Scholar Publishing Group
International Journal of Educational Curriculum Management and Research
https://doi.org/10.38007/IJECMR.2024.050108
ISSN 2790-0967 Vol. 5, Issue 1: 46-58

Evaluation System of Integrated Learning in and out of Physical Education Class Based on Artificial Intelligence Algorithm

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Keywords: Physical Education Learning, Integrated Learning Evaluation System in and out of Class, Artificial Intelligence Algorithm, Multimodal Learning

Abstract: There are many problems in the existing sports teaching mode and learning evaluation system, which are difficult to apply in today's sports teaching. Therefore, it is necessary to innovate the sports teaching mode and learning evaluation system. With the rise of emerging technologies, multimodal learning has also been better applied in the collection and analysis of dynamic data of learning evaluation, which has played a better optimization effect on the current sports learning evaluation system. The increasingly mature artificial intelligence technology has been applied in all walks of life. Therefore, this paper proposed to apply artificial intelligence algorithm to physical education teaching, and combined support vector machine to build an integrated learning evaluation system model inside and outside the classroom. The model was also tested and analyzed from the aspects of evaluation accuracy and evaluation error. The experimental results showed that the average evaluation accuracy was 90.5%, and the average evaluation error was 0.76. It can be seen from the above data that support vector machine can effectively improve the evaluation accuracy of the model and reduce the evaluation error. In the survey of satisfaction of sports teaching experiment integrating multimodal learning, the average teaching satisfaction of students in four classes was 88.9%, which showed that students had a high satisfaction with sports teaching integrating multimodal learning.

1. Introduction

At present, physical education teaching is still dominated by traditional teaching models. The teaching model is backward, the learning evaluation system is not perfect. There are still situations where the content of learning evaluation does not conform to the teaching objectives, which restrict

the development of physical education teaching. In order to break this dilemma, the teaching model needs to be innovated. Teaching in the classroom and extracurricular athletics naturally complement each another to form an integrated teaching mode. In order to better implement this teaching mode, it is also necessary to combine artificial intelligence algorithms to build an integrated learning evaluation system model inside and outside physical education classes, so as to better evaluate students' physical education learning objectively and comprehensively.

In recent years, sports learning has aroused widespread concern in the academic community. Many researchers have explored this. Borres Garcia Daniel summarized the research on sports cooperative learning carried out in recent five years, and used multiple databases to select articles on sports cooperative learning. He found that most of the research methods were qualitative and mixed [1]. Chng Lena S provided an overview of formative assessment and learning assessment. For the evaluation methods of sports learning activities, he also gave a lot of examples, and pointed out that two evaluation methods could produce good results for sports learning [2]. Mashud Mashud explored the effectiveness of physical education learning in primary schools in wetland areas. Combining quantitative and qualitative analysis, he analyzed the learning data. Through analysis, it was found that the effectiveness of physical education learning in primary schools was very low [3]. In order to explore the anxiety of Indonesian students in sports learning during the epidemic, Burhaein Erick conducted a self-assessment study on these students. The results showed that most students had anxiety in physical education learning [4]. Daum David N explored the distance teaching mode of physical education learning, and discussed it from such aspects as distance physical education teaching, online relationship maintenance, and parents' participation. He pointed out that in distance sports learning, the social needs of both teachers and students had to be met by teachers [5]. Casey Ashley proposed to integrate context, time, education and other elements into Dewey's educational philosophy, and apply them to sports cooperative learning to achieve the diversified development of students in sports cooperative learning [6]. However, these scholars' research on sports learning is not comprehensive enough. Based on artificial intelligence, the research on sports can play a better role.

A few academics have also carried out pertinent study on the use of artificial intelligence in sports. Zhang Jianye discussed the reform of sports information service combined with artificial intelligence, and summarized the relationship between multiple information technologies. He pointed out that artificial intelligence could provide a new method for sports evaluation [7]. Li Zihao studied how to improve the effectiveness of physical education teaching in combination with artificial intelligence, and analyzed different physical education teaching methods through experimental methods. The experimental results showed that the application of artificial intelligence to physical education teaching could play a role in improving students' multiple qualities [8]. In general, there are not many researches on the application of AI in sports. In order to improve the relevant research of physical education learning, it is necessary to study the integrated learning evaluation system in and out of physical education class based on artificial intelligence algorithm.

In this paper, support vector machine was applied to the evaluation system model of integrated learning in and out of physical education classes, and the model was tested and analyzed. The experiment showed that the average evaluation accuracy of this algorithm was 90.5%, and the average evaluation accuracy of traditional algorithm was 83.5%. In terms of evaluation error, the average evaluation error of this algorithm was 0.76, and the average evaluation error of traditional algorithm was 3.03. From the above data, it can be seen that the evaluation accuracy under the algorithm was higher and the evaluation error was smaller. In the survey of satisfaction of sports teaching experiment integrating multimodal learning, the average teaching satisfaction of the four classes was 88.9%. On the whole, students were relatively satisfied with sports teaching integrating multimodal learning.

