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Article

Intelligent Integration of Civic and Political Elements in Physical Education Teaching and Design of Personalized Learning Paths

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Abstract: Based on the application value of Civics and Politics elements in physical education teaching, this paper constructs a personalized management framework that includes learning state feature analysis, learning effectiveness prediction, teaching intervention decision-making and other parts, and utilizes the techniques of reinforcement learning algorithms and $Q-$ functions to study students' behaviors and assist teachers in decision-making. The Civics element is integrated into the personalized management framework of physical education teaching, and the effectiveness of the method in improving students' Civics cognition, physical fitness, and mental health is studied through comparative experiments. In the comparison of the level of civic and political cognition, the P-values of seven indicators such as national self-confidence and three indicators such as the spirit of striving are less than 0.05 after the experiment, which proves that the approach of this paper can significantly improve the level of students' civic and political cognition. In the comparison of physical condition, the P-value of 6 indicators such as 50-meter running after the experiment is less than 0.05, and the physical quality of the students in the experimental class is significantly better than that of the control class, which proves that this paper's approach can effectively improve the physical quality of the students. In the comparison of mental health, the P-value of 5 indicators such as depression factor after the experiment is less than 0.05, and some indicators are less than 0.01, and the mental health of the experimental class is significantly better than that of the control class, and the learning path of this paper also has a certain role in promoting students' mental health.

Keywords: civic elements; physical education; learning effectiveness prediction; reinforcement learning algorithm; $Q-$function

1. Introduction

With the current rapid development of modern information technology, artificial intelligence has covered all industries, bringing great influence to people's work, life and learning, and the way and method of education has also changed dramatically [1]. The construction of sports course ideology and politics should also think about how to use artificial intelligence technology to change the traditional teaching methods of sports courses, better integrate the elements of ideology and politics into the teaching process, and achieve a win-win effect of physical exercise and ideological and political education [2-4]. In-depth implementation of the curriculum reform of the current stage of physical education and ideological and political teaching is an important way to improve the feasibility of ideological and political education.

Promoting personalized teaching methods is a practical need to enhance the teaching of sports ideological and political education [5]. Artificial intelligence is able to accurately and efficiently

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analyze and process the information obtained in real-time tracking and obtaining the teaching scenarios of sports ideology and politics, as well as presenting the thinking and personality characteristics of each student in a comprehensive and detailed manner [6-7]. This helps teachers of sports ideology and politics courses to conduct in-depth exploration and application of teaching methods with high precision and strong personalization, thus providing a good environment to meet the needs of personalized sports learning of college students [8-9]. In addition, artificial intelligence can create a dynamic, open and immediate learning environment for sports ideology and politics, and can effectively process students' sensory information such as hearing, touching and vision, so that students can change from passive acceptance to active adaptation, discovery and thinking, and help them to actively explore personalized sports ideology and politics learning methods [10-11]. Based on this, the study tries to explore the innovative mode of sports course Civics teaching in the context of the evolution of artificial intelligence, based on the actual situation, adopting corresponding measures to optimize and improve, so as to make the teaching of sports course Civics in colleges and universities more scientific, to ensure the ultimate effect of educating people, and to provide reference for the vast number of sports and Civics educators [12-14].

This paper designs a personalized management framework for physical education for analyzing students' learning states and enhancing teachers' decision-making. The framework contains three main parts, namely, characterization of students' learning status, prediction of students' learning effectiveness, and decision-making of teaching interventions based on reinforcement learning. Civics elements are integrated into the personalized management framework and applied to physical education teaching. The experimental class 1 and the control class 2 are selected to analyze the changes in the level of Civics and Politics cognition, physical fitness status, and mental health status of the two classes before and after the experiment. To study the difference between the teaching method of integrating Civics and Politics elements into the personalized management framework of physical education teaching and the conventional physical education teaching method, and to explore the role of the former in improving teachers' decision-making level and promoting students' personalized development.

2. The application value of integrating the elements of Civics and Politics into physical education teaching

This part analyzes the application value of integrating the elements of ideology and politics into physical education teaching from the aspects of “cultivating students' socialist core values” and “implementing the fundamental task of educating people for virtue”.

2.1. Cultivate students' core socialist values

Socialist core values centrally embody the spirit of contemporary China, encapsulate the common value pursuits of the Chinese people, and are the spiritual bond that unites people's hearts and mobilizes collective strength. Figure 1 demonstrates the structure of cultivating students' core literacy in teaching. The physical education program in colleges and universities plays a crucial role in the moral cultivation of college students by providing diverse practice scenarios. These scenes provide a platform for students to deeply understand and identify with socialist core values. Therefore, by making the physical education curriculum in colleges and universities an intelligent conversion platform, students can not only internalize these values, but also externalize them, and cultivate democracy, the rule of law and the spirit of dedication among the student body.

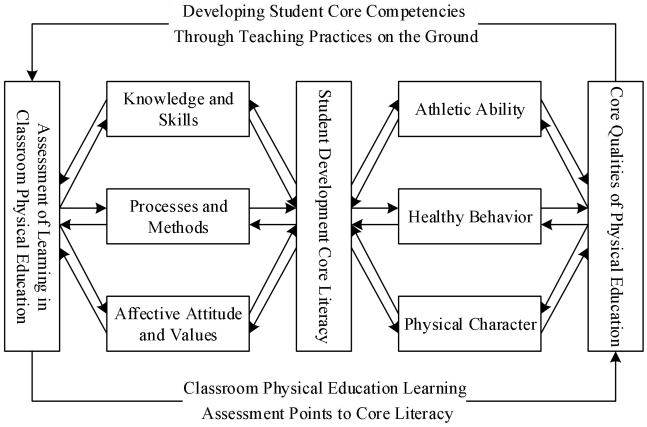

Figure 1. Structure of cultivating students' core literacy

2.2. Implementing the fundamental task of education for moral education

Physical education teaching should adhere to the student-centered development of education, comprehensively implement the education policy, and implement the fundamental task of establishing moral education. Incorporating diversified ideological and political elements into the curriculum not only enriches the content of physical education, but also allows students to receive comprehensive ideological cultivation and moral education while exercising. These ideological and political elements can include historical stories, heroic deeds and other key history of sports development, as well as emphasizing the principles of honesty and fair play in sports activities, guiding students to abide by the rules and respect for opponents, and promoting sportsmanship, thus enhancing the moral level of students and cultivating the qualities they should possess as modern citizens.

