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Exploration on the Development of Physical Education Teaching Integration Mode in Colleges and Universities Based on Artificial Intelligence

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ABSTRACT

Artificial intelligence plays an increasingly important role in contemporary education, and it provides new possibilities for the innovation of physical education teaching mode. This paper constructs a college sports teaching integration model based on artificial intelligence from five aspects: educators, learners, teaching methods, educational resources and teaching feedback and evaluation. It focuses on designing a precise teaching model PLRSM based on personalized learning resource recommendation by combining learner portrait and learning resource portrait, and takes the recommendation of physical education teaching resources for physical education students as a case study to verify the effectiveness of the proposed algorithm. The results show that compared with the traditional baseline algorithm, the PLRSM algorithm still maintains a better recommendation performance when the data set co-occurrence matrix is extremely sparse, and its correct rate of physical education teaching resources recommendation is 0.80. In addition, compared with the traditional teaching model, the AI-based college physical education teaching fusion model can significantly improve the learners' knowledge of physical education subject and course teaching, and its post-test score is higher than the pre-test score 11.525 to 15.436 points. The study provides theoretical support and practical guidance for the application of artificial intelligence in physical education teaching, and provides a useful reference for promoting the innovation of physical education teaching mode.

Keywords: Artificial intelligence, learner portrait, learning resource portrait, PLRSM, physical education teaching mode

1. Introduction

As one of the compulsory courses in colleges and universities, physical education is an important part of improving the quality education of college students [1]. However, the traditional physical education teaching in colleges and universities has problems such as students' inability to show interest in

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physical education classes and low participation rate in classroom activities, which leads to the physical health of most students not meeting the standards [2-3]. With the continuous development of science and technology at the same time, the students' sports demand is also steadily rising, the reform of the traditional physical education teaching mode is imminent, how to improve the quality of physical education teaching in colleges and universities to meet the students' sports needs is a problem that colleges and universities need to pay attention to [4-5].

Artificial intelligence is an emerging cross-cutting discipline, which has gained better achievements in the process of serving the development of sports in China [6]. With the continuous development of China's higher education and the reform of sports teaching in colleges and universities, the application of artificial intelligence provides more data support and intelligent services for sports teaching in colleges and universities [7]. Colleges and universities can use artificial intelligence technology to cultivate students' athletic ability, improve the level of competition, and realize the scientific, efficient and personalized teaching and training, so it is of great practical significance to carry out research on the innovation of college sports teaching based on artificial intelligence [8-9].

The integration of modern information technology and college physical education classroom can effectively change the learning mode and learning environment of physical education courses [10]. Students can utilize after-school time to study the theoretical knowledge and general knowledge of sports, and find video teaching materials through the network to understand and master the technical movements and skills of some sports in physical education [11]. At present, colleges and universities have established a perfect network and equipment, which has laid a solid foundation for promoting the organic integration of modern information technology and college physical education courses [12]. Information technology learning mode so that students' learning tools from textbooks and books to all kinds of electronic products, so that physical education is no longer simply jumping and skipping on the playground. Physical education teachers can also use information technology to arrange extracurricular assignments in physical education, improve students' motivation to learn, create a new learning mode of independent and collaborative learning, improve students' ability to exercise independently and develop good lifelong sports habits [13].

Literature [14] points out that with the development of computer technology and related disciplines, the application of multimedia technology in education is rapidly becoming the mainstream technology of education technology. Literature [15] studied the interaction law between the natural light environment comfort of sports training facilities and architectural design elements, and used appropriate dynamic optimization methods to improve the quality of the light environment in the sports space, so as to improve the visual comfort of the sports crowd in the stadium. Literature [16] points out that in the era of information technology it is necessary to improve the methods of teaching physical education and sports science, and the use of computers and other information technologies to improve the effectiveness of the teaching process is a modern approach. Literature [17] uses the flexibility and popularity of the Internet to expose more students to physical education and to master more sports skills, which is an effective way to fully mobilize the subjective initiative of students and improve the effectiveness of teaching. Literature [18] designed an intelligent management system for physical education courses using a web-based teaching aid system, and the designed multilayer system provides convenience for teachers and students in health and physical education. Literature [19] experimentally derived significant differences in digital competence among teachers with different teaching experiences and ages. In addition, younger teachers were more cognizant of their ability to apply digital competence in the physical education classroom environment. Literature [20] based on the analysis and content optimization of physical education teaching in the context of computer information technology, the results of the cluster analysis of physical education teachers and experts in higher education showed that, in terms of teachers, 36% of them were satisfied with physical education textbooks, which was in the first place. Literature [21] experiments show that the total performance of students' technical training, physical training and psychological quality training assisted by computer technology is 3.53% higher than that of students under traditional teaching.