2. Integrated Teaching Mode and Learning Evaluation System Inside and Outside PE Class

2.1 Multimodal Learning

In the real world, the types of information are very diverse, and there may be several other modes associated with information in a modal space. For example, image and information description, video and text interpretation, including human perception, are also realized with the help of various information. Different modes have their own statistical properties, which are interrelated and complementary to each other. Therefore, the data processing problem of multiple modes cannot be processed by a single mode, and the correlation between different modes needs to be represented by a multimodal model. Multimodal learning is shown in Figure 1.

In the perceptual world, to deeply understand information, it is necessary to process the data characteristics and statistical properties of multiple modes and find out the relationship between them. In multimodal tasks, there are a variety of data types and task scenarios, which are involved in multimedia, medical images, voice translation, robots and other fields.

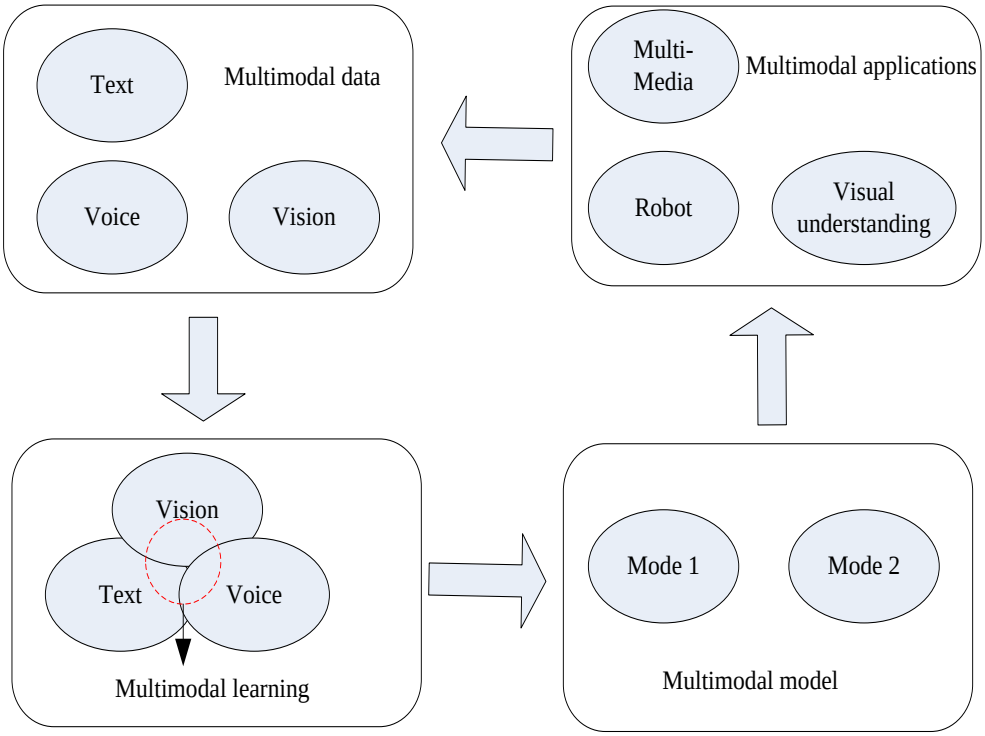

Figure 1. Multimodal learning

2.2 Integrated Teaching Mode Inside and Outside PE Class

2.2.1 Teaching Objectives

In terms of teaching objectives, the integrated teaching mode in and out of class has clear objectives in both in class teaching and extracurricular sports activities. The goal of sports participation is to enable students to learn some sports that can improve their physical fitness and meet their interests through in class teaching of physical education, which improves their interest in sports learning through extracurricular sports activities [9]. The goal of sports skills is that students can master 2-3 sports skills in class, which uses after-school time for physical exercise to improve relevant skills. The goal of physical health is to improve the physical fitness of students with the

help of in class learning, which uses after-school sports activities to improve physical fitness. The goal of mental health is to improve students' perception, attention and memory during in class learning, so as to enhance their willpower, and to enhance their anti-stress ability during after-school exercise. In addition to these, there are social adaptation goals.

2.2.2 Teaching Content

The teaching content consists of in class teaching, extracurricular group activities, sports training and other parts. These are the key contents of physical education teaching, which help to thoroughly implement the concept of integrated teaching in and out of class.

At this stage, the school has also made some adjustments to the physical education curriculum structure system. Extracurricular physical exercise, sports training, extracurricular activities and other contents are added to the system [10]. In terms of extracurricular teaching content, students can be allowed to exercise independently in extracurricular time. Sports data can also be evaluated with the help of relevant technologies. Some extracurricular group activities can also be carried out, such as some sports performances and sports competitions in schools, and students can also organize some sports activities spontaneously.

2.3 Design and Teaching Process of Integrated Teaching Mode Inside and Outside PE Class

2.3.1 Design of Teaching Mode

The design of teaching mode includes the following aspects:

(1) Student centered

In physical education teaching, students' autonomous learning spirit should be shown as much as possible, such as self-searching for learning materials, and spontaneously forming groups to discuss learning. Extracurricular time is used to carry out sports activities independently. The theoretical information taught at school is applied to extracurricular sports activities, and students can develop their motor skills more [11].

(2) Cooperative learning among students

When students learn sports skills, they are affected by the surrounding environment. Full communication between students can have a positive effect on the learning of sports skills [12]. After group discussion, students can communicate and discuss with teachers. They finally reach a consensus through guidance and discussion on technical actions.

