

# Classroom Reconstruction and Practice of College Tennis Teaching under PBL and TBL Concepts

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**Abstract:** This study explores the implementation of Problem-Based Learning (PBL) and Team-Based Learning (TBL) concepts in college tennis teaching to enhance student engagement and skill acquisition. Given the challenges of traditional tennis instruction, which emphasizes teacher-led learning and often neglects student autonomy and creative thinking, the study proposes a restructuring of tennis teaching methodologies. By integrating PBL and TBL, the research outlines a new instructional design that promotes collaborative problem-solving and active learning. The experimental results indicate that students taught using this new approach show significant improvements in their tennis skills and overall interest in physical education, compared to those receiving traditional instruction. The study emphasizes the need for ongoing teacher development and curriculum innovation to facilitate effective learning experiences in college sports education.

**Keywords:** Problem-Based Learning (PBL); Team-Based Learning (TBL); Instructional Design; Student Engagement; Skill Acquisition.

## 1. Introduction

The wave of the times constantly puts forward higher requirements on the comprehensive ability of Chinese college students and pushes for the continuous innovation of talent cultivation methods. The report of the 20th National Congress of the Communist Party of China (CPC) regards education, science and technology, and talents as the basic and strategic support for the comprehensive construction of a modernized socialist country<sup>[1]</sup>. Many curriculum reform documents have proposed the need to update teaching concepts, optimize teaching content, innovate the teaching process, improve teaching evaluation, and make physical education content more logical, systematic and articulated<sup>[2]</sup>; the physical education discipline should also give full play to the function of comprehensive education, and constantly improve students' ability to comprehensively apply knowledge to solve practical problems<sup>[3]</sup>.

Tennis is a star course in college physical education, but most of the public physical education students have not been in contact with tennis, coupled with the high difficulty of entry, the teaching difficulty is greater than that of basketball, soccer, volleyball and track and field these projects. And the traditional receptive learning highlights the teacher's main position, which is contrary to the students' personality development in the tennis classroom which mainly focuses on skill practice and competition practice, and the students' thinking development is also subject to certain constraints. Therefore, it becomes urgent to carry out teaching changes, improve and explore new ways of teaching tennis in colleges and universities.

Problem-Based Learning (PBL) is a student-centered teaching model that sets up relevant problem situations and requires students to independently explore, analyze and solve problems by combining their existing knowledge frameworks, so as to achieve the integration of knowledge and enhance their abilities. It was founded by Barrows, a professor of neurology in the United States, in 1969 and applied<sup>[4]</sup>. Team-Based Learning (TBL), a team-based teaching model,

systematically utilizes the interaction between dynamic factors in teaching to promote student learning, and takes the group's performance as the evaluation standard to jointly achieve the teaching goals, and was developed by Michaelsen, a professor at the University of Oklahoma, in 2002. Michaelsen formalized in 2002<sup>[5]</sup>. The two models have been widely used in many fields, including medicine, and have received excellent feedback. In this study, the concept of "problem" in PBL and the concept of "team" in TBL were integrated to form a teaching program and then explored in practice. In order to solve the constraints of traditional teaching on students' emotional development and creative thinking, it provides a new way of thinking and a new method for teaching tennis in colleges and universities, and improves and enriches the theory and practice of physical education teaching.

## 2. Instructional Design Justification

Both PBL and TBL are not teaching models derived through tennis teaching, so they need to be designed and integrated with the characteristics of the tennis program and the teaching environment before application, so as to fit the tennis teaching in colleges and universities.

### 2.1. Classroom Reframing Ideas

The classroom implementation process of PBL mainly includes the steps of creating learning situations, inquiry learning, teacher guidance, student reporting, etc.<sup>[6]</sup>, while TBL mainly includes the links of pre-course preparation, classroom collaboration and teaching evaluation<sup>[7]</sup>. After combining the teaching concepts of PBL and TBL with the characteristics of tennis teaching and the requirements of teaching in colleges and universities, the following five links are formed: (1) Creating Situations. Create open tennis playing or competition situations with different difficulties in different lessons. With the application of tennis skills as the premise, and in different lessons with the depth of learning and change, through the uncertainty of the situation to stimulate the group competitive psychology led to the