3. Personalized management framework design for physical education

The generic framework design for personalized management of school physical education instruction consists of data acquisition, learning state characterization, effectiveness prediction, analysis and evaluation, and instructional decision making. Figure 2 shows the generic framework for personalized management of school physical education. Among them, data acquisition is an important guarantee for learning state characterization, learning state characterization is a prerequisite for learning effectiveness prediction, learning effectiveness prediction is the basis for the implementation of personalized management of teaching, and instructional decision-making is the key to ensure the effective implementation of personalized management of teaching.

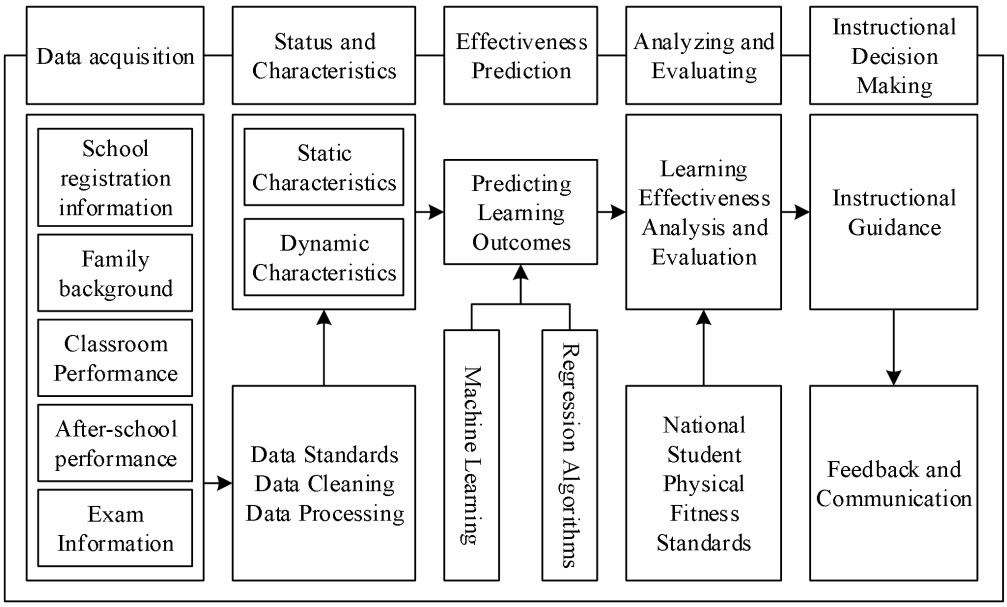

Figure 2. Personalized management frame work for physical education teaching

According to the individual learning state characteristics of each student, a correspondence relationship is constructed between students' learning state characteristics and teaching decisions, and a customized personalized teaching guidance plan is provided for each student. The problem of personalized management of teaching is transformed into a problem of optimization of teaching decision, and a corresponding general framework model is established. The model is based on the characteristics of students' learning state to find the best teaching guidance plan to enhance students' learning effectiveness.

3.1. Learning state characteristics

The prerequisite for the effectiveness of instructional management lies in the accurate identification of students' learning status characteristics. Only through in-depth analysis of students' learning status and learning behaviors can we provide them with targeted guidance and support, thus promoting the maximization of students' learning effects.

Students' learning status characteristics can be divided into static and dynamic characteristics. Static characteristics are mainly students' relatively stable personal identity information, including school number, name, height, weight, gender, age, ethnicity and other characteristics. Dynamic features are mainly students' relatively changing learning behavioral characteristics, including the degree of fondness for a subject, class attendance, after-class practice, and surrounding environmental factors. Through the data of students' learning status characteristics, we can carry out the prediction analysis of students' learning effectiveness, and make targeted teaching improvements and teaching decisions based on the learning characteristics, and the learning status characteristics are an important prerequisite for the personalized management of teaching.

3.2. Predictive modeling of learning effectiveness

Predictions of learning outcomes are the foundation of personalized management of instruction. Predicting learning outcomes helps to assess the effectiveness of teaching and learning and is essential for improving teaching strategies. The constantly changing state and characteristic information of students in the learning process also provides an important data base for learning effectiveness prediction. In this paper, the personalized management framework for physical education is designed to use linear regression analysis to predict learning effectiveness, conduct correlation analysis, and carry out significance tests through the influence of learning state characteristics on learning effectiveness.

Multiple linear regression analysis in linear regression modeling refers to the introduction of multiple explanatory variables to describe the linear relationship between the explained variables and these explanatory variables. This approach allows for a more comprehensive exploration of the effects of each explanatory variable on the explained variables, providing the researcher with more accurate and comprehensive analytical results. Usually there is a correlation before there is a regression impact relationship, so generally before conducting a linear regression analysis, you need to check the correlation between the data, check the relationship between the independent variables and the dependent variable, and remove the variables that do not have a correlation. A significance check is performed to show the significance of multiple independent variables X for the dependent variable Y . The significance check consists of two parts: a significance check for multiple independent variables versus the dependent variable as a whole (the F -check), and a significance test for the effect of each independent variable on the dependent variable (t -test), both of which are significance tests for linear regression. Finally, multiple linear regression analysis was conducted to obtain the regression model formula. The regression model formula was used to carry out the prediction of learning effectiveness.

