

# Research on Influencing Factors of College Physical Education Textbook Reform and Optimization Based on Genetic Algorithm

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**Keywords:** Genetic Algorithm, Reform of Physical Education Teaching Materials, Factors Affecting

**Abstract:** At Present, the Structure and Content of College Sports Teaching Materials Are Still Dominated by Competitive Events, and There Are Many Problems in the Construction of Sports Teaching Materials. This Paper Investigates the Current Situation of Physical Education Theory Teaching in Some Colleges and Universities in Our Country. the Author Thinks That Physical Education Theory Teaching Has a Positive Influence on College Students' Physical Behavior and the Establishment of Lifelong Physical Education Thoughts, But There Are Many Deficiencies in Physical Education Theory Teaching At Present. Based on Genetic Algorithm, the Factors Influencing the Reform and Optimization of Physical Education Teaching Materials in Colleges and Universities Are Analyzed by Factor Analysis Method. According to the Specific Characteristics of the Main Influencing Factors, the Corresponding Measures and Suggestions to Be Taken in the Reform and Optimization of Physical Education Teaching Materials Are Put Forward with the Scientific Development View.

## 1. Introduction

The New Round of Reform and Optimization of Physical Education Textbooks Has Created Good Opportunities for Innovation and Development, Provided More Platforms for Communication and Learning, and Also Provided a New Perspective for Physical Education Curriculum and Teaching Research. the Relationship between the Goals, Functions and Teaching Materials of Physical Education in Colleges and Universities Has Not Been Really Paid Attention to, Resulting in the Separation of the Teaching Materials and the Practice Process of Physical Education, Resulting in the Randomness of Physical Education and Affecting the Improvement of the Quality of Physical Education [1]. Therefore, Whether the Teaching Material of Physical Education Theory Matches with Physical Education Practice Activities Will Directly Affect Students' Understanding of Physical Education and Will Also Restrict Students' Understanding and Participation in Lifelong Physical Education. Genetic Algorithm is a Search (Optimization) Algorithm Based on Natural Selection Principle and Natural Genetic Mechanism. It Simulates the Evolution Mechanism of Life in Nature and Realizes the Optimization of Specific Objectives in Artificial Systems [2]. in Order to Better Meet the Needs of China's Higher Education Reform and Training Objectives, We Will Further Set Up a Teaching Material System for the Undergraduate Students of Physical Education in China's Ordinary Colleges and Universities. Based on the Understanding of Gymnastics Curriculum Objectives, We Will Construct Gymnastics Teaching Materials for the Physical Education Specialty That Meet the Current Physical Education Teaching Practice in Schools and Meet the Needs of the Social Development and the Development of Physical Education in the 21st Century.

## 2. Genetic Algorithm

Different from the traditional search algorithm, genetic algorithm starts the search process from a group of randomly generated initial solutions, called population. Each individual in the group is a solution to the problem, called chromosome. These chromosomes evolve continuously in subsequent iterations, called heredity. Genetic algorithm is mainly implemented through crossover,

mutation and selection operations [3]. The effectiveness of genetic algorithm mainly comes from reproduction and crossover operation, especially crossover, which plays a central role in GA. People's ideological exchange, academic exchange, and cross-disciplinary formed by multi-disciplinary intersection in social life are essentially the intersection of ideas and thoughts, and this intersection is fruitful, from which new ideas, concepts, inventions, and discoveries come.

Each weight represented on the chromosome is assigned to a given network structure. The network takes training set samples as input and output, and returns the reciprocal of the sum of squares of errors after operation as the evaluation function of the chromosome, as shown in Equation 1.

$$f = \frac{1}{\sum_i^n e_i^2} \quad (1)$$

In the initial chromosome set, the weights of the network are randomly determined by the probability distribution  $e^{-|\gamma|}$ , which is different from BP algorithm [4]. In the BP algorithm, the initial weight is generally a random number evenly distributed between -1.0 and 1.0.

