

Evaluation method of physical health course learning effect based on self-learning framework

Yan Wang^{1*}

Abstract

The current evaluation method of course learning effect selects evaluation indexes through scale, which leads to too many subjective factors in the evaluation index system, large evaluation deviation and poor reliability. According to the current teaching requirements and objectives of the physical education and health course, combined with the actual learning situation of the course, and in view of the problems existing with the traditional evaluation methods, the study of physical education and health course learning effect evaluation method based on self-learning framework. The evaluation index system is established by analyzing the factors that affect the learning effect of students' physical health course. Using decision with the experimental and analytic hierarchy process (AHP) to determine index weight, using neural network structures, self-learning framework, the implementation of curriculum study effect evaluation. The results of the case study show that the students' physical fitness, sports ability and health knowledge are improved obviously after the application of the method, and the method is feasible in practice.

Keywords: self-learning framework; physical health courses; learning effect; evaluation method; decision and experiment; neural network;

0 Introduction

In the face of the general trend of education reform, physical education actively follows the pace of education modernization, and correspondingly issued a series of policy and directive documents, which guide the thinking of scholars, the operation of physical education administrators and the practice of the majority of physical education workers in the front line of physical education (Williams et al., 2020). The physical health course is a course that makes students develop harmoniously in body, motor cognition, motor skills, psychology and social adaptation within a certain unit of time. It is an important way to implement quality education and cultivate talents with all-round development of morality, intelligence, body and beauty. It is a course that deepens the reform of the original physical education curriculum and highlights the health goal. How to achieve better physical health teaching effect is very important for each school to carry out physical health teaching work. Through the study of students' physical health effect evaluation, to the point of view of a relatively objective evaluation of the sports health curriculum teaching process, it can be more intuitive, specifically to find out problems existing in the teaching of physical health.

The evaluation of PE - related curriculum is a weak link in the study of curriculum evaluation and also a complex problem. Nowadays, the more popular evaluation method is developmental evaluation, which focuses on the classroom performance of teachers and students to promote the common development of teachers and students. The new curriculum advocates diversified contents, diversified methods, diversified evaluation

standards and evaluation subjects. However, when the teaching effect evaluation method is applied to the physical education and health course, it mostly adopts the traditional sports performance way, and lacks the technology and method of reflecting the latest evaluation thought. The evaluation process appears to be closed and static, lacking flexibility and dynamics (Yakub et al., 2019). Through the questionnaires students and according to the scale to evaluate students' learning situation, the method of the evaluation accuracy and evaluation result for the questionnaire and scale design depends heavily, unable to comprehensively and objectively evaluate the effect of learning (Cardozo et al., 2020; Zhang, 2021). Longitudinal progress test data, use the impact analysis model, thinking tools processing to quantitative study the effect of objective data, the corresponding evaluation result is obtained, and the pure theoretical courses of study effect evaluation is relatively reliable, but applied in the assessment of sports and health course effect is poorer (Görlich & Friederichs, 2021; Hou et al., 2020; Singer et al., 2020). Cresswell et al. (2021) designed a qualitative evaluation index. Such qualitative evaluation alone cannot give suggestions from the perspective of data, resulting in certain subjectivity of evaluation results. The integration of neural network, machine learning and other theories into the evaluation of learning effect effectively improves the efficiency of evaluation, but at the same time, the subsequent optimization work is difficult due to the large scale of training required (Borakati, 2021; D. Chen, 2021; Jinfeng & Bo, 2021). There are many studies on self-learning frameworks in foreign countries, but they mainly focus on whether self-learning is effective, self-learning under learning theory, conditions and ways of self-learning, etc.