Students' physical education performance is affected by a variety of comprehensive factors, such as age, height, weight, learning level, training level, field environment, psychological state, etc. The stochastic expression of the overall regression prediction function is as follows:

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_i X_i + \mu_i \; i = 1,2,3,\ldots,n \tag{1}$$

Neglecting the field environment, psychological condition and other random uncertainties, and the most important factor is the physical fitness situation, i.e., there is a causal relationship between height, weight, lung capacity and sports performance, the non-random prediction function expression model can be set as follows:

$$\hat{Y} = \beta_0 + \beta_1 X_{ui} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki} i = 1,2,3,\ldots,n \tag{2}$$

3.3. Decision Making for Instructional Interventions Based on Reinforcement Learning

3.3.1. Overview of Enhanced Learning

A standard reinforcement learning setup consists of an intelligent body and an environment with which it interacts. Among other things the intelligent body refers to the subject performing the task, which acts according to the current state of the environment and adapts its strategy or value function based on the feedback from the environment in order to make better decisions during future interactions. The environment refers to the external world in which the intelligent body is located, which contains all the information that the intelligent body needs, such as the current state, optional actions, rewards after performing actions, and the next state. Figure 3 shows the flow of interaction between the intelligent system and the environment in standard reinforcement learning. The intelligent body learns by interacting with the environment, and its actions affect the state of the environment and

receive corresponding reward signals. In the process of continuous interaction between the reinforcement-learning intelligent and the environment, it gradually learns what actions to take in different states to maximize the accumulated rewards by continuously trying different actions, obtaining reward signals, and adjusting its strategy or value function according to these signals. This process is similar to the way human beings learn, i.e., they gradually improve their skills and abilities through continuous trial and error.

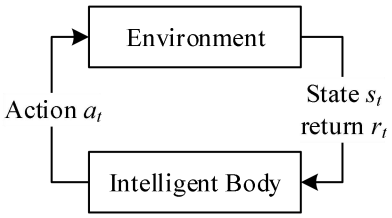

Figure 3. Interaction between intelligent system and environment

At each action execution moment t, the intelligent system accepts a state $s_t \in S$ from the environment, the intelligent system selects and executes an action $a_t \in A$ according to its current policy $\pi : S \to A$, then the intelligent system accepts a return r_t and transfers to the next state s_{t+1}, and repeats this process until the stopping condition is reached.

Classical reinforcement learning algorithms are mainly categorized into value-based reinforcement learning algorithms and policy-based reinforcement learning algorithms.

Value-based reinforcement learning algorithms are one of the most commonly used algorithms in reinforcement learning. Value-based reinforcement learning algorithms are a widely used class of algorithms in reinforcement learning, which aim to evaluate the advantages and disadvantages of taking different actions by an intelligent body in different states by learning a value function to guide the intelligent body's decision making. Q learning is one of the classical algorithms that evaluates the value of taking each action in each state by maintaining a Q value function. In each interaction, the intelligent body selects an action based on the current state, observes the next state and the reward obtained after executing the action, and updates the previous estimate based on the Q value function. Specifically, Q learning uses the Bellman equation to update the Q value function, whose basic form is shown in Equation (3):

$$Q(s,a) = Q(s,a) + \alpha\left(r + \gamma \times \max\left(Q\left(s',a'\right)\right) - Q(s,a)\right) \tag{3}$$

where $Q(s,a)$ denotes the value of taking action a in state s, r is the reward obtained by the intelligent body after taking action a from state s, s' is the next state observed by the intelligent body after executing the action, a' is the best action taken by the intelligent body in state s', α is the learning rate, and γ is the discount factor, which is used to measure the importance of future rewards.

Value-based reinforcement learning algorithms achieve the ability of an intelligent body to learn autonomously in its environment, adjusting and improving its strategies by constantly interacting with the environment and using Bellman's equation to update the value function.

Policy-based reinforcement learning algorithms are another commonly used reinforcement learning algorithm. The goal is to learn a policy function, i.e., given a state, output the probability distribution of taking each action in that state, so that the intelligent body can select the optimal action in different states, thus maximizing the rewards accumulated over time.

The most typical algorithm is the policy gradient algorithm, which optimizes the policy function through continuous iteration to maximize the long-term rewards of the intelligent body in the environment. Specifically, the strategy gradient algorithm estimates the gradient of the strategy function by sampling trajectories, where the parameters of the strategy function are updated by gradient ascent. The commonly adopted objective function is the expected reward function, i.e., Equation (4):

$$J(\theta) = E_{\pi_v}\left[\sum_{t=0}^{T} \gamma r_t\right] \tag{4}$$

Where, θ is the parameter of the strategy function, π_θ is the strategy generated according to the strategy function, T is the maximum number of time steps for each trajectory, γ is the discount factor, which is used to measure the importance of future rewards, and r_t is the immediate reward that the intelligent body gets at time t.

The main idea of the policy-based reinforcement learning algorithm is to learn the policy function directly and improve the decision-making ability of the intelligent body through continuous iterative optimization. Compared with value-based reinforcement learning algorithms, policy-based reinforcement learning algorithms are more suitable for tasks in high-dimensional state space and continuous action space, and have better convergence and stability.

3.3.2. Decision-making process for instructional interventions

The intelligent instructional intervention problem is essentially solving the optimal decision function $d^* \equiv \left(d_1^*, d_2^* \cdots, d_K^*\right)$ that maximizes the learning effect Y, i.e., the

$$d^* = \arg\max_d E\left(Y \mid A_1 = d_1^*\left(H_1\right), A_2 = d_2^*\left(H_2\right), \cdots, A_K = d_\kappa^*\left(H_K\right)\right) \tag{5}$$

This dynamic optimization problem can be solved using reinforcement learning based on backward recursive dynamic planning methods such as Q-learning. Algorithm $Q-learning$ is a widely used reinforcement learning method, where "Q" stands for quality, indicating the "quality" of the method used to evaluate each action. $Q-learning$ The algorithm assigns values to each state-action binary, called Q values, and the corresponding objective function is called the Q value function, or $Q-$function for short. Starting from the last stage, the corresponding $Q-$ function is optimized, and recursion is made to the previous stage one by one to finally get the optimal decision for the whole process.

(1) Reinforcement learning-based statistical model for intelligent instructional intervention decision-making

In Intelligent Instructional Intervention Decision Making, the student population of interest corresponds to the environment of reinforcement learning, the instructional intervention decision support system corresponds to the decision-making intelligences of reinforcement learning, the learning states and characteristics correspond to the states in reinforcement learning, the instructional interventions correspond to the actions in reinforcement learning, the value-added learning effect corresponds to the rewards of reinforcement learning, the instructional intervention decision function corresponds to the strategies of reinforcement learning, and the expectation of learning effect corresponds to the reinforcement of value of learning.