The study realizes the precise match between the instructor and the learner through the artificial intelligence platform, forming a new "artificial intelligence + physical education" teaching integration model with multi-level, broad field and multiple elements. In this process, in order to realize accurate teaching, a new personalized learning resource recommendation service model (PLRSM) is proposed based on the multidimensional feature differences between learner profiles and learning resource profiles, as well as the characteristics of learning resource recommendation. The performance of the proposed model is evaluated using precision rate and recall rate, and the recommendation effect is analyzed using the recommendation of physical education resources for physical education students as a case study. In addition, the effect of physical education teaching is also explored from the perspectives of learners' pedagogical knowledge of physical education disciplines and courses, and multidimensional comprehensive evaluation, in order to validate the feasibility of the constructed AI-based physical education teaching fusion model in colleges and universities.

2. Construction of the integration mode of college sports teaching based on artificial intelligence

"Artificial Intelligence + Sports Teaching" completely subverts the traditional teaching mode, which mainly changes the structure of educational resources, the mechanism of teaching feedback and evaluation, and changes into intelligent teaching methods. Most of the educational resources and teaching are based on digitalization, with more emphasis on the diversity and re-optimization of the combination of resources. It is worth paying attention to the "artificial intelligence + sports teaching" is built on many artificial intelligence equipment and big data processing center, it can not be separated from the technical support and the environment of the structure, but the teaching services provided by the intelligent, innovative, intelligent and advanced.

In practical application, it is divided into five distinct elements: educators, learners, teaching methods, educational resources and teaching feedback and evaluation, and the various elements coordinate and operate together to build the "Artificial Intelligence + Physical Education Teaching" teaching fusion model. In order to promote intelligent education and its application, it is necessary to firstly base on the current trend of education development, and then combine with the remarkable achievements of contemporary science and technology. This study injects the core literacy and advanced concepts of AI technology into physical education, and designs from top to bottom, constructing a model of the overall operation mechanism of "AI + Physical Education" as shown in Figure 1, with the following components:

1) Educator element. The educator has always been the leader in educational activities, and this is also true in physical education teaching. In the new "artificial intelligence + physical education teaching", physical education teachers play a leading role in education and teaching. Based on the medium of artificial intelligence platform, physical education teachers are upgraded to intelligent teachers, and according to the statistical results of big data, it is easier for teachers to grasp the students' pre-course preparation, classroom learning, and post-course feedback, so that they can teach students according to their abilities, and teach them according to the sports venues, and it is easier to control the direction of teaching when they are assisted in the teaching by intelligent machines.

2) Learner elements. Based on intelligent data statistics, students can know their own strengths and weaknesses, relying on intelligent teachers to carry out accurate docking, teaching programs designed according to the material, to promote the overall development of students. In self-study, students are not bound by the restrictions of traditional teaching time and place, so that learning becomes more independent and open.

3) Educational resource elements. Educational resources are integrated and optimized through the artificial intelligence platform, and the interconnection between terminal devices is realized through "cloud computing", so that educational resources can be reciprocated at all levels of physical education.
4) Teaching Method Element. Sports teaching is often constrained by venue factors and weather factors, sports teaching under artificial intelligence is completely free from these constraints, the use of virtual reality, now stadiums, sports equipment, environment and teaching seamless connection. Intelligent teaching and accurate teaching are implemented together, making teaching fruitful.
5) and evaluation elements. Teaching feedback and evaluation has always been the key to the teaching process of checking deficiencies and filling gaps, and the application of artificial intelligence technology and big data has made it simple and efficient. Data collection and intelligent analysis allow educators to become proactive in diagnostic evaluation, formative evaluation, summative evaluation, automated and quantitative evaluation, and timely delivery of information to students, so that they can learn and grow according to intelligent planning.