¹ School of Physical Education, South West Jiaotong University, Chengdu, 651756, China
Corresponding Author E-mail: wyeeducation567@sina.com

However, there are few evaluation and empirical studies on how to improve the learning effect of practice-based courses such as physical education under the framework of self-learning (Asad et al., 2020). But according to the study framework of relevant research results analysis shows that the self learning under the framework of sports and health course is analysis and evaluation of teaching and learning, can reduce errors in the evaluation and improve the reliability of evaluation results. Therefore, the research background, combining the current education system for middle school students learning about the current situation of the sports health curriculum, a research framework based on the study of sports health curriculum study effect evaluation method.

1 Evaluation method of physical health course learning effect based on self-learning framework

1.1 Analysis of factors affecting the learning effect of physical health course

To find and analyze factors affecting the effects of student sports health curriculum learning, this study adopts the method of total quality management causal analysis, to get the results of a survey by questionnaire and actual interview to sift through and make scientific classification. The causal analysis method is also called the bones diagram method. Its characteristic is to be able to find out all kinds of problems are classified, and these factors, from big to small, from coarse to fine, level, clear the causal relationship between the factors at all levels, for the quality control and improvement. In this study, 15 influencing factors were found, mainly

including students' factors, teachers' factors and other factors (Yangari & Inga, 2021). The analysis of factors affecting the learning effect of the physical health course is shown in Figure 1.

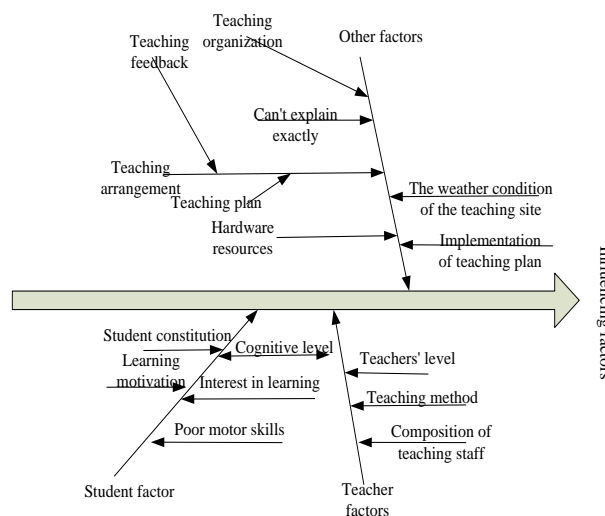


Figure 1 Analysis chart of influencing factors of physical health course learning effect

Under the guidance of the Pareto method, through careful analysis and judgment, the main reasons affecting the learning effect of physical education class of college students were firstly determined. By using Excel to statistically analyze the relevant data of the 220 valid questionnaires recovered, the statistical classification of factors affecting learning effect is shown in Table 1.

Statistical breakdown of factors influencing learning effectiveness

Influencing factors	Frequency	Frequency	Cumulative frequency
Student interest in learning	81	36.82%	36.82%
Motivation for learning	57	25.91%	62.73%
Students' motor skill levels	39	17.73%	80.46%
Student learning engagement	19	8.64%	89.10%
Teachers' knowledge of the curriculum	13	5.91%	95.01%
Teachers' teaching standards	7	3.18%	98.19%
Teachers' attitudes towards students	4	1.82%	100%

The main factors affecting the learning effect of students' physical health class are listed in Figure 2.

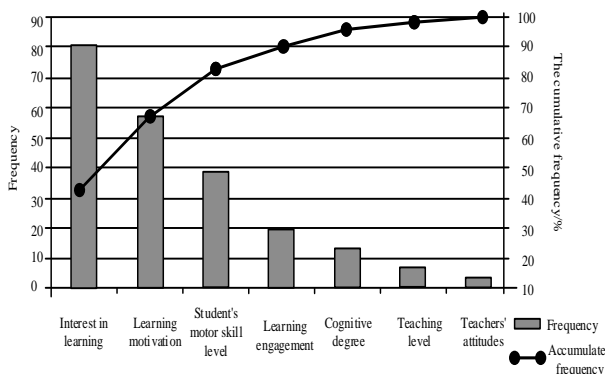


Figure 2 Ranking of the main factors affecting students' learning outcomes in physical education and health classes