In phase $k\left(k = 1, \cdots, K\right)$, the decision intelligence observes the student's learning state and characteristics $X_k \in \mathrm{X}_k$ and gives the instructional intervention $A_k \in \mathrm{A}_k$, where $\mathrm{X}_k, \mathrm{A}_k$ is the student state space and the instructional intervention space, respectively, and then the decision intelligence receives the feedback learning effect Y_k and moves to the next phase where the student's learning state and characteristics become X_{k+1}. The learning state and characteristics X_k are random vectors, which can include both continuous and discrete variables; Instructional Intervention A_k is a random variable that takes the value of 0 or 1 to indicate different instructional interventions; Learning Effect Y_k is also a random variable that takes the value of a continuous real number. The value-added learning effect $R_k = Y_k - Y_{k-1}$ is still used to portray the effect of the instructional intervention; the learning effect of the entire instructional process is denoted as $Y = \sum_{k=1}^{K} R_k$, and the instructional history is defined as $H_k \equiv \left(X_1, A_1, \cdots, X_{k-1}, A_{k-1}, X_k\right)$, $H_k \in \mathrm{H}_k$, and H_k as the instructional history space. The observations corresponding to the random vector or random variable X_k, A_k, Y_k, H_k are denoted x_k, a_k, y_k, h_k in turn.

The decision function vector is $d \equiv \left(d_1, d_2 \cdots, d_K\right)$, where the decision function $d_k : \mathrm{H}_k \to \mathrm{A}_k$ for stage $k\left(k = 1, \cdots, K\right)$ is a mapping from the instructional history space to the instructional intervention space. The decision function d corresponds to the value of

$$V^d = E_d\left[\sum_{k=1}^{K} R_k\right] = \int \sum_{k=1}^{K} R_k dP_d \tag{6}$$

where P_d is the distribution of the random variable $(X_1, A_1, R_1, X_2, \cdots, X_K, A_K, R_K)$ corresponding to the generation of the instructional intervention from the decision function d, and E_d is the corresponding mathematical expectation. That is to say, V^d is the expectation of the learning effect obtained throughout the instructional process by the instructional intervention generated from the decision function d.

The value function is recursive in nature and satisfies a specific recursive relationship, i.e., the Bellman equation:

$$V_k(h_k) = \max_{a_k} E\left[R_k + V_{k+1}(H_{k+1}) \middle| H_k = h_k, A_k = a_k\right] \tag{7}$$

Thus, it can be solved iteratively. This is the basis for the reinforcement learning algorithm to be able to reverse the recursive solution.

(2) Estimation of the $Q-$function

In this paper, a linear model is used to estimate the $Q-$function, i.e:

$$Q_k(h_k, a_k; \gamma_k, \beta_k) = \gamma_k^T H_k + A_k \cdot (\beta_k^T H_k), k = 1, \cdots, K \tag{8}$$

For $k = K$, $K-1, \cdots, 1$, the estimates of the regression parameters can be obtained by solving for the regression parameters, starting from the last stage and working forward stage by stage. Specifically, given n students' observations $\{X_1, A_1, Y_1, \cdots, X_2, A_2, Y_2, \cdots X_k, A_k, Y_k\}$, $i = 1, \cdots, n$, the LASSO method can be used to obtain parameter estimates $\hat{\gamma}_k$, $\hat{\beta}_k$.

(3) Optimal Decision Function Solving

Based on the estimation of the $Q-$ function for stage $k(k = 1, \cdots, K)$, the optimal decision function for the corresponding stage can be solved to obtain the optimal decision function:

$$d_k^*(h_k) = \arg\max_{a_k} Q_k(h_k, a_k; \gamma_k, \beta_k), k = 1, \cdots, K \tag{9}$$

Since $A_k = \{0,1\}$, $k = 1, \cdots, K$. The optimal decision function that maximizes $Q_k(h_k, a_k; \gamma_k, \beta_k)$ should be satisfied by Eq. (9):

$$d_k^*(h_k) = I(\beta_k^T H_k > 0), k = 1, \cdots, K \tag{10}$$

where I (condition P) represents the schematic function, i.e., it takes the value of 1 when condition P holds, and 0 otherwise. thus the optimal decision function for all K stages is obtained as:

$$d^* = (d_1^*(h_1), \cdots, d_k^*(h_k), \cdots, d_k^*(h_\kappa)) \tag{11}$$

Based on this optimal decision function, targeted and precise instructional interventions can be obtained at any stage $k(k = 1, \cdots, K)$, based on student characteristics and behavioral performance data.

4. Comparative Experiments on the Integration of Civic and Political Elements into Physical Education Teaching

This part sets up a comparative experiment between the experimental class and the control class to study the difference between the physical education teaching method using the management framework combined with the elements of Civics and the conventional physical education teaching method. It analyzes the differences between the two classes before and after the experiment in the three aspects of Civic Cognition, Physical Fitness, and Mental Health, and finds out the advantages of the physical education teaching method using the management framework combined with the elements of Civic and Political Science in promoting the personalized development of the students.

4.1. Experimental setup

4.1.1. Purpose of the experiment

Through the 13-week teaching experiment, we compared and analyzed the test data of the two classes before and after the experiment in the three aspects of Civic and Political Cognition, Physical Fitness, and Mental Health in physical education, to explore whether the teaching method of integrating Civic and Political Elements into the Personalized Management Framework of Physical Education can promote the personalized development of the students, as well as whether it has the scientific validity and feasibility.

4.1.2. Time and place of experiment

September 2022-December 2022, 13 weeks, 2 classes per week, 80 minutes per class. Gymnasium of a university in Jiangsu Province.

4.1.3. Experimental Objects

Freshman class 1 in the School of Marxism of a university in Jiangsu Province was used as an experimental class, and freshman class 2 was used as a control class. This experimental school in the physical education curriculum is different from the regular physical education classes, the regular physical education classes are carried out by the class as a unit of physical education teaching, while the experimental school's physical education classes adopt the form of option teaching, according to the students to fill out the “physical education class option form” set up a special class, divided into male and female students in reasonable proportion of the special class in order to ensure that the students' learning effectiveness and quality of each class to maintain at 60 students. In order to ensure the learning effect and quality of the students, the number of students in each class is kept at 60.

4.1.4. Control of experimental variable factors

In the teaching process, the experimental class and the control class have the same teaching schedule plan and examination syllabus, the experimental class adopts the teaching method of integrating the elements of Civics and Politics into the personalized management framework of physical education teaching to carry out the experiment, and the control class teaches in accordance with the conventional physical education teaching method.