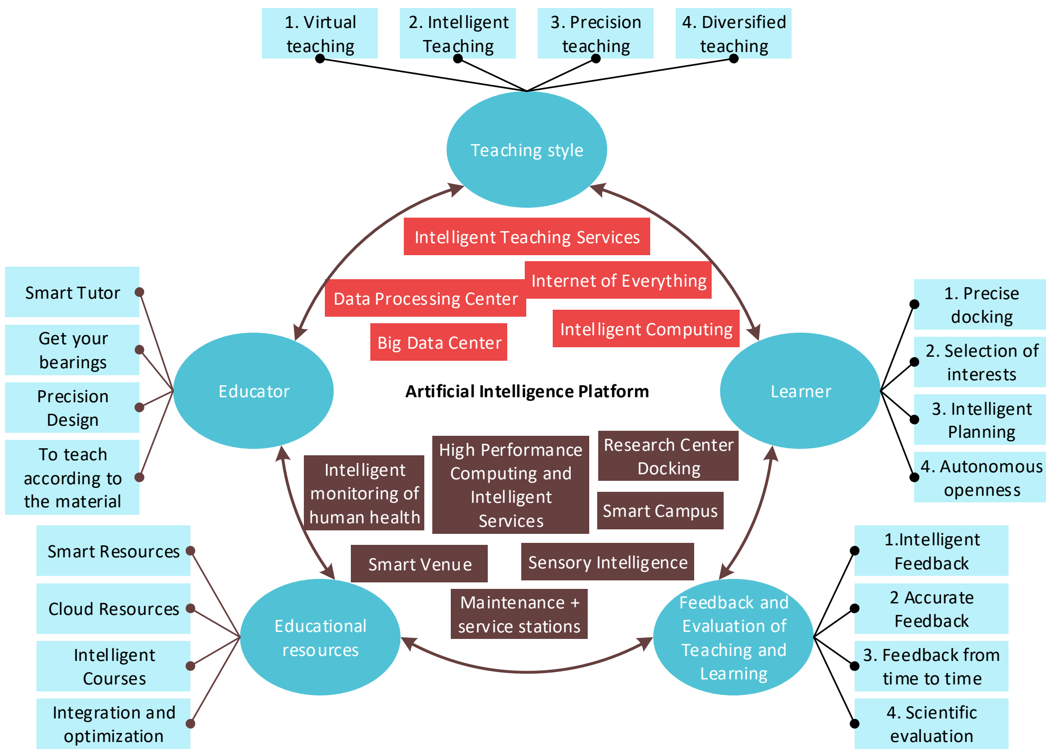

Fig. 1. The overall operation mechanism model of "artificial intelligence + physical education"

3. Accurate teaching model based on personalized learning resources recommendation

In the pursuit of personalized background, traditional sports teaching exposes the shortcomings of the individual students. Each student has different physical qualities and physical skills. This paper proposes a new recommendation model, which is modeled for a single learner, and the learning resources are divided into knowledge points, and each time the learning resources corresponding to a single knowledge point of a single learner are recommended in the resource recommendation process. The recommendation model maintains the flexibility to dynamically adjust the model content according to specific application scenarios to achieve accurate teaching.

3.1. Learner Profile

The study of portraits is a full description of the student's learning status. In the course of physical education, it contains the physical function level, the level of physical skill, the knowledge of sports theory and so on.

1) Define the learner's comprehension of a learning resource as $C = \{C_1, C_2, \ldots C_m\}$, and each C_m contains N one-dimensional vectors:

$$C_m = \{C_{m1}, C_{m2}, \ldots C_{mn}\}, 1 \le m \le M, 1 \le n \le N \tag{1}$$

where the C_{mn} value is represented by a real number that indicates the learner's comprehension of the nrd learning resource for the mnd knowledge point.

2) Define the learner's preference for the knowledge point medium as $\mathrm{MF} = \{MF_1, MF_2, \ldots MF_m\}$, and each MF_m contains K one-dimensional vectors:

$$MF_m = \{MF_{m1}, MF_{m2} \ldots MF_{mk}\}, 1 \le m \le M, 1 \le k \le k \tag{2}$$

where the number of K is the number of media types contained in the learning resource. The value of MF_{mk} is a real number indicating the probability of the learner's preference for the Kth media type for the M rd knowledge point.

3) Define the learner's preference for the content of the knowledge point as $\mathrm{CF} = \{CF_1, CF_2, \ldots CF_m\}$, and each CF_m contains K one-dimensional vectors:

$$CF_m = \{CF_{m1}, CF_{m2} \ldots CF_{mk}\}, 1 \le m \le M, 1 \le k \le k \tag{3}$$

where the number of K is the number of content types contained in the learning resource. The value of CF_{mk} is a real number indicating the probability of the learner's preference for the Kth content type of the M rd knowledge point.

4) Define the minimum learning time required for the learner to learn the knowledge point as:

$$T_{l\_km} = \{T_{l\_k1}, T_{l\_k2}, \ldots T_{l\_km}\} \tag{4}$$

Where T_{l_km} denotes the minimum learning time required for the Knd learner to learn the M rd knowledge point.

5) Define the maximum learning time required for the learner to learn the knowledge point as:

$$T_{u\_km} = \{T_{u\_k1}, T_{u\_k2}, \ldots T_{u\_km}\} \tag{5}$$

where T_{u_km} denotes the maximum time required for the Knd learner to learn the M rd knowledge point.

6) Define the learner's hotness preference for the learning resources corresponding to the knowledge point as H, $H = \{H_1, H_2, \ldots H_m\}$, and each H_m contains N one-dimensional vectors:

$$H = \{H_{m1}, H_{m2}, \ldots H_{mn}\} \tag{6}$$

where the value of H_{mn} is represented by a real number and H_{mn} represents the heat value of the nth learning resource corresponding to the mrd knowledge point.

3.2. Learning resource profiling

1) Define the difficulty of a learning resource as $DI = \{DI_1, DI_2, DI_3, \ldots DI_m\}$, and each DI_m contains N one-dimensional vectors:

$$DI_m = \{DI_{m1}, DI_{m2}, DI_{m3}, \ldots DI_{mn}\}, 1 \le m \le M, 1 \le n \le N \tag{7}$$

where the value of DI_{mn} is a real number indicating the difficulty of the nrd learning resource corresponding to the mnd knowledge point.