(3) Learning by combining multiple information resources

In this teaching mode, teachers need to provide students with various types of learning materials, such as sports videos, relevant websites, books, etc., with which students can learn independently.

(4) Embodiment of teaching objectives

In the process of physical education learning, it is necessary to implement the teaching objectives into the teaching model. In the process of teaching design, it is also necessary to always focus on the teaching objectives [13]. The structure of the teaching model is shown in Figure 2, which highlights the teaching objectives.

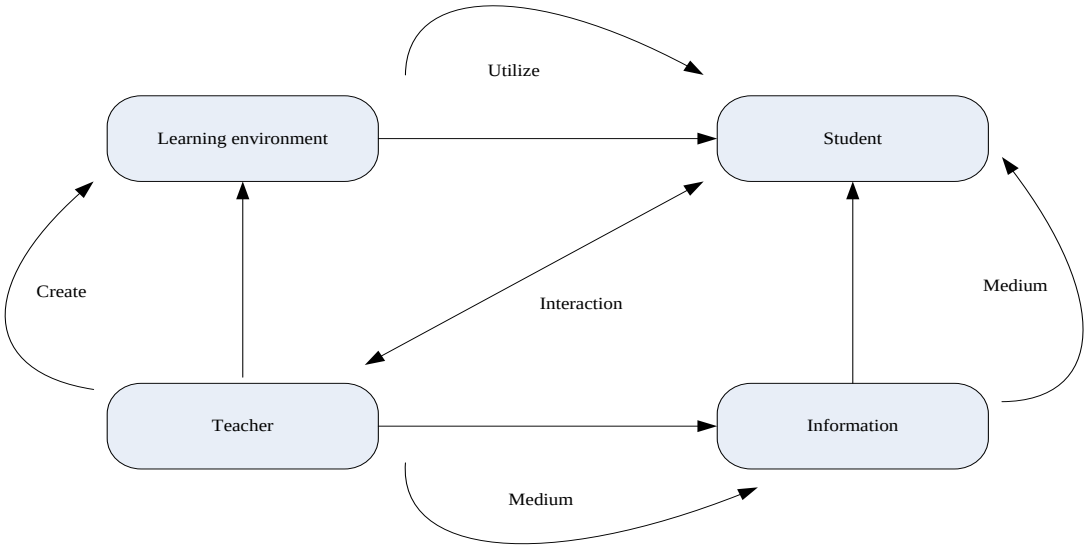

Figure 2. Structure of teaching model

2.3.2 Teaching Process of Teaching Mode

The teaching process of the teaching mode is shown in Figure 3, which includes the following aspects:

(1) The process of physical education teaching needs to have some characteristics to assist the teaching of sports skills.

(2) Cooperative learning. The students are divided into groups and discuss with the teacher. All of them are members of the group and the technical actions are discussed together.

(3) Evaluate the teaching effect.