Independent variables: the teaching method of integrating the elements of Civics and Politics into the personalized management framework of physical education teaching, and the regular physical education teaching method. Dependent variables: cognition of Civics and Politics, physical fitness, mental health.

Irrelevant variables:

(1) The homogeneity of the students in the two classes is ensured through the pre-experimental and post-experimental tests of the students in the experimental and control classes.

(2) The experiment was conducted in a double-blind experimental mode, i.e., neither the students in the experimental class and the control class nor the teachers of the classes were aware of the contents of the experiment to ensure the accuracy and objectivity of the results.

(3) The course time, equipment and facilities, assessment standards and the number of male and female students in the experimental and control classes were kept the same.

(4) During the teaching process, if uncontrollable factors are encountered, the teaching content and program will be postponed according to the teaching schedule to ensure the complete implementation of the teaching content and the accuracy of the collected data.

4.2. Comparative analysis of the cognitive level of Civics before and after the experiment

4.2.1. Perceptions of Civics in the two classes before the experiment

Table 1 shows the results of the comparison of the Civic and Political Cognition of Physical Education Course between the experimental class 1 and the control class 2 before the experiment. Ten dimensions, including national self-confidence, were chosen as the indicators of students' Civic and Political Cognition, and the means and standard deviations of the two classes in different dimensions were compared to analyze whether the Civic and Political Cognition of the two classes before the experiment possessed significant differences.

Analyzing the data in Table 1, the mean and standard deviation values of the experimental class 1 and the control class 2 before the experiment in the 10 dimensions of national self-confidence, national

self-esteem, motor perception, motor thinking, fighting spirit, solidarity, dedication, pragmatism, learning to learn, and healthy life do not have significant differences, and the p-value is greater than 0.05, which suggests that the Civic and political cognitive situation of the two classes before the experiment in physical education teaching do not have significant differences and meet the requirements of the experiment.

Table 1. Ideological and political cognition before the experiment(N=60)

	Experimental class(M±SD)	**Comparison class(M±SD)**	**T-value**	**P-value**
National self-confidence	13.51±3.28	13.75±3.83	-0.336	0.738
National pride	13.57±2.38	12.95±2.72	1.213	0.229
Motion perception	13.73±2.43	14.07±2.34	-0.716	0.476
Motor thinking	12.99±2.63	13.73±2.24	-1.522	0.130
Fighting spirit	14.03±2.82	13.81±2.82	0.391	0.698
Spirit of solidarity	13.77±2.98	12.97±3.34	1.269	0.209
Spirit of dedication	13.35±2.34	13.17±3.02	0.336	0.739
Pragmatic spirit	14.05±2.63	13.87±3.34	0.302	0.765
Learn to learn	13.83±3.25	14.21±3.13	-0.597	0.552
Healthy life	12.95±2.87	12.87±3.35	0.129	0.895

4.2.2. Perception of Civics in the two classes after the experiment

Table 2 shows the results of the comparison of the ideological and political cognition of physical education courses between experimental class 1 and control class 2 after the experiment. As can be seen from Table 2, the mean and standard deviations of the two classes in the dimension of national self-confidence were 14.99±3.01 and 13.85±2.49, $P<0.05$, indicating significant differences. The mean and standard deviations of the two classes in the dimension of national self-esteem were 15.13±3.46 and 13.61±3.07, $P<0.05$, indicating significant differences. The mean and standard deviations of the two classes in the motor perception dimension were 15.25±3.42 and 13.73±3.76, $P<0.05$, indicating a significant difference. The mean and standard deviations of the two classes in the motor thinking dimension were 14.05±2.43 and 12.99±2.26, $P<0.05$, indicating significant differences. The mean and standard deviations of the two classes in the dimension of fighting spirit were 15.53±2.18 and 13.69±2.15, $P<0.05$, indicating significant differences. The mean and standard deviations of the two classes in the solidarity dimension were 15.51±3.37 and 13.09±2.83, $P<0.01$, indicating a significant difference. The mean and standard deviations of the two classes in the dedication dimension were 14.65±3.37 and 13.05±3.36, $P<0.01$, indicating a significant difference. The mean and standard deviations of the two classes in the pragmatic spirit dimension were 15.63±3.08 and 14.19±3.71, $P<0.05$, indicating significant differences. The mean and standard deviations of the two classes in the learning dimension were 15.09±2.72 and 13.13±2.08, $P<0.01$, indicating a significant difference. The mean and standard deviations of the two classes in the healthy life dimension were 14.83±3.37 and 13.41±3.56, $P<0.05$, indicating significant differences.

In summary, through comparison and analysis, it can be seen that the P-values of the seven indicators of national self-confidence, national self-esteem, sports awareness, sports thinking, dedication, pragmatism, and healthy life are all less than 0.05, indicating significant differences; while the P-values of the three indicators of the spirit of struggle, the spirit of solidarity, and the spirit of learning to learn are all less than 0.01, indicating highly significant differences. The reason for this analysis is that the teaching method of integrating the Civics and Politics element into the personalized management framework of physical education teaching is able to continuously analyze students' physical education learning behaviors, predict their learning effectiveness, and carry out special reinforcement according to a Civics and Politics element in which the students are weak, assisting the teachers to make effective decisions for improvement. Compared with the conventional physical education teaching method that focuses on basic techniques, teachers can make in-depth analysis and clear elaboration of Civics and Politics elements and integrate them into the boring and single basic technique explanation to make the teaching process interesting and vivid, which can make students fully feel the charm of physical education learning and improve their Civics and Politics cognitive level.