Instead of proportional selection, the parental metric  $S$  is used to determine the probability that each individual in the population is selected. Individuals in the population become parent chromosomes with the probability shown in Equation 2.

$$\begin{aligned} P_2 &= P_1 \cdot S \\ P_3 &= P_2 \cdot S \\ &\vdots \end{aligned} \quad (2)$$

Where  $P_1, P_2, P_3, \dots$  respectively represent the probabilities of the individuals with the optimal, suboptimal, and third ... evaluation functions.

The quality of chromosomes is measured by fitness. According to the size of the fitness, a certain number of individuals are selected from the previous generation and the offspring as the next generation group, and then continue to evolve, so after several generations, the algorithm converges to the best chromosome, which is probably the optimal solution or suboptimal solution of the problem. If a bit string is regarded as a complete idea, many effective permutations and combinations of different values in different positions on the bit string form a set of ideas. The crossing of 5 bit strings corresponds to the recombination of different ideas. New ideas are generated in this recombination, and the power of genetic search is also in this.

### 3. In-Depth Analysis of Factors Affecting the Reform and Optimization of Physical Education Textbooks

The principle of primary and secondary contradiction in methodology tells us that only by concentrating on finding out the main contradiction can we find out the key, key or center to solve complex problems. As the continuous enrollment expansion in recent years has brought about serious impacts on physical education teaching in various colleges and universities, the main manifestations are as follows: the number and number of teaching classes increase, and the work burden of teachers increases; The teaching period of physical education extends to the morning and evening. There is a negative growth in the area of sports venues and a serious shortage of sports venues in universities. However, due to the fact that the unified teaching materials cannot fully meet the needs of different regions and schools, some provinces and cities have compiled corresponding teaching materials respectively. As the material basis of heredity, genes are the basic genetic units used to control biological traits. Genes are carried by chromosomes, which are the units that make up chromosomes. The infiltration of ideas such as lifelong physical education and physical education, as well as the social environment and the value orientation of individual students towards college physical education, have made the guiding ideology of college physical education teaching in our country [5]. The development of the times requires that college students not only have solid

professional knowledge and skills, but also need students to have strong physique, perfect physical and mental quality development, and be able to regard the development and improvement of physical quality as their own needs. On the basis of interviews with experts, this topic selects 17 influential factors that reflect the strongest as original variables (see table 1) for factor analysis, so as to grasp the main aspects of contradictions and correctly understand the nature and mainstream of things.

Table 1 Results of Factor Load Matrix Rotation

Serial number	Variable name	Factor 1	Factor 2
1	Students have formed the habit of lifelong physical exercise	0.145	0.223
2	Professional level of physical education teachers	0.214	0.885
3	The cognition of relevant leaders on the importance of the reform and optimization of physical education teaching materials	0.742	0.23
4	The construction level of school sports venues, equipment and other hardware supporting facilities	0.225	0.224
5	The availability of special funds for curriculum reform	0.802	0.128
6	Various incentive policies related to curriculum reform formulated by the school	0.665	0.384
7	Professional dedication of physical education teachers	0.721	0.701

Most of the existing teaching materials appear in the form of arrangement and combination of sports events, and the specific contents are also arranged according to the sequence or difficulty degree of sports technology. This is a typical teaching material structure with technology teaching as the main line. In such limited class hours, surrounded by nearly 200 technical movements, it is difficult to form a special interest in a certain event, let alone to form the habit of exercise, and lifelong sports has become empty talk. Binary code is the most commonly used code. Binary code is very simple and practical, and it is also very similar to the chromosome composition of organisms. It can be well explained by biological genetics theory and is also very convenient for genetic algorithms to carry out various genetic evolution operations [6]. It is necessary for college sports to follow the general rules of college sports teaching development according to the development of the times and the training objectives of college talents, and to accurately grasp the direction of college sports development and reform in order to achieve better development. In order to test whether there is a strong correlation between the original variables, KMO(Kaiser-Meyer-Olkin) test and bartlett sphericity test are mainly used. The test results show that [7]. KMO value is 0.845, which is greater than 0.6, indicating that these variables are suitable for factor analysis. Bartlett's sphericity test results show a concomitant probability of 0.000, which is also considered suitable for factor analysis. From the results of "square sum of factor load after rotation" in Table 2, it can be seen that the 4 common factors extracted from the initial solution according to a certain standard (eigenvalue is greater than 0.8) reflect most (75.255%) information of the original variables.