2) Define the medium type of the learning resources corresponding to the knowledge point as $MT = \{MT_1, MT_2, \ldots MT_m\}$, and each MT_m contains N one-dimensional vectors:

$$MT_m = \{MT_{m1}, MT_{m2}, \ldots MT_{mn}\}, 1 \le m \le M, 1 \le n \le N \tag{8}$$

where the value of MK_{mn} is represented as an integer, $MT_{mn} = 1$ indicates that the learning resource is a video, $MT_{mn} = 2$ indicates that the learning resource is an audio, $MT_{mn} = 3$ indicates that the learning resource is a document, $MT_{mn} = 4$ indicates that the learning resource is a slide show, and $MT_{mn} = 5$ indicates that the learning resource is a picture. MT_{mn} means the media type of the nth learning resource corresponding to the mth knowledge point.

3) Define the content type $\mathrm{CT} = \{CT_1, CT_2, \ldots CT_m\}$ of the learning resource corresponding to the knowledge point, and each CT_m contains N one-dimensional vectors:

$$CT_m = \{CT_{m1}, CT_{m2}, \ldots CT_{mn}\}, 1 \le m \le M, 1 \le n \le N \tag{9}$$

where the value of CT_{mn} is represented as an integer, $CT_{mn} = 1$ indicates that the learning resource is a pre-test, $CT_{mn} = 2$ indicates that the learning resource is a theory, $CT_{mn} = 3$ indicates that the learning resource is an example, and $CT_{mn} = 4$ indicates that the learning resource is a conceptual detail. CT_{mn} indicates the content type of the nth learning resource corresponding to the mth knowledge point.

4) Define the learning time required for the learning resources as $T, T = \{T_1, T_2, \ldots T_m\}$, and each T_m contains N one-dimensional vectors:

$$T_m = \{T_{m1}, T_{m2}, \ldots T_{mn}\}, 1 \le m \le M, 1 \le n \le N \tag{10}$$

where the value of T_{mn} is represented by a real number that indicates the time required for the N rd learning resource for the M nd knowledge point.

5) Define the heat value of the learning resource corresponding to the knowledge point as $HP = \{HP_1, HP_2, \ldots HP_m\}$, and each HP_m contains N one-dimensional vectors:

$$HP_m = \{HP_{m1}, HP_{m2}, \ldots HP_{mn}\}, 1 \le m \le M, 1 \le n \le N \tag{11}$$

where the value of HP_{mn} is represented by a real number, and HP_{mn} represents the value of the number of click-throughs of the nth learning resource corresponding to the mrd knowledge point.

3.3. Learning resource recommendation model construction

Based on the multidimensional feature differences between learner profiles and learning resource profiles and the characteristics of learning resource recommendation, the Personalized Learning Resource Recommendation Service Model (PLRSM) is proposed. Different from the current recommendation models in the field of e-commerce and news resources, the recommendation model for the field of learning resource recommendation has the following two characteristics, first: the recommended learning resources must be basically ordered to meet the objective law of objective and orderly learning based on prior knowledge, which is the objective law of knowledge learning in the field of education. Second: the algorithm and model parameters are predicted by similar learners. Since the resources to be recommended in the learning domain are for different knowledge points, there is no similarity between knowledge points, so parameters such as the learner's mastery of new knowledge points in the model cannot be obtained through the learner's learning of other knowledge points in the learning data statistics.

The feature difference evaluation function is constructed according to the recommendation model, $\min F(x) = \sum_{i=1}^{5} W_i F_i$. Where W_i is the weight coefficient of the function, and F_i is the four objective functions established according to the feature differences between learners and learning resources. Different weights are set for the four objective functions according to the degree of importance, and the aggregation method is used to construct function $F(x)$ to solve the constraint satisfaction problem of multi-objective combination optimization. The four objective functions are shown below:

F_1 The function represents the average characteristic difference between the learners' ability to understand the learning resource corresponding to a concept and the difficulty of the learning resource, which indicates whether the difficulty of the learning resource satisfies the cognitive ability that the learners have:

$$F_1 = \frac{\sum_{n=1}^{n} x_{mn} \left| S_{mn} - DI_{mn} \right|}{\sum_{n=1}^{N} x_{mn}}, 1 < m < M \tag{12}$$

The F_2 function represents the average difference between a learner's preference for the media type of the learning resource corresponding to a concept and the media type of the learning resource:

$$\begin{aligned} F_2 &= \frac{\sum_{k=1}^{k} \left| MF_{mk} - M_{mk} \right|}{k}, 1 < m < M. \\ M_{mk} &= \frac{Num2_{mk}}{\sum_{k=1}^{k} Nu2_{mk}} \\ Num2_{mk} &= \begin{cases} Num22_{mk} + 1 & if \ \ 2_{mn} = k, k = 1,2,3,4,5 \\ 0 & if \ \ 2_{mn} \neq k, k = 1,2,3,4,5 \end{cases} \\ Q2_{mn} &= X_{mn} MT_{mn} \end{aligned} \tag{13}$$

where $Q2_{mn}$ denotes the matrix product of the initial learning resource matrix and the resource type, and M_{mk} denotes the share of that resource type in all learning resources.