Table 2. Ideological and political cognition after the experiment(N=60)

	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
National self-confidence	14.99±3.01	13.85±2.49	2.073	0.042
National pride	15.13±3.46	13.61±3.07	2.330	0.023
Motion perception	15.25±3.42	13.73±3.76	2.123	0.037
Motor thinking	14.05±2.43	12.99±2.26	2.274	0.026
Fighting spirit	15.53±2.18	13.69±2.15	4.269	0.002
Spirit of solidarity	15.51±3.37	13.09±2.83	3.903	0.003
Spirit of dedication	14.65±3.37	13.05±3.36	2.387	0.020
Pragmatic spirit	15.63±3.08	14.19±3.71	2.120	0.038
Learn to learn	15.09±2.72	13.13±2.08	4.068	0.002
Healthy life	14.83±3.37	13.41±3.56	2.056	0.044

4.3. Comparative analysis of physical fitness status before and after the experiment

4.3.1. Physical fitness of boys and girls in the two classes before the experiment

Table 3 shows the physical fitness status of boys in the two classes before the experiment. The data of 9 indicators, such as pull-ups and 1000 meters running, are used to measure the physical quality of the boys in the two classes, and the mean and standard deviation of the indicators are compared to study whether there is a significant difference in the physical quality of the boys in the two classes before the experiment. Analysis of Table 3 shows that the mean and standard deviation values of the 9 physical quality indicators of the boys in the two classes before the experiment do not differ much, and the P-value is greater than 0.05, which is not a significant difference and meets the requirements of the experiment.

Table 3. Comparison of physical fitness before the experiment (Male)(N=60)

Index	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
Height(cm)	168.4±8.31	169.4±7.95	0.586	0.57
Weight(kg)	57.3±9.57	57.37±9.19	1.14	0.20
BMI value	19.26±3.40	19.21±2.05	1.083	0.22
Vital capacity(ml)	3872±727.79	3949.9±881.32	0.520	0.606
Fifty meter race(s)	8.52±0.77	8.52±1.05	0.029	0.979
Sit in a forward bend(cm)	-1.33±8.95	-1.03±6.26	1.662	0.102
Pull-ups (each)	0.626±0.86	0.920±0.92.65	-1.15	0.250
Standing long jump(cm)	192.8±21.98	187.9±23	1.528	0.14
1000m(s)	293.1±36.70	294.67±44.43	1.190	0.163

Table 4 shows the physical quality of girls in the two classes before the experiment. The data of 9 indicators, such as sit-ups and 800-meter run, are used to measure the physical fitness of girls in the two classes, and the mean and standard deviation of the indicators are compared to study whether there is a significant difference between the physical fitness of girls in the two classes before the experiment. Analyzing Table 4, it was found that the mean and standard deviation values of the 9 physical quality indicators of the girls in the two classes before the experiment did not differ much, and the P-values were all greater than 0.05, which did not have significant differences and met the requirements of the experiment.

Table 4. Comparison of physical fitness before the experiment (Female)(N=60)

Index	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
Height(cm)	166.2±6.77	166.5±6.44	-0.563	0.645
Weight(kg)	56.4±9.04	56.5±12.1	0.529	0.560
BMI value	19.4±4.43	19.6±5.54	0.760	0.46
Vital capacity(ml)	3456.3±609.75	3409.9±607.27	-1.170	0.140
Fifty meter race(s)	9.27±0.76	9.26±0.97	-0.062	0.96
Sit in a forward bend(cm)	6.7±8.95	6.6±6.63	-0.014	0.989
Sit-ups (one)	36.5±5.92	34.1±11.41	0.763	0.450
Standing long jump(cm)	167.9±20.05	165.7±23.46	-0.497	0.620
800m(s)	208.8±30.05	209.3±40.04	1.329	0.15

4.3.2. Physical fitness status of boys and girls in the two classes after the experiment

Table 5 shows the physical condition of boys in both classes after the experiment. As can be seen from Table 5, after the experiment, the mean values of height of the experimental class and the control class were 168.5cm and 169.5cm, respectively, and the difference between them was very small. After the experiment, the mean values of body weight of the two classes were 56.5kg and 57.2kg respectively, with little change. The difference in the mean values of BMI between the two classes before the experiment was very small, and the lack of variability in the BMI values of the two classes after the experiment was due to the fact that there was no significant difference in the weight and height of the two classes, which led to the lack of significant difference in the BMI as well (T=1.855, P=0.067). Post-experimental spirometry means were 3879 and 3883.2 each, a difference of 4.2 points, with the experimental class being relatively more stable. The fluctuation range of 50-meter run after the experiment was 7.74-9.3 seconds and 7.27-9.71 seconds, and the mean values were 8.35 and 8.49 seconds, respectively, and the experimental class's 50-meter run performance improved more than that of the control class, and there was a significant difference. The mean values of seated forward bending of the two classes before the experiment were -1.33 and -1.03 respectively, and the mean values after the experiment were 1.303 and 0.723 respectively, and the seated forward bending of the experimental class improved more than that of the control class, and there was a significant difference (T=1.246,P=0.035). From the pull-up index test scores, the mean values after the experiment were 2.5 and 1.5, and the strength of the experimental class changed from being smaller than the control class to being one more than the control class, and there was a significant difference (T=0.547,P=0.026). The mean values of standing long jump after the experiment were 198.3 and 193.2 respectively, indicating that the standing long jump scores of both classes were improved. The T-value of standing long jump performance is 0.645, P-value is more than 0.05, there is a significant difference. From the mean value of 1000 meter run, it can be seen that the mean value of the two classes after the experiment is 271.6 seconds and 279.52 seconds, and the T-value of 1000 meter run performance after the experiment is 1.93, and the P-value is 0.045, and there is a significant difference.

Table 5. Comparison of physical fitness after the experiment (Male)(N=60)

Index	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
Height(cm)	168.5±8.32	169.5±7.96	-0.635	0.525
Weight(kg)	56.5±9.4	57.2±9.1	1.221	0.223
BMI value	19.4±4.9	19.32±3.2	1.855	0.067
Vital capacity(ml)	3879±737.3	3883.2±823.9	-1.484	0.141
Fifty meter race(s)	8.35±0.78	8.49±1.22	1.27	0.037
Sit in a forward bend(cm)	1.303±9.34	0.723±7.4	1.246	0.035
Pull-ups (each)	2.5±2.98	1.5±2.24	0.547	0.026
Standing long jump(cm)	198.3±18.91	193.2±20.64	0.645	0.044
1000m(s)	271.6±29.20	279.52±45.79	1.93	0.045