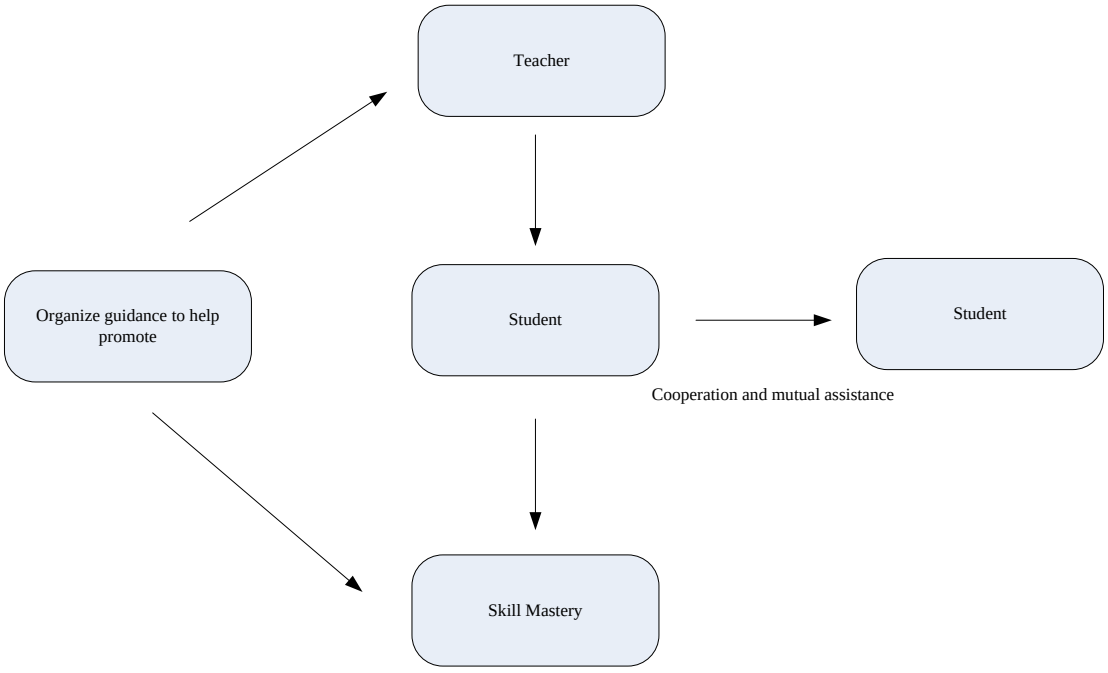

Figure 3. Teaching process of teaching mode

2.4 Integrated Learning Evaluation System Inside and Outside PE Class

2.4.1 Connotation of Learning Evaluation System

The integrated teaching mode in and out of class fully integrates physical education courses, extracurricular sports activities and sports training to promote the healthy development of students' physical and mental health, so as to stimulate students' interest in sports learning and cultivate their ability to learn sports [14]. Under the tide of teaching reform, the integrated learning evaluation system in and out of class has also been put forward. The effective way to evaluate the integrated teaching mode in and out of class is the learning evaluation system. The connotation of this system is to change the single in class test and evaluation mode at this stage. In the learning evaluation system, sports courses, extracurricular sports activities, sports training and other contents are added, and the system is used to objectively and comprehensively evaluate students.

2.4.2 Structure of Learning Evaluation System

The structure of the learning evaluation system mainly includes the following parts:

(1) Evaluation objective

The teaching aim is consistent with the evaluation goal, and the evaluation goal is guided by the teaching goal. By adhering to the principle of health first, students' physical and mental health development is promoted. It should not only improve students' special skills, emotional attitudes, theoretical knowledge and other aspects, but also focus on cultivating students' awareness of physical exercise and attitude to participate in sports activities. The above contents cannot be realized one by one in traditional classroom teaching. Therefore, it is necessary to build an integrated teaching mode and learning evaluation system inside and outside the class, and combine the in class teaching with extracurricular sports activities.

(2) Evaluation content

In the learning evaluation system, the most important indicator is the evaluation content. In addition to the examination of students' special skills, the evaluation should also be carried out in terms of learning attitude, theoretical knowledge, cooperation spirit, etc. Sports theoretical knowledge can be examined by written examination. From the perspective of lifelong sports learning, learning attitude should also be a part of the evaluation content. Emotional performance refers to the attitude of students in participating in sports learning. Cooperative spirit refers to the team cooperation formed by students in physical exercise.

(3) Evaluation subject

The subject of evaluation refers to the implementers of evaluation. In the process of physical education teaching, the implementers of evaluation include teachers, students and teaching assistants. In the teaching process, students, as learning objects, occupy the main position. Students need to have the ability to learn independently, communicate with teachers actively, so as to summarize their own learning and give feedback to teachers. In this process, students are not individual individuals, but need to cooperate with other students to learn, and they can evaluate each other. The evaluation methods are more diversified, including students' self-evaluation, students' mutual evaluation and teachers' comments.

(4) Evaluation criteria

Evaluation criteria are not always fixed. Teachers should not excessively abide by unified standards when formulating evaluation standards. It is also necessary to formulate more scientific and reasonable evaluation standards based on the differences of different students, and comprehensively evaluate students from different perspectives. Physical education teachers can formulate appropriate evaluation criteria according to the actual teaching situation to

comprehensively and objectively evaluate students [15]. When assessing students' usual performance, WeChat, QQ and other software can be used to let students forward the video of participating in exercise to the class group as the basis for assessment. For students' participation in relevant sports activities, relevant certificates can be used as the basis for assessment.

3. Integrated Learning Evaluation System Model of Physical Education in and out of Class Based on Support Vector Machine

3.1 Overview of Support Vector Machine

Support vector machine belongs to supervised learning algorithm. It is an algorithm based on statistical learning theory. It has certain applications in pattern recognition, image processing, artificial intelligence, etc. Statistical learning theory is often used in machine learning. The learning problem in case of insufficient samples can also be well handled, which provides theoretical support for the application of support vector machine in this area. Support vector machines are also divided into convex quadratic programming problems. Compared with neural network algorithm, support vector machine can solve the problem of local optimization well. The model structure of support vector machine is shown in Figure 4.

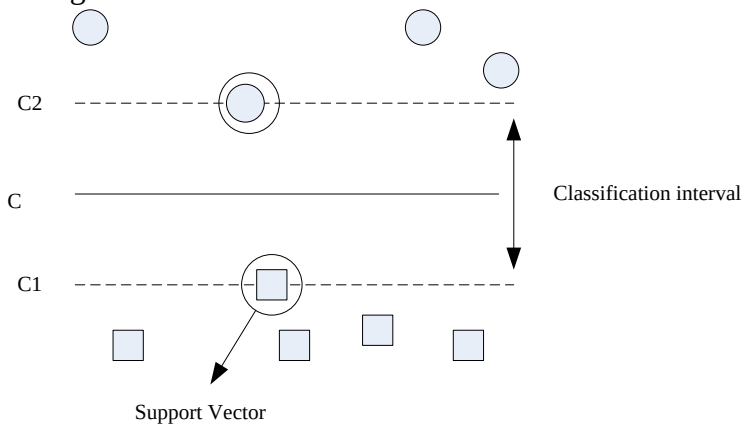

Figure 4. Model structure of support vector machine

Support vector machine adopts the principle of structural risk minimization. It also has good fitting ability for small sample processing. Evaluation of pupils' learning in physical education that is effective can be combined with support vector machine to build an integrated evaluation system model. The model parameters are chosen in conjunction with the particle swarm optimization process, and the model is then used to model the Learning evaluation system.