Table 2 Results of Factor Extraction and Factor Rotation after Factor Analysis (Interpretation of Total Variance)

Factor	Initial eigenvalue			The extracted sum of squares of initial factor loads			Square sum of factor load after rotation		
	Total	Contribution rate	Cumulative contribution rate	Total	Contribution rate	Cumulative contribution rate	Total	Contribution rate	Cumulative contribution rate
1	5.361	47.564	47.808	5.4567	47.084	47.815	3.771	26.401	20.654
2	1.401	10.241	58.246	1.406	11.981	58.642	2.463	20.364	46.594
3	1.092	8.712	68.143	0.823	8.227	68.142	1.962	13.251	60.221
4	0.815	6.912	75.552						
2	0.665	5.506	80.487						

### 3.1 Management Factor is the Most Important Factor Affecting the Reform and Optimization of Sports Teaching Materials

At present, there are many researches on the strategy of college students' sports development, but the research on the specific steps to realize the strategy and how to implement it in the aspects of

curriculum setting, teaching materials construction, teaching methods, etc. is relatively lagging behind, and the compilation of syllabus and curriculum planning are still based on learning. The training goal of physical education specialty in our country refers to the basic requirements of training the educated to be the people with certain social needs. It stipulates the basic specifications and quality standards of the people to be trained [8]. From the point of view of sports, the process of sports is a dissimulation process that consumes the human body's material and energy, and it is also an inducement process that leads to strengthening the body. The process that produces the results of strengthening the body also requires the recovery and maintenance process after sports. Therefore, the teaching materials that emphasize sports and neglect maintenance are incomplete teaching material systems. Various incentive policies related to the reform, periodic evaluation of the effectiveness of the curriculum reform by higher authorities, and instant evaluation of the optimization of the reform of physical education teaching materials by relevant school management departments can be summarized as “management factors”. as can be seen from table 2, the contribution rate of this factor is 25.336%, which is the highest among various characteristic factors. therefore, the reform of physical education teaching in colleges and universities in the new period is the self-demand of the development of physical education in colleges and universities. only through continuous reform can the physical education teaching in colleges and universities obtain new development, maintain fresh vitality and give full play to the educational effect of physical education.

The reform and optimization of physical education teaching materials in schools need the guarantee of manpower, material resources, financial resources and time. These guarantees depend on the attention and support of school leaders. Teachers lack autonomy in selecting physical education teaching materials and often use the same set of teaching materials all the year round. The contents of the teaching materials are not only outdated, but also cannot be effectively close to the teaching objectives of physical education in colleges and universities and divorced from students' reality. Therefore, the attention and support of school leaders directly determine whether the reform and optimization of physical education teaching materials can be carried out normally and the quality of the reform and optimization of physical education teaching materials, which undoubtedly becomes a very important factor affecting the reform and optimization of physical education teaching materials. At present, there are a series of administrative routine restrictions on the general pattern of physical education in colleges and universities, the guiding ideology of running a school, the curriculum setting and the compilation of the syllabus. It is difficult to keep pace with the new scientific research results in time, and the teaching materials under the guidance of the syllabus are also difficult to “set new standards”. The training objectives are dynamic. The times are changing, society is developing and history is advancing. The training objectives should be updated accordingly. And scientific decision-making is the main content of leadership work and the key link to promote scientific development. Therefore, whether scientific decision-making can be achieved becomes an important criterion to test the ability of Party committees at all levels to implement the scientific development concept.

### **3.2 Physical Education Teachers Play a Subjective Role in the Reform and Optimization of School Physical Education Textbooks**

The second factor reflects variable information such as “PE teachers' professional level”, “PE teachers' professionalism”, “PE teachers' awareness of the importance of curriculum reform”, which can be summarized as “PE teachers' factor”. Currently, class teaching system is mainly adopted, and the teaching time is relatively fixed, which is not suitable for the new teaching mode in colleges and universities, so it is difficult to play its positive role. The singleness of teaching mode in colleges and universities not only leads to the weakening of students' interest in physical education, but also directly affects the improvement of teaching efficiency in colleges and universities. The compilers of teaching materials should have a high sense of responsibility, be familiar with the contents they compile, have considerable teaching experience and good writing skills, and understand the frontier and development trends of the subject knowledge, so as to compile a level teaching material.