discovery of the problem, to provide material for team communication. (2) Group exploration. Classroom groups, students based on the role of team competition psychology to discover the problems in the situation and communicate with each other, and appoint an "observer" to summarize the problem. (3) Teacher guidance. Teachers listen to the confusion of each group, follow the students' thinking to give the correct guidance, teach the correct technical movements and practice methods. (4) Cooperative learning. After mastering the correct technical movements and obtaining the ideas of practice, students will practice through teamwork and try to return to the initial situation to verify whether the problem has been solved. (5) Discussion and sharing. Organize students to report and display the results of practice

in groups and share their experiences. The teacher will summarize and evaluate the results to close the class.

In the traditional teaching model, it consists of a beginning part, a basic part and an end part, which are carried out in accordance with the conventional three-stage teaching, i.e., the teacher teaches the learning content, the students practice or compete, the teacher instructs and corrects the errors, and finally the teacher evaluates the learning outcomes and summarizes the classroom performance.

Based on this, the main part of the classroom can be abstracted into two conceptual maps as shown in Figure 1 after stripping it of its main part and combining the openness of the classroom with the students' subjective initiative.

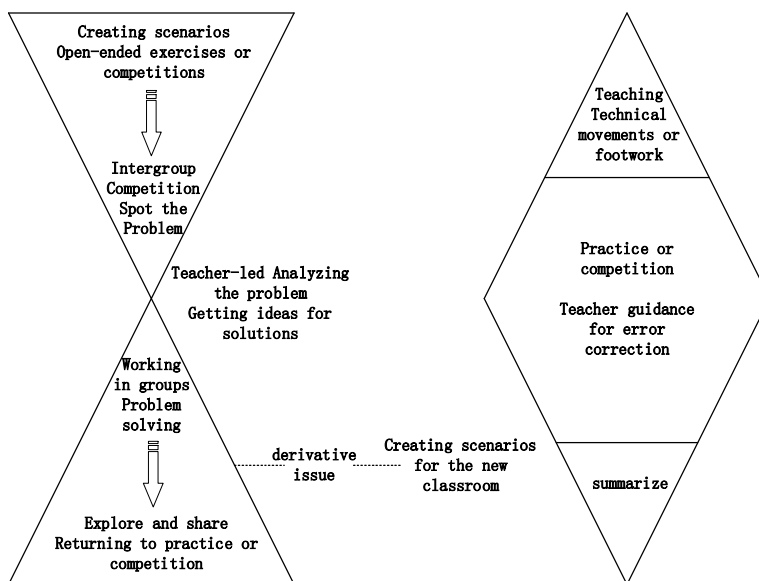


Figure 1. Conceptual diagram of classroom subjects in PT model and traditional teaching model