3.2 Construction of Learning Evaluation System Model

3.2.1 Support Vector Machine Application

Support vector machine has less constraints and doesn't suffer from the overfitting problem compared to other machine learning method. Therefore, it is more suitable for application in the evaluation system model of integrated learning in and out of PE classes.

The student's learning evaluation data set is represented by M . $M = \{(m_1, n_2), (m_2, n_2) \cdots, (m_x, n_x)\}, i = 1,2, \cdots, x$. The support vector machine's regression algorithm is as follows:

$$g(m) = \beta \cdot \delta(m) + c \quad (1)$$

In the above formula, β and c represent parameters.

To construct the learning evaluation system model, it is necessary to find the most appropriate values of β and c. In combination with the principle of structural risk minimization, the formula can be transformed into:

$$\min \frac{1}{2}\|\beta\|^2 + Q\frac{1}{f}\sum_{i=1}^{f}\mu(g(m_i) - n_i)$$

$$\text{S.t. } \mu(g(m_i) - n_i) = \begin{cases} |g(m_i) - n_i| - \mu, |\beta \cdot \delta(m) + c - n_i| \geq \mu \\ 0, |\beta \cdot \delta(m) + c - n_i| < \mu \end{cases} \quad (2)$$

In the above formula, the solution process is complex and needs to be simplified to reduce the difficulty of calculation. As a result, relaxation factors μ and μ^* are introduced to to create the following quadratic planning form:

$$\min \frac{1}{2}\|\beta\|^2 + Q\sum_{i=1}^{k}(\psi_i + \psi_i^*)$$

$$\text{S.t.} \begin{cases} n_i - \beta \cdot \delta(m) - c \leq \mu + \psi_i, \mu_i \geq 0; i = 1,2,\cdots,x \\ \beta \cdot \delta(m) + c - n_i \leq \mu^* + \psi_i^*, \mu_i^* \geq 0; i = 1,2,\cdots,x \end{cases} \quad (3)$$

Lagrange multipliers d_i and d_i^* are used to transform Formula (3), which is:

$$\min \frac{1}{2}\sum_{i,j=1}^{a}(d_i^* - d_i)(d_j^* - d_j)h(m_i, m_j) + \mu\sum_{i=1}^{a}(d_i^* + d_i) - \sum_{i=1}^{a}(d_i^* + d_i) - n_i(d_i^* - d_i) \quad (4)$$

In the above formula, $h(m_i, m_j)$ represents a kernel function.

The following is the support vector machine's regression function formula:

$$g(m) = \sum_{i=1}^{j}(d_i - d_i^*)(\mu(M_i), \mu(M)) + c \quad (5)$$

The kernel function used is the radial basis function, and the formula is:

$$h(m_i, m_j) = \exp\left[\frac{\|m_i - m_j\|^2}{2\gamma^2}\right] \quad (6)$$

The radial basis function's parameter is represented by γ .

3.2.2 Particle Swarm Optimization

In particle swarm optimization, pbest is the optimal solution and gbest is the optimal solution of the population. The formula for the fitness function, which describes the individual differences of particles, is:

$$\text{fitness} = \frac{1}{2T}\sum_{i=1}^{V}\sum_{j=1}^{B}(n_{ij} - e_{ij})^2 \quad (7)$$

m_{il}^h and R_{il}^h are the speed and position of the h iteration of particle i.

The update method is as follows:

$$R_{il}^{h+1} = \varphi R_{il}^h + p_1 Rand(S_{il} - m_{il}^h) + p_2 Rand(S_{gbest}^h - m_{il}^h) \quad (8)$$

$$m_{il}^{h+1} = m_{il}^h + R_{il}^h \quad (9)$$

In the above formulas, p_1, p_2 represent the learning evaluation factors. $Rand(\cdot)$ represents a

random number. φ represents inertia weight.

For the problem of how to determine the parameters of the particle swarm optimization technique, the support vector machine needs to be combined to complete.

The workflow of learning evaluation system model based on support vector machine is shown in Figure 5.