However, this is not the case. Some of them are only nominal and the actual writers are others. Physical education teachers are guides and promoters of students' development, designers and organizers of learning activities in physical education classes. They play a subjective role in the reform and optimization of school physical education teaching materials. Some physical education scholars in China have begun to introduce lifelong physical education. From the connotation of this concept (which refers to lifelong physical exercise and fitness education), we can see that school physical education is a stage of lifelong physical education. It is an introduction period and a critical period. It not only ensures students' health and growth, but also lays a foundation for physical exercise after graduation.

Therefore, as a physical education teacher, besides having good personal and professional qualities, one should also fully understand the importance of reform and the sense of social mission, devote oneself to one's job and love one's post, constantly innovate, and have a strong sense of reform, cooperation spirit and ability to develop physical education courses. In traditional teaching, PE teachers in colleges and universities lack innovative ideas in teaching. Most PE teachers' teaching methods are single, stylized and have serious empiricism. Although this traditional teaching method has certain advantages, it is difficult for students to maintain lasting attention and interest. The goal of school physical education must be based on the function of school physical education. In other words, the establishment of school sports goals is based on the function of school sports. This requires that the graduates of physical education major sent to primary and secondary schools should have a solid foundation, a wide range of knowledge, strong ability and high quality. There is no doubt that these changes will definitely put forward new and higher requirements for the reform of teaching content or curriculum system of physical education major. Adapting to the requirements of quality education and the development needs of the student-centered physical education reform, we can shoulder the important task of curriculum reform only when we present it in front of students with a brand-new appearance.

### **3.3 The Construction of Curriculum and Curriculum Supporting Resources is an Important Guarantee to Realize the Reform and Optimization of Physical Education Teaching Materials**

The third factor mainly reflects the information of two variables: “the degree of construction of school sports venues, equipment and other hardware supporting facilities” and “the actual level of school-based physical education curriculum construction”. At present, the evaluation system of physical education in colleges and universities has not made any positive adjustment according to the development of the times. The evaluation system is relatively backward, mainly manifested in unscientific and imperfect evaluation indexes, which attach importance to learning results, neglect the evaluation of learning process, and attach importance to the development of students' physical education skills. Physical education teaching objectives and teaching materials are mutually restricted and interdependent. First of all, physical education teaching objectives determine the direction and scope of selecting physical education teaching materials. Only when the selection of physical education teaching materials conforms to certain teaching objectives can it be a useful “material”. Both the national curriculum and school-based curriculum emphasize the development of students as the center, but the national “curriculum standards” cannot put forward corresponding and targeted suggestions for the teaching implementation in each city and school, only the goals and directions can be put forward. Neglecting the evaluation of students' physical education learning quality development and singleness of evaluation subjects lead to one-sided evaluation results, which cannot play a guiding role in evaluation. Nowadays, the goal of gymnastics curriculum is formulated according to the training goal of physical education major and the characteristics of gymnastics. The selection and arrangement of gymnastics teaching materials are only useful materials if they conform to the gymnastics teaching goal and can contribute to the realization of this goal.

The construction, development and utilization of curriculum supporting resources is an important guarantee to realize the objective of physical education curriculum. Physical education curriculum is taught mainly by physical exercises, and its teaching place is mainly outdoors. The reform of

sports teaching materials involves content selection, teaching method research, organizational measures, evaluation, etc. The reforms in these areas are ultimately influenced by the target ideology. Therefore, the construction and reform of teaching materials, as a key link of college physical education reform, must also be guided by the goals of school physical education. However, previous gymnastics teaching emphasized mastering the quantity and difficulty of skills, and raised the goal of gymnastics curriculum from the technical teaching level. What students learned after employment was not used in school physical education teaching and community guidance, while the basic skills they learned were not well learned, which led to some deviations in people's understanding of gymnastics teaching. Therefore, colleges and universities must establish new ideas for the construction of the physical environment for sports, increase the investment in sports funds, strengthen the construction of sports venues and facilities, and incorporate the construction of school sports facilities into the overall physical and cultural construction plan of the school. Physical education teachers in colleges and universities should further optimize the existing teaching material system, and further improve the pertinence of teaching materials according to the teaching objectives, school conditions and learning conditions of colleges and universities so as to make them better close to the school conditions and learning conditions so as to give full play to the knowledge carrier function of the existing teaching materials.