The F_3 function represents the minimum value of the average difference between the learners' preference for the content type of the mth knowledge point and the content type of the knowledge point:

$$\begin{aligned} F_3 &= \frac{\sum_{k=1}^{k} \left| CF_{mk} - C_{mk} \right|}{k}, 1 < m < M \\ C_{mk} &= \frac{Num3_{mk}}{\sum_{k=1}^{k} Num3_{mk}} \\ Num3_{mk} &= \begin{cases} Num3_{mk} + 1 & if \ \ Q3_{mn} = k, k = 1,2,3,4 \\ 0 & if \ \ Q3_{mn} \neq k, k = 1,2,3,4 \end{cases} \\ Q3_{mn} &= X_{mn} CT_{mn} \end{aligned} \tag{14}$$

where $Q3_n$ denotes the product of the initial learning resource matrix and the resource content type matrix. C_{mk} denotes the weight of the resource content type over all knowledge points.

The F_4 function represents the minimum value of the average difference between the learner's current hotness for the mth knowledge point and the learner's hotness preference for the knowledge point:

$$\begin{aligned} F_4 &= \frac{\sum_{n=1}^{n} \left| H_m - HP_{mn} \right|}{k}, 1 < m < M \\ HP_{mn} &= \frac{Num4_{mn}}{\sum_{n=1}^{n} Num4_{mn}} \end{aligned} \tag{15}$$

Where HP_{mn} denotes the weight value of this learning resource being viewed. Num_{mn} indicates the weight of the hotspot preferences of this learning resource in relation to all knowledge points.

The F_5 function indicates that the time spent by the learner on the learning resource cannot be more than and less than the maximum time, within the time range expected by the learner when learning:

$$F_5 = \left(\max\left(T_{1\_n} - \sum_{n=1}^{n} x_{mn} t_{mn}, 0\right)\right) + \left(\max\left(0, \sum_{n=1}^{n} x_{mn} t_{mn} - T_{u\_n}\right)\right) \tag{16}$$

4. Empirical Analysis of Physical Education Teaching in Colleges and Universities

4.1. Analysis of Recommended Resources for Teaching Physical Education

In order to verify the effectiveness of the personalized learning resource recommendation service model (PLRSM) proposed in this paper, the performance of the algorithm is evaluated using two metrics: precision rate P and recall rate R. The algorithm is also compared with traditional baseline algorithms such as Random, Popular, ICF, and UCF. In order to ensure that the experimental results are fair and credible and fully convincing, this paper selects four experimental datasets (MT, MK, MM, HE) for evaluation, which contain 13,438, 1,723, 3,956, and 8,612 physical education teaching resources, with sparsity of 99.83%, 93.75%, 96.14%, and 98.87%, respectively. The closer the sparsity is to 1, it means that the more vacant values in the co-occurrence matrix of this data set, the stronger the sparsity is. The experimental comparison results are shown in Table 1. Where N indicates that N resources are recommended to the user. It can be seen that the UCF algorithm and ICF algorithm show good performance on the MK and MM datasets, but when the dataset co-occurrence matrix is extremely sparse (e.g., in the MT and HE datasets), the ICF algorithm and the UCF algorithm can not play the algorithm's effectiveness properly, while the PLRSM algorithm still maintains a better recommendation performance. The Random and Popular algorithms perform worse than the PLRSM algorithm in the four datasets. Random and Popular algorithms perform worse than PLRSM algorithm and even lower than UCF and ICF algorithms, which is because the above four datasets are not able to provide better description information of sports learning resources, resulting in imprecise resource profiles, which affects the performance of the final algorithm. Meanwhile, it can be found that for all the algorithms in the table, the precision rate of the algorithms when N=4 is higher than the precision rate when N=8, while the recall rate is lower than the recall rate when N=8. This is because the larger the value of N the more likely the algorithm is to recommend the user's favorite sports learning resources to the user, which leads to an increase in the recall rate. The experiments verify the effectiveness of the Personalized Learning Resource Recommendation Service Model (PLRSM) proposed in this paper, which can more accurately recommend the preferred sports learning resources to users.