Where the horizontal coordinates are the influencing factors, the right vertical coordinates are the cumulative frequency percentages, and the left vertical coordinates are the statistical frequencies. It can be seen from the analysis results that the cumulative percentage of middle school students' learning interest, students' learning motivation and students' sports skill level reaches 80.46% in the factors affecting the learning effect of students' sports and health class, which is the main factor affecting the learning effect of students' sports and health class and the key problem to be solved to improve the learning effect of students' sports and health class. Students' participation and the teacher's recognition in the course of cumulative percentage from 80.46% to 89.1%, as the secondary factors influencing the students' physical health class effect. Teachers' teaching level and the teacher to students' attitude to the cumulative percentage from 95% to 100%, becoming the general factors influencing the students' physical health class effect.

Among the above-mentioned main factors influencing the effectiveness of students' learning in physical education and health courses, students' interest in learning is one of the most important factors affecting the quality of their learning. Attitude towards physical education is a specific evaluation and psychological tendency of students towards physical education as a social activity, which is formed on the basis of their own moral concepts and value orientations. The analysis of the three elements of attitude is mainly divided into attitude towards teaching activities, attitude towards teaching quality, and attitude towards teachers and classmates. In turn, students' motivation to learn is influenced by their understanding of the value of physical education and the health curriculum and the teacher's guidance during the lectures. When students study physical education and health courses, the perception of the instructor has a greater impact on the students' learning outcomes. Physical education teachers are an important guarantee for the successful implementation of physical education and health

curriculum standards, and the teaching level of teachers, the age and gender distribution of the teaching force, and the degree of knowledge of the curriculum philosophy and objectives all influence the delivery of physical education teachers, which in turn affects the learning effect of students (Avila et al., 2020). In addition to the main factors affecting students' learning of physical education and health courses mentioned above, the learning environment of students during the implementation of the course and the corresponding supporting learning facilities affect the students' learning effect of the course. Based on the above analysis of the factors that affect the effect of students' learning physical education and health courses, a course learning effect evaluation index system is established.

1.2 Establishing an index system for evaluating the learning effectiveness of physical education and health courses

Under the guidance of health first thought, according to the current situation of students' learning and evaluation of physical education and health courses in colleges and universities, a new evaluation index system has been constructed based on the teaching outline of physical education and health courses. The sports health curriculum teaching outline clearly pointed out that sports and health course evaluation content should include four aspects: physical fitness, knowledge and skills, learning attitude, emotion and spirit of cooperation. The evaluation criteria of the physical education and health curriculum should not only focus on summative assessment, but also pay attention to the evaluation of students' learning process. Not only should we pay attention to quantitative evaluation, but also attach importance to qualitative evaluation. We should not only adopt absolute evaluation, but also attach importance to relativity evaluation. Based on the analysis of the physical education health curriculum in the current education system and the factors that affect students' learning of the sports health course, this paper sets up the two level evaluation system as shown in Table 2 (Heemskerk et al., 2020; Papastergiou & Mastrogiannis, 2021).

Table 2

Indicator system for evaluating the learning effectiveness of physical education and health courses

Evaluation system	Level I indicators	Secondary indicators
Indicator system for evaluating the learning effectiveness of physical education and health courses	A1 Attitude to Learning	B1 Classroom Attendance
		B2 Classroom Performance
		B3 Post-lesson feedback
	A2 Mental Health	B4 Love of sports
		B5 Cooperative Interaction Skills
		B6 Environmental resilience
		B7 Capacity for self-regulation