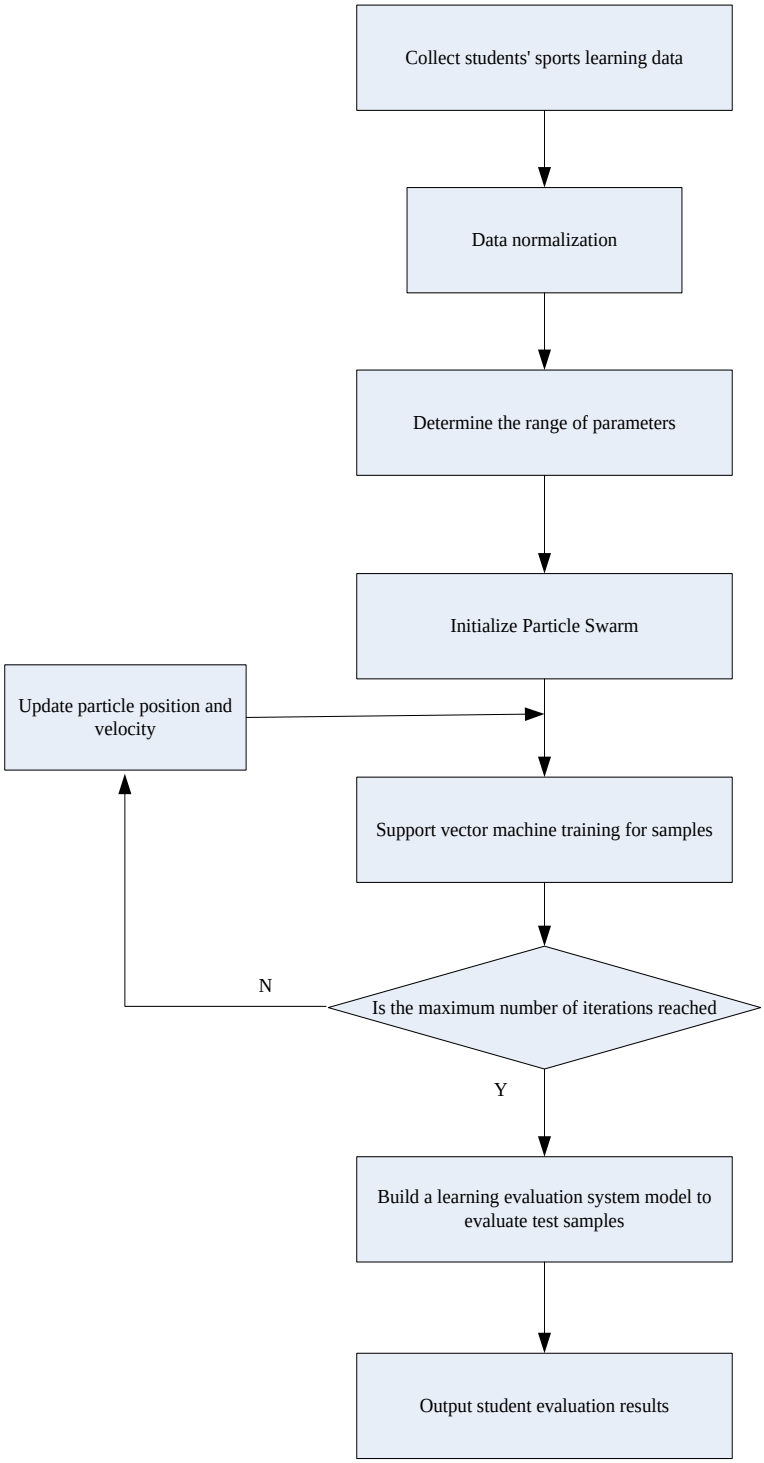

Figure 5. Flow chart of learning evaluation system model

3.3 Model Experiment of Learning Evaluation System

In this paper, 180 students from three physical education colleges are selected as the research objects. Combined with support vector machine, this paper analyzes the learning evaluation system model from the aspects of special skills, sports ability, theoretical knowledge, learning attitude and cooperation spirit. In order to reflect the scientificity and comparability of this experiment, the traditional algorithm is also used for comparative experiments.

3.3.1 Evaluation Accuracy Experiment

For the comparison of different effects of learning evaluation system models for two algorithms, this paper conducts relevant test analysis from the aspect of evaluation accuracy. The experimental results are shown in Figure 6.