Table 1. The recommended algorithm compares the results

	N	Random		Popular		ICF		UCF		PLRSM	
		P	R	P	R	P	R	P	R	P	R
MT	4	0.08	0.06	7.93	6.38	10.39	8.43	8.74	7.14	19.93	16.46
	8	0.08	0.09	6.52	10.48	7.92	12.82	6.93	11.82	12.56	20.41
MK	4	1.42	0.37	21.32	5.03	35.80	8.45	32.71	7.66	39.65	9.26
	8	1.36	0.37	19.02	8.95	30.26	14.24	28.33	13.33	32.67	15.38
MM	4	0.95	0.16	21.14	3.19	35.13	5.31	31.45	4.75	34.15	5.17
	8	0.97	0.32	18.22	5.53	30.22	9.12	27.56	8.34	27.04	8.12
HE	4	0.22	0.07	3.65	1.08	0.63	0.19	2.63	0.76	8.17	2.39
	8	0.22	0.12	3.31	1.95	0.59	0.31	2.44	1.43	6.21	3.69

Taking the recommendation of physical education teaching resources for a physical education student as a case study, Table 2 shows the results of PLRSM-based physical education teaching resources recommendation. The student actually chose a total of 62 courses of sports teaching resources, recommended courses selected N for 20, a total of 20 recommended courses, recommended subjects include both basic courses, including professional courses, recommended courses compared with the actual course, the recommended correct rate of 0.80, recommended most of the courses for sports courses, also contains some popular choice of basic courses, which are recommended but not actually selected. Most of the recommended courses are sports courses, and some basic courses are also included, which are recommended but not actually chosen, and can also open up the horizons in the subsequent study, providing students with personalized learning programs. The individualized learning method ensures that students can effectively master the recommended courses, and they can constantly break the learning boundaries and explore more areas of learning.

Table 2. Recommendations for PLRSM's physical education resources

N	Actual course	Actual course	Actual course	Recommended course	Right/ deny
1	School sports	Basic French (3)	Sports theory and practice	Pedagogy foundation	1
2	Engineering heat	Mathematical analysis	Mathematical modeling	Introduction to aerospace	0
3	Pedagogy foundation	Military theory and training (2)	Basic French (2)	Psychology foundation	1
4	Volleyball	Sports theory and practice (1)	Sports psychology	Human science	1
5	Exercise physiology (3)	Military theory and training (1)	Human science (2)	School sports	1
6	Human science	Theoretical mechanics (1)	Sports theory and practice (2)	Track and field	1
7	Introduction to aerospace	French application	Ideological and political class	Theoretical mechanics	0
8	Martial arts (3)	Sports health	Optics	Engineering heat	0
9	Martial arts (2)	Football	International business law (1)	Gymnastics	1
10	Track and field	Theoretical mechanics (2)	Exercise physiology (2)	Basketball	1
11	Psychology foundation	Sports health	Martial arts (1)	Volleyball	1
12	Theoretical mechanics (1)	Military theory and training (3)	International business law	Football	1
13	Theoretical mechanics (2)	Basic French (1)	Sports theory and practice (3)	Martial arts	1
14	Physical anatomy	Electromagnetic radiation	Structural force	Exercise physiology	1
15	Theoretical mechanics	Graduation design	French	Basic French	0
16	Gymnastics	Fluid force	Production practice	Sports health	1
17	Basketball	Martial arts	Wave physics	Physical anatomy	1
18	Military theory and training	Boya	International business law	Sports psychology	1
19	Sports	College English	Military training	Sports theory and practice	1
20	Exercise physiology	Military theory	Probability statistics	Military theory and training (3)	1
21	Intermediate technology	Mechanical engineering training			

4.2. Analysis of Physical Education Teaching Effectiveness

4.2.1. Analysis of learners' pedagogical knowledge of physical education subjects and courses.In this section, a quasi-experimental research method is adopted to carry out a practical study on the integration of physical education teaching in colleges and universities based on artificial intelligence under the guidance of intelligent learning and related learning theories. Firstly, a learning resource base of "sports knowledge and teaching ability" was constructed as a prerequisite and basic resource for the study. Then, 44 learners with similar knowledge and ability were selected as experimental subjects through the test of physical education subject knowledge and physical education teaching ability, and were randomly divided into group X and group Y (there was no statistically significant difference between group X and group Y in terms of knowledge and ability). Group X adopted the traditional teaching mode, and group Y adopted the college physical education teaching integration mode based on artificial intelligence. At the end of the 16-week study, the effectiveness of the AI-based college physical education teaching integration model was verified through a comparative analysis of the pre- and post-tests of the learners in the experimental group. Using the test contents prepared at the beginning of the study (one-minute sit-up C1, 800-meter run C2, pull-up C3, 100-meter run C4, seated body flexion C5, standing long jump C6, 50-meter run C7, lung capacity C8, and body mass index C9) at the beginning of the experiment and at the end of 16 weeks of the experiment, respectively, in order to detect the changes in the knowledge of physical education subject and course teaching of the learners, and the results of the test are shown in Table 3 shows.