	B8 Healthy lifestyle
A3 motor skills	B9 Basic motor skills
	B10 Specialized athletic ability
	B11 Vocational sporting ability
A4 Knowledge of physical health	B12 Prevention and management of common sports injuries
	B13 First aid knowledge
	B14 Rate of progress in health literacy
	B15 Range of motor skills improvement
	B16 Physical fitness improvement margin
A5 Teaching of teachers	B17 Teacher teaching standards
	B18 Teachers' knowledge of the curriculum
A6 Teaching resources	B19 Utilization of hardware facility resources
	B20 Software and curriculum resource development and utilization
	B21 Development and use of information resources

Table 2 includes the main factors influencing the students' sports health curriculum, and considering the current teaching situation of physical education and health course, select other factors that affect students' learning effect, and establish the evaluation index system of physical education and health course learning effect. In this evaluation index system, teachers' cognition of courses mainly includes teachers' cognition of teaching objectives, teaching contents and teaching concepts. Sports health curriculum content is the embodiment of course, embodies the objective requirements, decides the choice of students learning style, the use of teachers' teaching methods, teaching content, to the scientific and systemic. The teaching level of teachers and the composition of teachers will directly affect students' learning enthusiasm, learning acceptance, and then affect students' learning effects. In addition, the teaching resources are an important auxiliary to student learning in the process of curriculum knowledge. Students in the learning process can use appropriate teaching resources for the final effect it also has a certain course of study.

Whether the selection method of evaluation index is reasonable and the selection of index quantity is appropriate determines the quality of index system construction. The sports health curriculum study effect evaluation index system involves many indexes, involving there might be some correlation between indicators. Therefore, an appropriate index selection method should be adopted to analyze the index system so as to establish a scientific and reasonable evaluation index system for the learning effect of sports health course. The optimization of evaluation indicators can be divided into qualitative and quantitative optimization. In this study, the expert consultation method (Delphi method) in the qualitative method will be used to optimize the indicators in the primary index system. On the basis of existing evaluation indicators, the original indicators are adjusted by consulting

relevant expert opinions (Costa et al., 2021).

The number of experts selected is also one of the conditions that must be considered in the application of Delphi method, which plays a decisive role in the effect of formulating index system. In general, a group of 4 to 16 experts can achieve better results, and a group of 10 to 30 experts can achieve better results. In this study, 13 experts and scholars who are familiar with specialized teaching reform in sports teaching, school sports and other fields were selected as the consulting expert group to conduct two or three rounds of expert questionnaire survey.

Experts generally degree C_r of the authority of experts to judge scheme on the basis of and familiarity with two aspects of the problem, using the C_a said judgment influence degree coefficient, general with the practical experience and theoretical analysis, understanding and intuitive judgment as the basis, and divided into high, medium and low three according to the degree, with C_s said experts familiar with the problem of degree, It is generally divided into five levels: very familiar, relatively familiar, familiar, not very familiar and very unfamiliar. The calculation formula is as follows (J. Chen, 2017):

$$C_r = \frac{C_a + C_s}{2} \quad (1)$$

According to the expert's opinion, the evaluation standard of the evaluation index is adjusted to complete the construction of the evaluation index system of the learning effect of physical health courses. After establishing the above evaluation index system of physical education and health course learning effect, the weight of evaluation index is determined.

1.3 Determine the weight of evaluation indicators

Weight is an essential part of the evaluation index system, index weights point to in the index system index the importance of quantitative values, so extensive investigate sports health curriculum learning

effect to affirm the target weights of the evaluation index system for the determination of evaluation index system is very important. This study adopted the decision and experimental research methods to complete the level determination of index weight.