## 2.2. Course Tandem Ideas

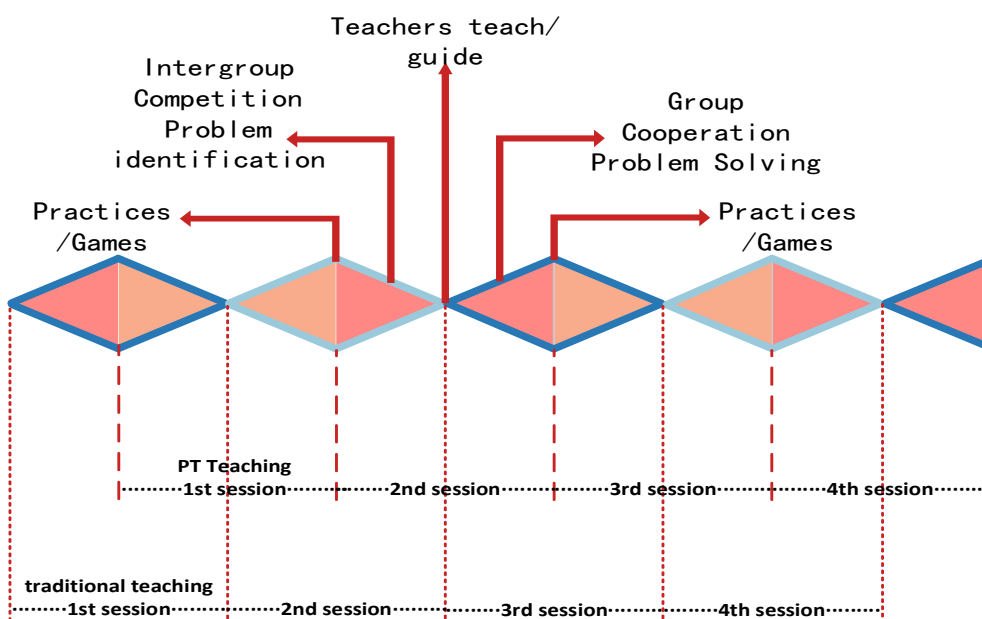


Figure 2. Conceptual diagram of the "chain of minnows" for the general organization of teaching and learning

As can be seen from Figure 1, the PT classroom does not change the students' practice time too much, but splits the students' practice session into upper and lower halves by reconstructing the teaching content and reorganizing the classroom content. Chinese primary and secondary school

physical education classes are usually a single lesson<sup>[8]</sup>, but each lesson in college classrooms is usually two lessons, up to 90 minutes long. PT precisely divides the classroom into two "halves", and the open-ended practice or competition in the "second half" will generate new problems, bringing new

situations for the subsequent class. In the "second half", the open-ended exercises or competitions will lead to new problems, which will bring new contextualization materials for the subsequent class, thus increasing the connectivity of the class. By connecting the individual concept maps, a chain structure can be formed like Figure 2, in which the first and last parts of a small fish are connected to each other.

As you can see from the "Little Fish Chain", each "hourglass" of the same color is a PT lesson, and each "diamond" surrounded by thick lines is a PT lesson. This kind of linked classroom will be more closely connected because of the derivative problems. For example, in forehand teaching, students will transition from forehand bobble to bobble with each other, and then realize inter-net bobble, small-court forehand pull ..... Teachers give appropriate guidance in which students gradually acquire the grip, correct body posture, improve the trajectory of the movement, and solve the problems of failing to hit the ball, controlling the power poorly, not being able to find the hitting point, and controlling the route poorly, until they completely master the course, and then they will be able to learn to hit the ball with their own hands. The students will be able to solve the problems of not being able to hit the ball, not being able to control the power, not being able to find the hitting point, not being able to control the route, etc., until they master the forehand striking technique in a complete way; realizing the overall teaching.

### **3. Teaching Experiment Design and Implementation**

#### **3.1. Experimental Design**

##### **3.1.1. Purpose and Content of the Experiment**

Purpose of the experiment: to investigate the differences between PT mode and traditional teaching mode in tennis teaching in public sports classes in colleges and universities.

Experimental content: Based on the teaching program, the school-based textbook<sup>[9]</sup> was used as a reference, and forehand and backhand techniques were used as the main teaching content. After the students were surveyed or tested before the experiment, PT teaching was adopted for the experimental class and traditional teaching was adopted for the control class to carry out the teaching experiment for 16 weeks.

##### **3.1.2. Experimental Subjects**

Taking China Academy of Art as an example, after comparing the data of physical fitness test and considering the weather factor of outdoor lectures, two teaching classes attending classes on the same day were selected as experimental subjects. They were randomly divided into experimental and control classes with 24 students in each class, all of whom were male.

##### **3.1.3. Time and Place of the Experiment**

The experimental period is from March 7, 2023 to June 20, 2023, with 16 weeks and 32 credit hours. The experimental site is the Shannan Tennis Court of China Academy of Art (Xiangshan Campus). The teaching site is 4 pieces of soft plastic hard court of acrylic material of standard size.

##### **3.1.4. Experimental Equipment**

Tennis racket (uniformly provided, brand: Bonny Bolly Model: COURSE), green standard training tennis ball (brand: DUNLOP Dunlop Model: Coaching), Xpress red stress relieving ball, orange stress relieving ball, rope ladder, marking disc, marking cone, tape paper, etc.

#### **3.1.5. Measuring Tools**

(1) Basic information questionnaire. Statistics on students' basic information such as major, height, weight, etc. and survey on students' experience in tennis.

(2) Tennis ball sense test. Students in both classes were tested for ball sense with the 1-minute racket and 1-minute bobble recommended in the school textbook<sup>[9]</sup>, and the average was taken after two tests were conducted in each class.