Table 6 shows the physical fitness status of girls in both classes after the experiment. The mean values of height of the experimental and control classes after the experiment were 166.47cm and 166.33cm respectively and there was no significant difference. The mean values of body weight of the two classes after the experiment were 56.42kg and 56.66kg respectively and there was no significant

difference. Whereas, the mean value of BMI did not change much after the experiment and there was no significant difference. The post-experimental mean values of lung capacity were 3585.5 and 3509.8 each, with a difference of 75.7 points, and comparatively the experimental class had a greater improvement in the mean value of lung capacity. The fluctuation range of 50-meter run after the experiment was 8.48-9.94 seconds and 8.23-10.31 seconds, with mean values of 9.21 and 9.27 seconds, respectively, and the improvement of 50-meter run performance of the experimental class was greater than that of the control class. The mean values of post experimental sitting forward bends were 10.54 and 7.48 respectively, the experimental class improved more than the control class, and there was a significant difference between the two classes in sitting forward bends after the experiment (T=-2.030,P=0.043). The mean values of one minute sit-ups were 38.9 and 37.1 each after the experiment and there was a significant difference (T=-2.382,P=0.018<0.05). The mean values of standing long jump after the experiment were 169.8 and 167.9, respectively, and there was an improvement in standing long jump performance in both classes. From the mean value of 800 meter run, it can be seen that the mean values of both classes are 203.7 and 206.7 seconds, 800 meter run performance after the experiment T value is 1.942, P value is 0.047, there is a significant difference between the results after the experiment.

Table 6. Comparison of physical fitness after the experiment (Female)(N=60)

Index	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
Height(cm)	166.47±6.08	166.33±7.60	-1.126	0.28
Weight(kg)	56.42±8.46	56.66±6.72	1.066	0.141
BMI value	19.57±2.49	19.48±2.96	-0.39	0.73
Vital capacity(ml)	3585.5±603.23	3509.8±613.26	-1.652	0.105
Fifty meter race(s)	9.21±0.73	9.27±1.044	1.515	0.133
Sit in a forward bend(cm)	10.54±8.41	7.48±7.69	-2.030	0.043
Sit-ups (one)	38.9±6.95	37.1±8.54	-2.382	0.018
Standing long jump(cm)	169.8±20.14	167.9±21.93	0.429	0.671
800m(s)	203.7±24.31	206.7±26.06	1.942	0.047

Comprehensively comparing and analyzing the physical fitness status of boys and girls in the two classes before and after the experiment, it is found that the physical fitness of boys and girls in the experimental class 1 is better than that of boys and girls in the control class 2 in most of the indicators. It proves that the teaching method of integrating the elements of Civics and Politics into the personalized management framework of physical education teaching has advantages in improving students' physical fitness. Analyzing the reasons, it may be that the teaching method allows teachers to pay more attention to the students' learning status in the classroom, continuously mobilize the students' enthusiasm for sports in the process of explaining the Civics and Politics elements, and correct the students' technical movements in a targeted way, so that the students can strengthen their exercise and improve their physical quality in the process of subconsciously.

4.4. Comparative analysis of mental health status before and after the experiment

Ten indicators such as the obsessive-compulsive factor were chosen to measure students' mental health. The mental health status of boys and girls in the two classes before the experiment was studied separately, and it was found that there was no significant difference between the mental health status of boys and girls in the two classes in the 10 indicators, which was in line with the requirements of the experiment. In order not to repeat the narrative, the psychological health status scales of boys and girls in the two classes before the experiment are not expanded in the following, and the psychological health status indicators of boys and girls in the two classes after the experiment are compared directly.

4.4.1. Comparison of the mental health status of boys in the two classes after the experiment

Table 7 shows the results of the comparison of the mental health indicators of the boys in the two classes after the experiment. Analyzing Table 7, it can be seen that the obsessive-compulsive factor score of the boys in the experimental class after the experiment is 9.97 and that of the boys in the control class is 10.15, with a t-value of -0.513 and a P-value of 0.608, and that there is no significant difference between the obsessive-compulsive factor scores of the boys in the two classes at the 5% level of significance. The paranoia factor scores of boys in the experimental and control classes were

10.53 and 9.95 respectively, with a t-value of 1.909 and a p-value of 0.058 > 0.05, so there is no significant difference in the paranoia factor scores of boys in the two classes. The hostility factor scores of boys of both classes are 9.39 and 9.75 with t-value of -1.309 and p-value of 0.192, so there is no significant difference at five percent level of significance. The interpersonal tension sensitivity scores were 9.41, 10.21, t=-2.504, P=0.013, with a significant difference, and the boys in the experimental class were significantly better than the control class. Post-experimental depression factor scores for both classes of boys were 9.37, 10.26, t=-2.711, P=0.007, with a significant difference that boys in the experimental class scored better on this subscale as compared to the control class and the difference was extremely significant. Anxiety factor scores were 9.45, 9.99, t=-1.805, P=0.073 and there was no significant difference at five percent level of variability. The score of the factor of sense of academic stress for the boys of the experimental class was 10.45 and the score of the boys of the control class was 11.12 with t value of -1.993 and P value of 0.047 < 0.05, so there is a significant difference between the scores of the boys of the two classes, and the boys of the experimental class were significantly better than the control class. The maladjustment factor for boys of both classes was 9.61 and 10.21 with t-value of -2.105 and P-value of 0.036, so there is a significant difference and boys of the experimental class are significantly better than the control class. The scores of emotional instability factor were 9.71, 9.65, t=0.201, P=0.841 with no significant difference. The scores for the psychological imbalance factor were 9.05 and 9.74, with a t-value of -2.634 and a P-value of 0.011, with a significant difference, and the boys in the experimental class were significantly better.

The teaching method of integrating the Civics element into the personalized management framework of physical education significantly improves the health level of male students in five psychological aspects, namely, interpersonal tension sensitivity factor, depression factor, learning stress factor, maladaptation factor, and psychological imbalance factor, compared with the conventional physical education teaching method.