The first level indexes are coded and the initial matrix is established. To score of the influence of the relationship between the indexes, according to the impact factors from small to large, scores between [0, 10] get initial matrix. Using the normalization method, select the row and maximum method, by the maximum row, column matrix. The mean value of the maximum range for standardized treatment after get new matrix. According to the comprehensive influence matrix, get comprehensive influence matrix.

$$T = N(I - N)^{-1} \quad (2)$$

Where, N is the index matrix obtained after normalization; I is the identity matrix. According to the sports health curriculum study effect evaluation index system of comprehensive influence matrix, computing the effect, is the

effect, central degree and reason degree. Impact degree, impact degree, centrality and cause degree are the measurement values of the influence degree of the four measurement factors in the evaluation system, which are calculated according to the comprehensive impact matrix, and the specific calculation formula is as follows (Markiewicz et al., 2017):

$$\text{The effect: } D_i = \sum_n t_{ij} \quad (i = 1, 2, \dots, n) \quad (3)$$

$$\text{Impact level: } C_i = \sum_n t_{ij} \quad (j = 1, 2, \dots, n) \quad (4)$$

$$\text{Central degrees: } M_i = D_i + C_i \quad (5)$$

$$\text{Cause degree: } R_i = D_i - C_i \quad (6)$$

$$\text{Weight: } W_i = \frac{\sqrt{(M_i^2 + R_i^2)}}{\sum_{i=1}^n R_i} \quad (7)$$

The weight of the secondary index is determined by analytic hierarchy process. The calculation process of the secondary weight of the evaluation system of learning effect of physical education and health courses is shown in Figure 3.

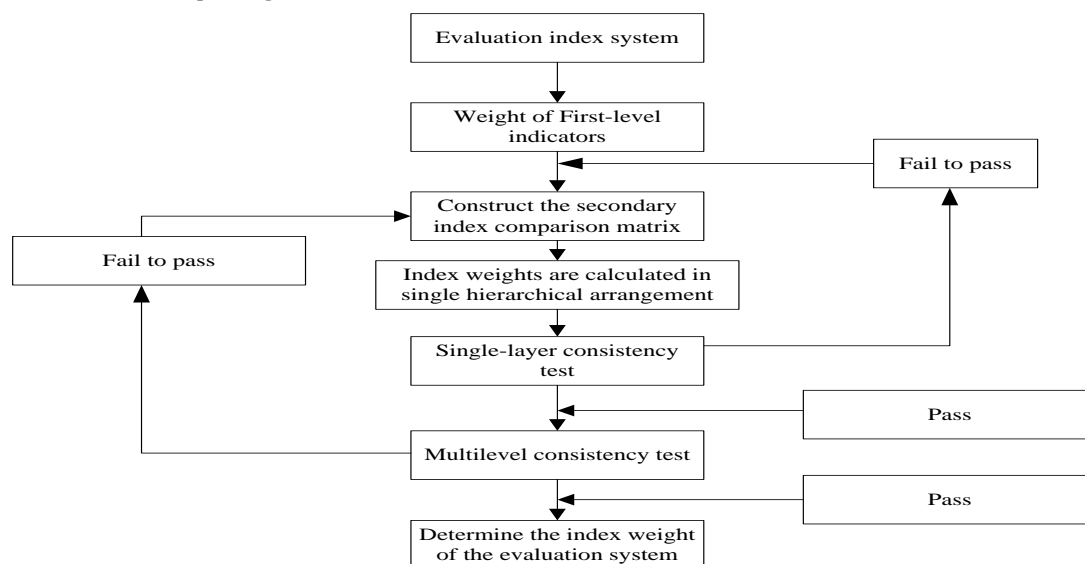


Figure 3 Calculation process diagram of secondary weight

In the evaluation system of physical education and health course learning effect, the secondary indicators under the primary indicators were compared in pairs, and the relative importance of secondary indicators was judged according to the 9-level scale method, and the judgment matrix A was obtained. Check the consistency of the judgment matrix and calculate whether the result of the matrix is valid. After calculating the maximum characteristic root λ_{max} of judgment matrix A , the consistency index is calculated according to the following formula.

$$CI = \frac{\lambda_{max}}{n-1} \quad (8)$$

The random consistency RI values are shown in Table 3.