The mean value of the post-test scores of group X is higher than the pre-test scores of 3.942~6.196 points, but this difference is not significant, indicating that the traditional teaching mode adopted by group X also improves the learners' teaching knowledge of physical education disciplines and courses, but the effect of the improvement is not significant. The post-test scores of group Y are significantly higher than the pre-test scores of 11.525~15.436 points, and there is a significant difference in the scores, indicating that the integration mode of physical education teaching in colleges and universities based on artificial intelligence significantly improved the learners' knowledge of teaching physical education subjects and courses. there was no significant difference between the pretest scores of group X and group Y (t-value of 0.001, sig-value of 0.846>0.05), and there was a significant difference between the posttest scores of group X and group Y (t-value of 2.154, sig-value of 0.013<0.05), that is, the posttest scores of group Y were significantly higher than the posttest scores of group X. The results of the above tests showed that the posttest scores of group Y were significantly higher than the posttest scores of group X in physical education subjects and courses, but the effect of improvement was not significant. The above test results indicate that in terms of the mastery of teaching knowledge in physical education disciplines and courses, the effect of the artificial intelligence-based university physical education teaching integration model is significantly better than the traditional teaching model.

Table 3. The results of the students' physical discipline and course teaching knowledge test

	Pretest		Posttest	
	X group	Y group	X group	Y group
	M±SD	M±SD	M±SD	M±SD
C1	77.532±11.123	77.529±11.135	82.721±4.183	89.054±4.758
C2	76.429±12.537	76.430±12.516	80.839±4.531	90.676±4.223
C3	77.157±12.134	77.154±12.114	83.353±5.432	91.227±4.515
C4	76.179±11.054	76.177±11.072	81.736±6.481	88.903±3.126
C5	77.323±11.918	77.324±11.927	82.563±7.162	89.585±3.078
C6	76.696±12.784	76.692±12.778	81.405±6.123	91.491±4.859
C7	77.688±10.465	77.686±10.474	83.849±5.458	93.122±3.985
C8	76.841±12.088	76.839±12.093	80.783±4.956	89.887±4.164
C9	77.178±11.653	77.182±11.648	82.253±5.387	90.951±4.398
T	0.001		2.154	
Sig	0.846		0.013	

Along with the analysis of the pedagogical knowledge of the course, the study conducted five tests on learners' resilience, self-awareness, regulation, effective communication, and empathy. The 1st test was conducted at the beginning of the study when the learners' resource needs were analyzed, and the 2nd to 5th tests were conducted at the end of the 4th, 8th, 12th, and 16th weekends of the quasi-experimental study, respectively. The results of the learners' learning ability tests are shown in Table 4. It can be seen that both group X and group Y learners' learning ability showed a trend of gradual improvement, and group Y learners improved more than group X. From the t-test results of the mean scores of the two groups, the p-value of the learners' learning ability in the first four tests is greater than 0.05, and the difference is not significant. The difference between the mean scores of the two groups in the fifth test was significant ($p<0.05$), i.e., through the 16-week quasi-experimental study, the average score of learners' learning ability in Group Y was significantly higher than that of Group X. Compared with the first test, the learning ability of the learners in group X improved by 6.29-6.93 after the fifth test, and group Y improved by 14.78-16.3, with the greatest improvement in effective communication ability, which indicates that the integration mode of college physical education teaching in the present study can enhance the learning ability of the learners more significantly. In summary, the application of artificial intelligence technology in the field of college physical education teaching can capture students' dynamic data anytime and anywhere, transform students' inner emotions, concentration, psychological needs, etc. into quantifiable data, and collaborate with schools and families to carry out healthy physical education.

Table 4. Learner learning ability test results

	Resistance to failure		Self-cognitive ability		Regulating capacity		Effective communication ability		Empathy	
	X group	Y group	X group	Y group	X group	Y group	X group	Y group	X group	Y group
First test	71.15	71.36	73.54	73.98	75.16	75.96	72.51	72.89	74.12	74.68
T test	t=0.0564,P>0.05		t=0.0468,P>0.05		t=0.0513,P>0.05		t=0.0563,P>0.05		t=0.0487,P>0.05	
Second test	72.46	73.98	74.51	76.12	76.95	78.26	73.47	74.88	75.38	77.86
T test	t=0.0615,P>0.05		t=0.0597,P>0.05		t=0.0633,P>0.05		t=0.0674,P>0.05		t=0.0628,P>0.05	
Third test	74.26	77.84	76.87	79.49	78.38	80.69	75.68	76.97	77.07	80.14
T test	t=1.2315,P>0.05		t=1.1561,P>0.05		t=1.0495,P>0.05		t=1.1352,P>0.05		t=1.2154,P>0.05	
Fourth test	76.86	81.46	78.64	85.37	80.84	86.67	77.39	81.89	79.64	85.97
T test	t=2.5461,P>0.05		t=2.2651,P>0.05		t=2.3518,P>0.05		t=2.0132,P>0.05		t=2.4754,P>0.05	
Fifth test	77.89	86.45	79.83	90.28	81.76	92.19	79.44	87.67	80.91	90.68
T test	t=3.6418,P<0.05		t=3.3511,P<0.05		t=3.2249,P<0.05		t=3.5416,P<0.05		t=3.2352,P<0.05	