(3) Physical fitness test. The physical fitness of students is tested with the four items of 50m running, pull-up, standing long jump and 1000m running in the National Physical Fitness Standard for Students.

(4) Sports learning interest. Students' interest in physical education learning was measured with the Evaluation Scale of College Students' Interest in Physical Education Learning<sup>[10]</sup>. The results of reliability test showed that Cronbach's Alpha was 0.862, Cronbach's Alpha of each subscale was >0.7, KMO=0.817, and the Sing value of Bartlett's spherical test was  $p < 0.05$ , which indicated that the reliability and validity were good.

##### **(5) Tennis Skill Level Evaluation Test**

The evaluation of technical movement, depth of baseline stroke and accuracy of baseline stroke were averaged by three coaches with coaching qualification according to the international standard ITNNS. The technical movement evaluation was conducted by 3 coaches with coaching qualification by referring to the tennis forehand hitting skill evaluation index<sup>[12]</sup> developed by Chai Jiao and taking the average value of the percentage scores, while the baseline hitting depth and baseline hitting accuracy were conducted in accordance with the international standard ITN test.

#### **3.1.6. Experimental Control**

Experimental independent variable: intervention of PT instruction in tennis lessons.

Experimental dependent variables:(1) Tennis skill level. (2) Physical fitness. (3) Interest in physical education learning.

Controls for extraneous variables: (1) A "single-blind" method was used, in which subjects were not aware of their grouping. (2) Both classes had the same teaching space, the same equipment, the same teacher, the same pace, and the same evaluation content. (3) Before the experiment, the students in the two classes were surveyed on their basic situation, tennis sense, physical fitness and interest in physical education, and it was determined that none of the students in the two classes had any tennis-related training experience, and there was no significant difference in the relevant data after the analysis of variance.

### **3.2. Example of a Single Class**

Take Week 3 - "Tennis Forehand Technical Movements 1".

#### **3.2.1. Traditional Teaching Classroom Processes**

Preparatory part: assembly and formation, announcement of the class, organization of apprenticeships, safety and security; warm-up activities.

Basic part: (1) Learning the hand shape of forehand technique. (2) Learning the steps and essentials of forehand technique, the teacher first demonstrates and then breaks down the movement, the students learn the 4 steps of ready position, step up to lead the racket, swing the racket to hit the ball and follow up with the swing respectively. (3) Practice the broken down movements with racket and without ball. (4) Practice the complete movement without the ball and with the racket. (5) In-situ forehand ground ball practice. The teacher will observe and guide the students during the process of

imitation and practice, and correct the wrong technical movements.

Closing part: static stretching and relaxation, summarize the content of the lesson and students' performance, collect the equipment, set up the school running punch card homework, announce the end of the lesson, and goodbye to teachers and students.

### 3.2.2. PT Teaching Classroom Process

Pre-lesson grouping and preparation: students are divided into heterogeneous groups of 6 based on the 4 tennis courts. The group leader leads the group members to the corresponding tennis court for warm-up activities.

Contextual introduction: In the last session, we conducted a ball sense progression exercise. This session requires the students in the group to use the forehand two pair to bobble the ball, after the count reaches 15, the net to bobble the ball down to the earth, after reaching the count again, then back to the position of the serving line to bobble the ball across the net to pull the ball.

Explore in groups to identify problems: students look for gaps from the pre-set goals and gaps from other groups and explore them based on completion. The following questions arise: Why does the ball often fly off the field? Why is the number of times the ball is turned over significantly lower than others? What is the correct posture? What grip is more comfortable? How do you control the course and height of the ball? How does the center of gravity change?

Teacher's guide: The teacher summarizes the problems, gives the correct advice to the students and teaches the correct technical movements of the tennis forehand stroke. In this process, the students gradually master the grip pattern in tennis forehand stroke, and form the prototype of a complete stroke.

Cooperative learning and problem solving: students organize themselves in small groups to carry out exercises and try to return to the situation to achieve a small field pull.