Table 3

Random consistency RI values

Number	1	2	3	4	5	6	7	8
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41

According to the consistency index value in table 3, the RI value of the corresponding consistency index is obtained. This leads to a random consistency ratio:

$$CR = \frac{CI}{RI} \quad (9)$$

When the value of random consistency ratio is less than 0.10, the judgment matrix is consistent, that is, the corresponding secondary index weight is reliable. Determine the effect of learning after all levels of index weight in evaluation index system, establish self learning framework implementations sports health curriculum learning effect evaluation.

1.4 Self-learning framework to achieve learning effectiveness assessment in physical education and health courses

In this paper, the self-learning framework based on ELM is used to establish the learning effect evaluation model of physical education and health course, and the final evaluation result is obtained. Take the data of learning effect evaluation as the input of the framework, design the number of two hidden layer nodes according to the number of primary and secondary evaluation indicators, and the number of output nodes is the student learning effect evaluation level. For dataset $\{x_i, t_i\}$ containing N mutually independent samples, input $x_i = [x_{i1}, x_{i2}, \dots, x_{in}]^T$ and output $t_i = [t_{i1}, t_{i2}, t_{i3}, t_{i4}]^T$ correspond to the evaluation level of learning effect. The corresponding activation function of hidden layer node in self-learning framework is $g(x)$. The evaluation formula of learning effect in self-learning framework is as follows:

$$\sum \beta_i g_i(x_j w_i + b_j) = y_i \quad (10)$$

In the above formula, β_i is the weight vector connecting the i th hidden node and the output node under the self-learning framework, namely, the second-level index weight of the evaluation index system; w_i is the weight vector between the input node and the i th hidden node, namely, the weight of the first-level index in the evaluation index system; b_j is the calculation threshold of hidden layer node. The self-learning framework is trained with training samples and the training objective is to minimize the output deviation of the framework. The computational thresholds of nodes in two hidden layers in self-learning framework are determined by training. Practical courses to study effect evaluation, according to the index after quantitative framework of data input, after processing by calculation, study effect evaluation results are obtained. According to the above content, completed the framework based on the study of sports health curriculum study effect evaluation method research.

Table 4

Comparison and significance test of physical fitness and motor skill test data between the experimental and control groups in the pre-validation period

Item/group	Experimental group	Control subjects	T	P
Age	20±0.56	20±0.68	0	P>0.05
Height (cm)	172.3±5.8	172.1±6.7	0.12	P>0.05
Body weight (kg)	69.8±9.6	70.1±10.1	0.44	P>0.05
50m(s)	6.9±0.62	7.0±0.51	0.53	P>0.05
1000m(s)	215±30.67	216±30.79	0.18	P>0.05
Sitting forward bend (m)	13.8±1.12	13.5±1.31	0.11	P>0.05
Vital mass index	61.2±6.2	60.8±7.5	0.21	P>0.05
Long jump (athletics)	4.32±0.53	4.31±0.62	0.86	P>0.05
Shot put (athletics event)	8.72±0.76	8.67±0.69	0.95	P>0.05

From table 4, we can see that there was no statistical

2 Case verification

To test the evaluation method is scientific and practical value, in this section, we will adopt the way of example of the previously proposed framework based on the study of sports health curriculum learning effect evaluation method to study the actual application situation, expecting can objectively reflect the students' learning effect, At the same time through research for further developing sports health curriculum scientific theory reference for the teaching and learning.

2.1 Verification preparation

2.1.1 Contents of the verification preparation

A total of 400 students were selected from a university and randomly and equally divided into two groups, experimental and control, and different evaluation methods were used to evaluate the learning effectiveness of the two groups when the students were taught the physical health course. The physical fitness and motor skills of the students in both groups were tested before the validation as a reference standard before the validation of the evaluation method example. During the testing process, it was ensured that the testing environment was consistent for both groups of students to minimize interference with the validation results. According to the requirements of the evaluation method, experts in the field of physical education and health teaching were invited to determine the weights of evaluation indicators for the evaluation method. The instance validation data were processed through the same data processing software.