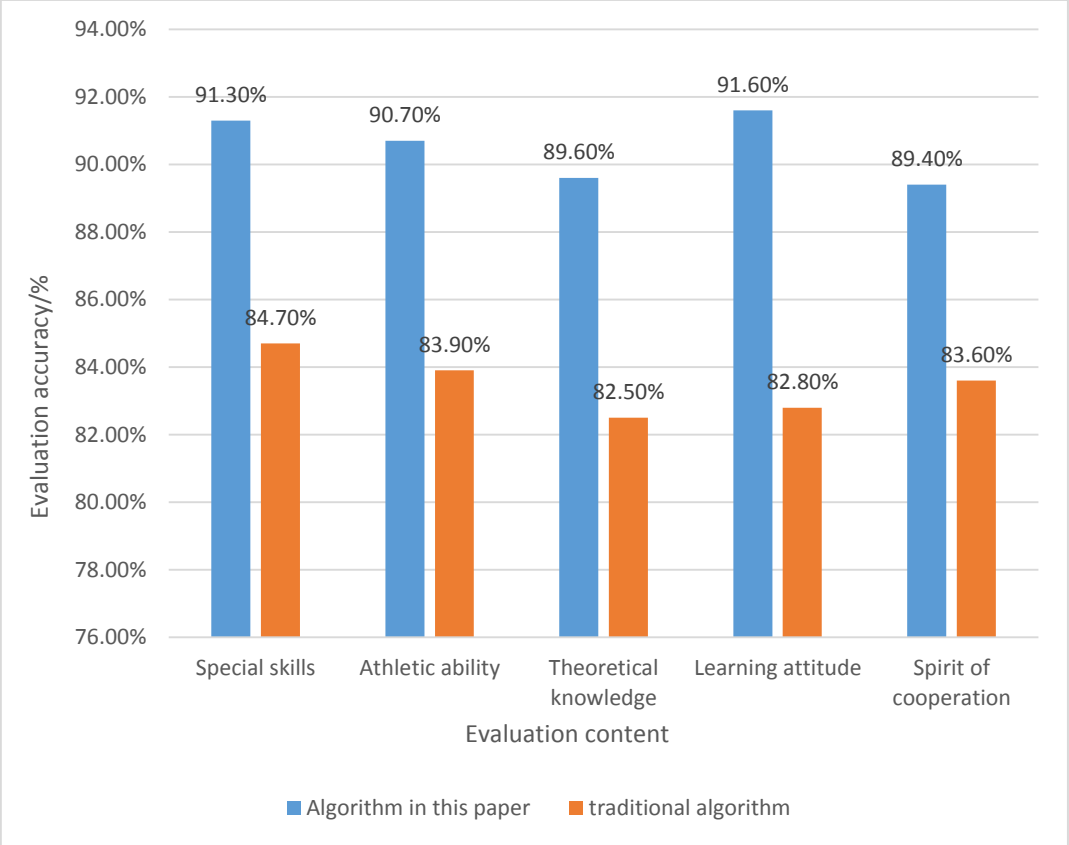

Figure 6. Comparison experiment of evaluation accuracy

It can be seen from Figure 6 that the two algorithms have different evaluation accuracy rates for this model. In this algorithm, the overall evaluation accuracy is relatively high. Among them, the evaluation accuracy of cooperative spirit is the lowest, 89.4%. The evaluation accuracy of learning attitude is the highest, 91.6. It can be calculated that the average evaluation accuracy of the five evaluation contents is 90.5%. Under the traditional algorithm, the evaluation accuracy is slightly lower. Among them, the evaluation accuracy of theoretical knowledge is the lowest, 82.5%. The evaluation accuracy of special skills is the highest, 84.7%. Therefore, the average evaluation accuracy of the five evaluation contents can be calculated as 83.5%. In contrast, the evaluation accuracy of this algorithm is higher, reflecting certain advantages.

3.3.2 Evaluation Error Experiment

In order to better reflect the advantages of this algorithm, this paper also tests and analyzes the model from the evaluation error, and compares it with the traditional algorithm. The test results are shown in Figure 7.

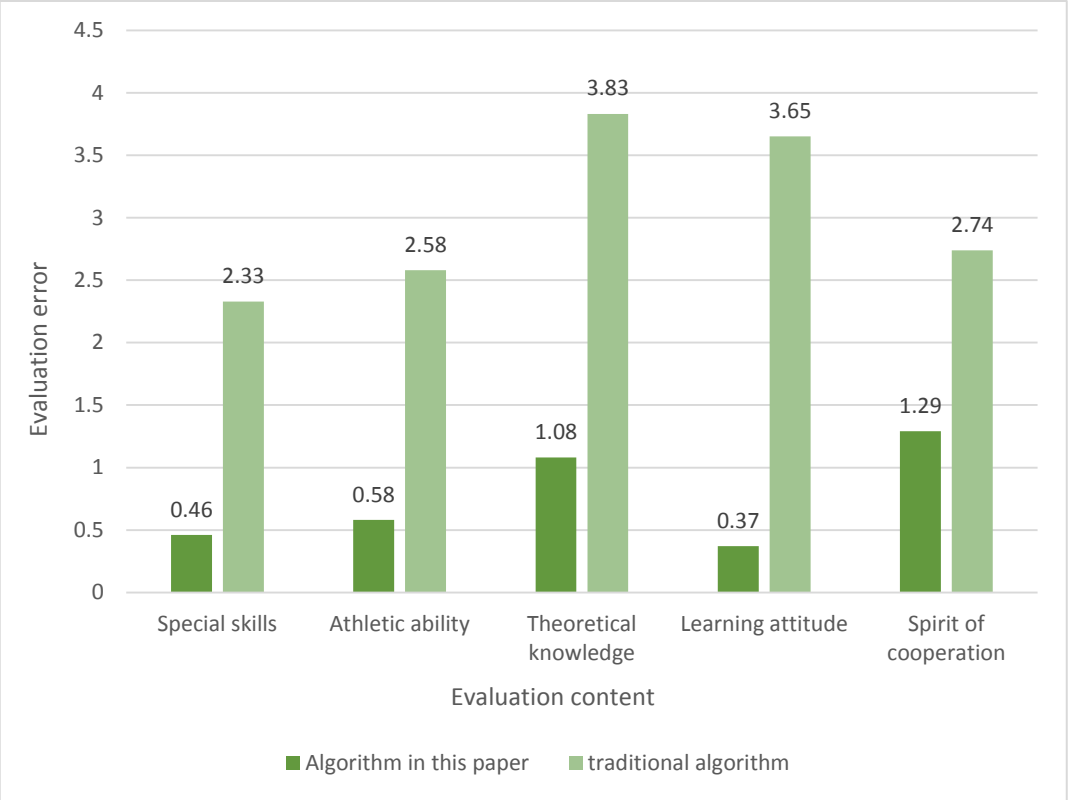

Figure 7. Evaluation error comparison experiment

It can be seen from Figure 7 that the evaluation errors of the two algorithms are quite different. In this algorithm, the evaluation error of learning attitude is the smallest, 0.37. The evaluation error of cooperative spirit is the largest, 1.29. It can be concluded that the average evaluation error of the five evaluation contents is 0.76. On the whole, the evaluation error of this algorithm is small. Under the traditional algorithm, the evaluation error of special skills is the smallest, 2.33, and the evaluation error of theoretical knowledge is the largest, 3.83. Therefore, the average evaluation error of the five evaluation contents is 3.03, which shows that the overall evaluation error of the algorithm is slightly higher. In contrast, the algorithm in this paper has lower evaluation error and more significant advantages.