Table 7. Comparison of mental health indicators after the experiment (Male)(N=60)

Index	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
Forcing factor	9.97±1.450	10.15±1.833	-0.513	0.608
Paranoia factor	10.53±1.528	9.95±1.445	1.909	0.058
Hostile factor	9.39±1.340	9.75±1.300	-1.309	0.192
Interpersonal tension sensitive factors	9.41±1.630	10.21±1.375	-2.504	0.013
Depressive factor	9.37±1.260	10.26±1.839	-2.711	0.007
Anxiety factor	9.45±1.327	9.99±1.574	-1.805	0.073
Learn the stress factor	10.45±1.593	11.12±1.584	-1.993	0.047
Maladaptive factor	9.61±1.229	10.21±1.546	-2.105	0.036
Emotional instability factor	9.71±1.233	9.65±1.448	0.201	0.841
Psychological imbalance factor	9.05±1.355	9.74±1.195	-2.634	0.011

4.4.2. Comparison of the mental health status of girls in two classes after the experiment

Table 8 shows the results of the comparison of the mental health indicators of the girls in the two classes after the experiment. As can be seen from Table 8, the obsessive-compulsive factor score of the girls in the experimental class after the experiment is 9.93, and that of the girls in the control class is 10.51, with a t-value of -1.433 and a P-value of 0.156, and there is no significant difference. The paranoia factor scores of girls in both classes were 9.66 and 10.19 respectively with t-value of -1.446 and p-value of 0.150, there was no significant difference. Hostility factor scores were 10.37 and 10.79 with t-value of -1.031 and p-value of 0.305 > 0.05 respectively and there was no significant difference. Interpersonal tension sensitivity scores were 10.07, 10.84, t=-2.068, P=0.041, with a significant difference, and girls in the experimental class were significantly better than the control class. Post-experimental depression factor scores of girls of both classes were 9.60, 10.54 respectively, t=-2.715, P=0.006 with significant difference, girls of experimental class scored better as compared to control class and the difference was extremely significant. Anxiety factor scores were 10.31 and 11.09, respectively, with a t-value of -2.137 and a P-value of 0.035 < 0.05, which is a significant difference, and girls in the experimental class scored significantly better compared to the control class. The scores of Learning Stress Sense Factor were 9.84 and 10.68 with t-value of -2.217 and P-value of 0.029, which is a significant difference, and girls of the experimental class were significantly better than the

control class. The scores of maladjustment factor were 10.05, 10.52, t=-1.327, P=0.188, there was no significant difference. The scores of emotional instability factor were 9.81, 10.38, t=-1.385, P=0.169 and there was no significant difference. The scores of the psychological imbalance factor were 9.71 and 10.96, with a t-value of -3.158 and a P-value of 0.002, and there was an extremely significant difference, with girls in the experimental class performing better.

Under the teaching method of integrating the elements of Civics and Politics into the personalized management framework of physical education teaching, the girls' health levels of the interpersonal tension sensitivity factor, depression factor, anxiety factor, learning stress feeling factor, and psychological imbalance factor were significantly better than those who received the conventional physical education teaching method.

Table 8. Comparison of mental health indicators after the experiment (Female)(N=60)

Index	Experimental class(M±SD)	Comparison class(M±SD)	T-value	P-value
Forcing factor	9.93±1.676	10.51±1.577	-1.433	0.156
Paranoia factor	9.66±1.597	10.19±1.444	-1.446	0.150
Hostile factor	10.37±1.800	10.79±1.533	-1.031	0.305
Interpersonal tension sensitive factors	10.07±1.519	10.84±1.577	-2.068	0.041
Depressive factor	9.60±1.456	10.54±1.362	-2.715	0.006
Anxiety factor	10.31±1.380	11.09±1.628	-2.137	0.035
Learn the stress factor	9.84±1.439	10.68±1.704	-2.217	0.029
Maladaptive factor	10.05±1.478	10.52±1.444	-1.327	0.188
Emotional instability factor	9.81±1.776	10.38±1.644	-1.385	0.1769
Psychological imbalance factor	9.71±1.676	10.96±1.576	-3.158	0.002

Comparative analysis of the mental health status of boys and girls in the two classes before and after the experiment shows that the teaching method of integrating the elements of Civics into the personalized management framework of physical education significantly improves the mental health status of students. Studying the reasons for this may be influenced by two aspects. First, the teaching method introduces the elements of Civics and Politics, which regulates students' mental state at the psychological level, guides students to think more often using a macro perspective, and avoids being confined to the daily friction of interpersonal relationships; second, the personalized management framework used helps teachers to discover the fluctuation of students' state at the psychological level in a timely manner, and to make corresponding teaching decisions, so that they can make timely adjustments to the students' psychological problems.

5. Conclusion

Through the comparison of the indicator situation between the experimental class 1 and the control class 2, it can be intuitively seen that the teaching method of integrating the Civics and Politics element into the personalized management framework of physical education teaching is significantly better than the conventional physical education teaching method. Before the experiment, there was no significant difference between the two classes in terms of the level of Civics and Politics cognition, physical fitness condition and mental health condition. After the experiment, in terms of the level of Civic and Political Cognition, the P-values of the 10 indicators of the two classes were less than 0.05, and the level of Civic and Political Cognition of the experimental class 1 was significantly higher than that of the control class 2. In terms of physical fitness status, excluding relatively fixed indicators such as height, weight and BMI value, the P-values of the remaining several indicators are all less than 0.05, and the physical fitness of the experimental class 1 class is significantly higher than that of the control class 2 class. In terms of mental health status, the P-values of the male students in the experimental and control classes on the five indicators of interpersonal tension and sensitivity factor, depression factor, learning stress feeling factor, maladaptation factor, and psychological imbalance factor are all less than 0.05; the female students of the two classes on the five indicators of interpersonal tension and sensitivity factor, depression factor, anxiety factor, learning stress feeling factor, and psychological imbalance factor are likewise with significant differences. The students in experimental class 1 improved their mental health better than those in control class 2.

A comprehensive analysis of the reasons why the teaching method of integrating the elements of ideology and politics into the personalized management framework of physical education teaching is

significantly better than the conventional physical education teaching method. The use of the personalized management framework allows physical education teachers to analyze students' learning status in a timely and efficient manner and optimize teaching decisions according to the prediction results given by the learning effectiveness prediction model, so that students' enthusiasm for physical education learning is always maintained at a high level, and they participate in the classroom consciously and actively to develop their personalities. The intelligent integration of the Civics element allows physical education teachers to educate students by combining high-quality spiritual knowledge, guiding students to pay attention to the country and society, improving their core qualities, and turning their attention to personal development and teamwork, so that students can reduce the emergence of psychological problems while improving their Civics knowledge.

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