2.1.2 Basic statistics on the subject of validation

In order to find out whether there was any variability in the physical fitness and motor skills of the two groups of students before the implementation of the new evaluation method, the two groups of students were tested before the experiment. The statistics of the physical fitness and motor skills test data of the students in the experimental and control groups before the empirical validation are shown in Table 4.

difference in body shape index, general motor ability

and physical function between the experimental group and the control group before the experiment, indicating that the experimental group and the control group belonged to the same population, and the initial conditions of the experimental group and the control group were the same.

2.2 Verification scheme design

The example in the form of contrast, this article put forward is course study effect evaluation method is applied in the experimental group, will be based on the

deep learning courses, study effect evaluation method is applied to the control group. Calculate according to the teaching of sports health curriculum for students in teaching, final, undertake various tests, with the change of students' test scores measure the feasibility and effectiveness of the proposed approach.

2.3 Verify results and analysis

The comparison of changes in students' sports ability and health knowledge before and after the application of the evaluation method is shown in Figure 4.

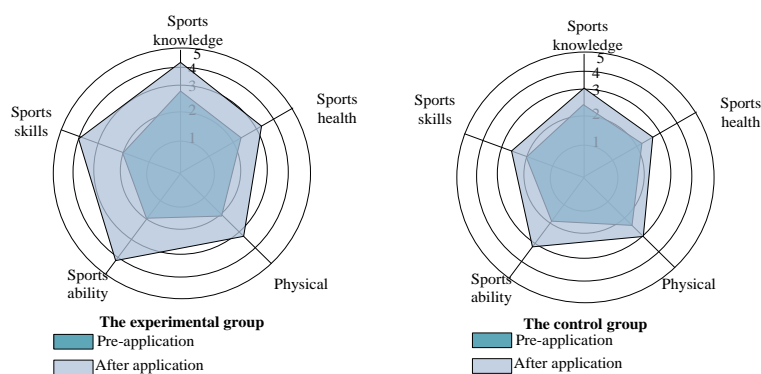


Figure 4 Comparison of changes in physical activity ability and health knowledge

Analysis of the information in Figure 4 above shows that after applying the evaluation method proposed in this paper, the students' physical education ability, motor skills and abilities, and physical health improved significantly more than applying the evaluation method based on deep learning. According to the physical health curriculum concept, students in the experimental group clearly learned the curriculum better, indicating that it is more practical to apply the evaluation method in this paper to assist teaching. As a side note, the evaluation results of this paper's evaluation method are more realistic and reliable.

Conclusion from the analysis of the above example, this paper puts forward the framework based on the study of sports health curriculum learning effect evaluation method. The evaluation results more accurate, and is applied to actual sports health curriculum teaching auxiliary to optimize the teaching effect is better, has the feasibility and reliability of actual use.

3 Conclusion

The physical education and health course is a compulsory course that uses physical exercise as the main means and aims at improving students' health, and is an important part of the school curriculum system. The course emphasizes practical features and strives to improve students' practical skills. The course attaches importance to the foundation of teaching content, trains students to develop healthy

living habits, and lays a good foundation for students' lifelong physical education. Focus on stimulating students' interest in sports and promoting their healthy growth. Emphasis is placed on giving full play to the nurturing function of physical education, cultivating students' strong will qualities and promoting their all-round development. And the assessment of physical education and health courses from the perspective of students' learning effects can help teachers to make more targeted teaching plans and improve teaching effects. To this end, this paper proposes a learning effectiveness evaluation method for physical education and health courses based on a self-learning framework, and investigates the applicability, feasibility, and accuracy of the evaluation method by means of example validation, confirming that the evaluation method has good practical application. Due to the small validation scope selected in the instance validation, this study still has certain shortcomings and will be further improved and optimized in future research to meet the needs of teaching and learning effectiveness evaluation of physical education and health courses in different contexts.

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