3.4 Satisfaction Survey of Sports Teaching Experiment Integrating Multimodal Learning

This experiment selects four classes of students as the research object. In physical education teaching, multimodal learning has been integrated into the teaching experiment for a semester. At the end of the semester, the students in these classes are investigated on their satisfaction with the teaching experiment. The results of the survey are shown in Figure 8.

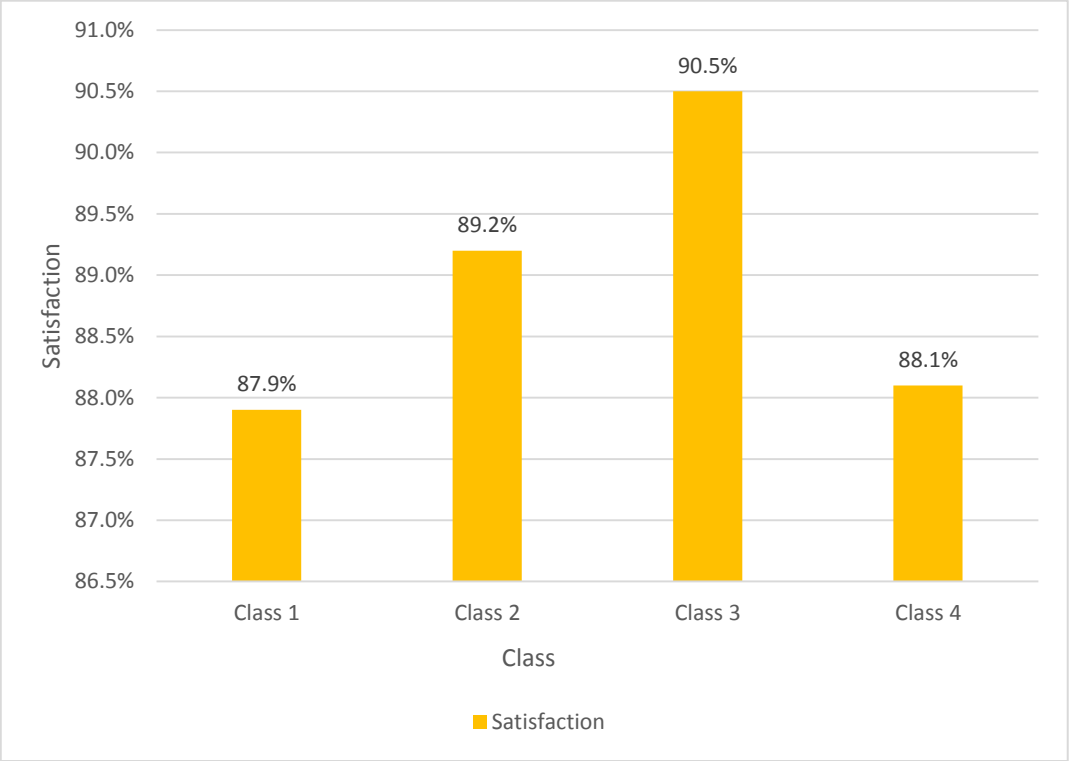

Figure 8. Satisfaction of physical education teaching with multimodal learning

It can be seen from Figure 8 that the students in the four classes are relatively satisfied with the physical education teaching integrating multimodal learning. Among them, Class 1 has the lowest teaching satisfaction, 87.9%, and Class 3 has the highest teaching satisfaction, 90.5%. It can be calculated that the average teaching satisfaction of the four classes is 88.9%. From the above data, the integration of multimodal learning in the process of physical education teaching can stimulate students' interest in learning to a large extent, thus improving students' satisfaction with physical education teaching.

4. Conclusion

In the tide of educational reform, the current physical education teaching model has been unable to keep up with the pace of the times. It has been exposed many drawbacks, which needs to find a new teaching mode to change this situation. With the powerful boost of science and technology, multimodal learning technology has become increasingly mature, which has a good effect on the collection and processing of learning data. In view of the problems in physical education teaching, this paper put forward an integrated teaching mode in and out of class. Combined with support vector machine, a learning evaluation system model was built, and the model was also tested and analyzed from the aspects of evaluation accuracy and evaluation error. Under this method, the evaluation accuracy of the learning evaluation system model has been greatly improved. The evaluation error was still smaller, which showed that the algorithm in this paper could play a good role in optimizing the model. This paper also integrated multimodal learning and conducted an investigation on the satisfaction of physical education teaching. The survey results showed that students were generally satisfied with the sports teaching method of integrating multimodal learning. In the future research work, support vector machine algorithm still needs to constantly adapt to the development needs of the learning evaluation system model to improve the performance of the

algorithm and provide more accurate evaluation information for the model.

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