4.2.2. Comprehensive multi-dimensional evaluation. The curriculum standard proposes that learning evaluation should be centered on core literacy, combined with specific teaching content, to assess the level of development of students' core literacy, specifically including the development of athletic ability, the formation of healthy behaviors, and the cultivation of physical education ethics, and to focus on the combination of process evaluation and summative evaluation, qualitative evaluation and quantitative evaluation, relative evaluation and absolute evaluation, and teacher evaluation and student evaluation. This section is evaluated in ten dimensions: height and weight index, health knowledge, competition performance, attendance performance, learning attitude, standing long jump, sit-up, pull-up, endurance run and 50-meter run, and Fig. 2 shows the results of multidimensional comprehensive evaluation of the two groups of students after the experiment. After the teaching experiment, the comprehensive scores of group X and group Y were 69.73 and 93.85 respectively, with a difference of 24.12 points between the two groups, in which the learners in group X had the highest score in endurance running (88.29), and group Y had the highest score in attendance performance (100). It shows that the implementation of the integration mode of college physical education teaching based on artificial intelligence can better improve students' physical fitness, physical education achievement, learning attitude, usual performance, and improve the quality of physical education teaching, and its effect is better than that of traditional teaching, which has certain application value.

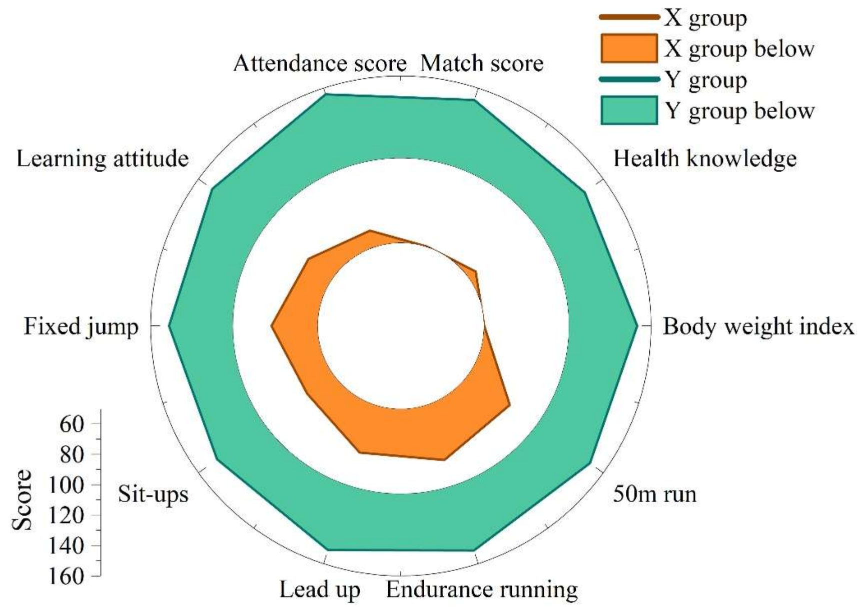

Fig. 2. The multidimensional evaluation of the two groups of students after the experiment

5. Conclusion

The integration of artificial intelligence and school sports innovates the sports teaching mode, so that students' personalized training needs can be met. In this paper, we first constructed a college sports teaching integration model based on artificial intelligence, then proposed a precise teaching model (PLRSM) based on personalized learning resources recommendation, and then conducted empirical analysis from two aspects of sports teaching resources recommendation and teaching effect, and the results showed that:

1) Compared with the four traditional baseline algorithms, the PLRSM algorithm proposed in this paper is able to provide better descriptive information of physical education learning resources in all four datasets, with accurate resource portraits, and can more accurately recommend interested physical education learning resources to users. At the same time, PLRSM in the case of teaching resources recommendation for physical education students, the recommendation correct rate is 0.80, which verifies the effectiveness of PLRSM proposed in this paper and helps teachers to teach accurately.

2) The mean value of the post-test scores of Group X is higher than the pre-test by 3.942-6.196 points, and the post-test scores of Group Y are significantly higher than the pre-test scores by 11.525-15.436 points, and Group Y's post-test scores are significantly higher than Group X's post-test scores. It indicates that in terms of the mastery of teaching knowledge of physical education disciplines and courses, the effect of the AI-based college physical education teaching integration model is significantly better than the traditional teaching model. In addition, the comprehensive score of Group Y is 24.12 points higher than that of Group X, indicating that the effect of the AI-based college physical education teaching fusion model to improve the quality of physical education teaching is better than that of traditional teaching.

In conclusion, the integration mode of college physical education teaching based on artificial intelligence can improve the quality and effect of college physical education teaching, promote the improvement of students' comprehensive quality, and provide a reference basis for the high-quality development of college physical education teaching.

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