teacher A	Thursday 7-8	Gymnasium 113
Shuttlecock	Element C	Teacher D	Friday 9-10	Gymnasium 107
…	…	…	…	…

4. Pathways to building a culture of mindfulness in physical education and sports teaching

In this paper, by constructing a model to intelligently regulate the elements of ideological and political education in the physical education curriculum, integrating ideological and political education into the physical education curriculum for the construction of ideological and political education in the physical education curriculum can cultivate the students' good qualities, promote the students' physical and mental health, and realize the students' all-round development. The following discusses the construction path of curriculum ideology and politics in physical education from the three levels of students, teachers and schools.

4.1. Student level

In the ideological construction of sports courses, students in colleges and universities should change their inherent way of thinking, study actively, and integrate classroom content through diversified learning methods, so as to achieve the purpose of unity of knowledge and action. First of all, students should realize the close connection between sports and health, pay attention to their physical and mental health, and gradually cultivate regular exercise habits, good dietary habits and positive attitudes towards life. Secondly, they should enrich their learning methods and adopt the blended learning method of independent learning and collaborative learning. Finally, expand extracurricular sports activities. Take the initiative to participate in sports club activities and other sports events to enhance teamwork, leadership and communication skills, and form a sense of collective pride and honor.

4.2. Teacher level

Teachers innovate their teaching methods according to the collision of different Civics elements and teaching contents, guiding the physical education classroom to produce the effect of Civics education and realize the purpose of teaching and educating people. On the one hand, they actively participate in relevant teaching training, expert lectures teaching observation and other activities, study relevant guiding documents or syllabi, and accurately grasp the teaching direction and methods of Civics and Politics in physical education courses. In the teaching process, actively integrate the elements of Civics and Politics, and make students learn Civics and Politics and improve their moral cultivation through interactive teaching methods such as case teaching, role-playing, and situational simulation. On the other hand, we have more exchanges and cooperation with teachers of Civics disciplines to discuss how to integrate Civics education into the teaching of different disciplines, and in the design of lesson plans, we focus on operativeness, applicability and effectiveness, to ensure the organic combination of Civics education and skills training, so that the teaching method can develop in a more comprehensive direction.

4.3. School level

Colleges and universities should pay attention to the construction of the sports course ideology and politics, integrate and deploy resources, and improve the construction of the curriculum system of

the sports course ideology and politics. First of all, the construction of sports program ideology and politics should be incorporated into the overall development planning and education and teaching reform of the school, and the important position of sports program in the overall development of students should be clarified. Secondly, design the core workflow of the integration of sports curriculum ideology and politics, through the establishment of a multi-departmental collaborative leadership group, responsible for the overall planning and coordination of the promotion of the integration of sports curriculum ideology and politics. All relevant departments work in close contact to integrate and deploy internal and external resources, including teacher resources, teaching facilities, and technical support. Finally, a long-term mechanism for the construction of the Civics and Politics of Physical Education Program is established, including a teaching management system, a teacher training system, a teaching evaluation and incentive mechanism, etc., to ensure the effectiveness and continuity of the Civics and Politics of Physical Education Program construction.

5. Conclusion

Incorporating elements of Civic and political education in physical education can promote the achievement of student literacy goals in colleges and universities. Based on the regulation of Civic and political education elements in physical education teaching, this project constructs a multi-objective optimization model and solves it by using an improved two-population genetic algorithm. And take the physical education course of a university as an example for case study, the research results are as follows:

1) The three genetic algorithms were compared with the experimental results of the regulation of the elements of Civic and Political Education. Under the same experimental conditions, the improved two-population genetic algorithm in this paper is better than the standard genetic algorithm and two-population genetic algorithm in terms of the value of the fitness function and the speed of convergence, and it completes convergence in 300 generations of iterations, and its fitness at convergence is improved by 2.04% compared with that of the two-population genetic algorithm. At the same time, the average fitness function value for each Civic Education element regulation target is 0.842, which is higher than the other two methods.

2) The results of solving using the constructed multi-objective optimization and regulation method meet the requirements of physical education teaching, and the utilization rate of the Civic and political education element reaches 0.87, and the results of solving on the objective space of other factors are also more satisfactory, which to a certain extent can satisfy the actual needs of physical education teaching.

3) The construction of Civics and Politics in physical education can be started from the level of students, teachers and schools, students should change their way of thinking and enrich their learning methods, teachers should integrate Civics and Politics elements into the teaching of the curriculum and innovate the teaching methods, and the schools should integrate and deploy the resources to improve the construction of the curriculum system.

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