### **3.4 The Realistic Sports Demand of Students is the Direction Target for the Reform and Optimization of Sports Teaching Materials**

The fourth factor mainly reflects the content of the two variable information of “lifelong physical exercise habits formed by students” and “cognition degree of students on the function and value of physical education”, which can be summarized as “student factor”. Its factor contribution rate is 14.235%, and it is also an influential factor that cannot be ignored. The relative stability of college physical education teaching materials has brought about the lag of content, and its pertinence is not strong. We also need to perfect the existing teaching material system. Colleges and universities should strengthen the awareness of studying teaching materials and actively explore the development of school-based teaching materials through studying different versions of teaching materials. If college students want to learn their favorite sports skills well, they will certainly use various opportunities to strengthen the training of physical fitness. Sports ability and physical quality complement each other and improve together. Therefore, when compiling teaching materials, we must fully consider the relationship between the two and try our best to combine the contents of physical fitness exercises with the contents of sports techniques skillfully and organically. The process of physical education teaching in the new era should be said to be a process of interaction between learning subjects (students) and education subjects (teachers). Physical education teachers have changed from traditional teachers of sports skills to modern teachers of students' sports literacy and health literacy. The formation of physical education consciousness and habits is not based on the macro theory and concept of physical education, but on a specific sports event. The “hodgepodge” type of physical education teaching will inevitably be eliminated. Therefore, in the future, the construction of college physical education teaching materials must also be based on the curriculum reform and development to compile teaching materials.

The unique essential function and value of physical education are irreplaceable by other social phenomena and things. It is of distinct epochal and scientific nature. For students, the function and value of physical education can be summarized as “cultivating body” and “cultivating heart”. Lifelong physical education should be integrated into the theoretical teaching content, with emphasis on cultivating college students' sports consciousness and sports cultural accomplishment. Conscious sports consciousness can enable college students to adjust their sports styles according to changes in social conditions and participate in physical exercises for life after entering society. For example, command queue formation exercises, instruction in classroom organization and teaching, reasonable application of gymnastics teaching methods, protection and help in teaching, etc. Attention should be paid to strengthening the guidance and education of sports values, and efforts should be made to stimulate students' enthusiasm and interest in participating in sports, and various

forms of extracurricular sports competitions should be carried out in combination with the actual situation. However, any teaching mode needs constant innovation in order to continuously enhance its influence and attraction. Therefore, colleges and universities should further deepen the traditional teaching mode, optimize the form or mode, enhance the interest of physical education teaching, and combine teaching with pleasure.

#### 4. Conclusions

In short, the reform of physical education in colleges and universities is urgent and of great significance. Physical education teachers in colleges and universities should further enhance their professional sense of mission, emancipate their minds, change their teaching concepts, strengthen practical exploration and reflection. Starting from the current situation of physical education in colleges and universities, they should deeply dissect the factors that restrict the development and promotion of physical education in colleges and universities. Genetic algorithm is used to optimize posture prediction, which effectively solves the prediction problem of influencing factors in the reform and optimization of teaching materials. Fully understand the important role of the influencing factors of the reform and optimization of physical education teaching materials. Strengthen the research work on the construction of teaching materials, strengthen the research on the theory and guiding ideology of physical education teaching in colleges and universities, as well as the systematic research on teaching syllabus, curriculum setting and teaching methods, etc., and discuss how to write the latest research results into the teaching materials in time, and reflect the influence of marginal disciplines and cross disciplines on physical education in colleges and universities. Establish an information feedback system through follow-up investigation to master the feedback of teachers and students on teaching materials. Absorb advanced gymnastics theoretical knowledge and scientific research achievements as much as possible, and make necessary elimination and updating of the original knowledge content to meet the needs of today's society.

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