Discussion and Sharing: The teacher again leads students to discuss and reflect on the improved means or methods of exercise, and promotes students' self-summarization. Finally, static stretching is performed, the teaching equipment is recovered, and the class is dismissed

## 4. Results and Analysis

### 4.1. Comparative Analysis of Experimental and Control Classes after the Experiment

After the 16-week teaching experiment, a survey or test was administered to both classes and the data from the post-experiment test was comparatively analyzed to verify the effectiveness of the instruction.

#### 4.1.1. Tennis Skill Test Comparative Analysis of Scores

The results of the tennis skill test were analyzed using the independent samples t-test and the results obtained are shown in the table below.

**Table 1.** Test of differences in students' performance on the tennis skill test after the experiment

sports event	experimental class $\bar{x} \pm SD$	control subjects $\bar{x} \pm SD$	mean difference (experimental class - control class)	t-value	p-value	
Evaluation of technical movements	76.740±7.331	66.180±10.280	10.550	4.096	0.000	
baseline hitting depth (diving)	forehand	10.920±2.669	9.080±3.764	1.840	1.947	0.058
	fig. easily done	7.500±2.085	4.670±2.479	2.830	4.285	0.000
	stability	9.040±0.806	6.920±1.283	2.120	6.871	0.000
	totals	27.460±4.064	20.670±5.370	6.790	4.940	0.000
Baseline hitting accuracy	straightness	11.170±3.199	9.130±3.012	2.040	2.270	0.028
	forward slash (computing)	9.130±2.643	7.960±2.386	1.170	1.605	0.115
	stability	10.580±1.018	9.040±2.053	1.540	0.089	0.002
	totals	30.880±5.335	26.130±6.067	4.570	0.968	0.006

The difference in scores between the two classes on the evaluation of technical movements was highly significant, with the experimental class having better technical movements than the control class. Students in the experimental class generally had a better rhythm in anticipating the landing point of the incoming ball and the location of the stroke, moved more aggressively in pace, hit the ball with a more solid combination, and moved more smoothly and naturally. Students in the control class showed more pronounced movements in the lead and follow-through swings, but the overall picture was slightly less favorable. The difference between the two classes in the total scores of the depth and accuracy tests was highly significant, with the

experimental class being significantly better than the control class. Students in the experimental class had better backhands and stability in the depth test ( $p < 0.01$ ), better stability in the precision test ( $p < 0.01$ ), and slightly better straight shots ( $p < 0.05$ ).

#### 4.1.2. Comparative Analysis of Physical Fitness of Students

After testing the normality of the students' physical fitness test data after the experiment, it was analyzed using independent samples t-test and non-parametric test to obtain the results as shown in the table below.

**Table 2.** Test of differences in students' physical fitness tests after the experiment

sports event	experimental class $\bar{x} \pm SD$	control subjects $\bar{x} \pm SD$	mean difference (experimental class - control class)	t-value (Z value)	p-value
50-meter dash (s)	7.425±0.4945	7.454±0.486	-0.029	-0.206	0.838
Standing long jump (cm)	236.580±14.392	242.040±14.001	-5.460	-0.805	0.425
Pull-ups (pcs)	4.250±4.089	5.250±4.504	-1.000	-0.740	0.459
1000 meter run (s)	263.080±33.719	272.960±28.451	-9.880	-1.097	0.279

The results of each test item showed  $p(z) > 0.05$ , the difference was not significant, indicating that the two teaching classes remained at the same level in terms of physical fitness after the teaching experiment.

#### 4.1.3. Comparative Analysis of Students' Interest in Physical Education Learning

The data from the experimental post-test of students'

interest in physical education learning in the two classes were subjected to normality test, and independent samples t-test was conducted on the results of the test of the dimensions of interest in physical education learning to obtain the results as shown in the table below.

**Table 3.** Differential test of students' interest in physical education learning survey after the experiment

dimension (math.)	experimental class $\bar{x} \pm SD$	control subjects $\bar{x} \pm SD$	mean difference (experimental class - control class)	t-value	p-value
negativity	22.920±1.176	18.380±1.313	4.540	12.623	0.000
zeal	26.830±1.435	21.420±1.998	5.410	10.788	0.000
Skill acquisition	22.790±1.179	15.080±1.176	7.710	22.675	0.000
extracurricular activity	20.460±1.444	15.630±1.637	4.830	10.848	0.000
Sports Focus	14.630±1.861	13.630±1.663	1.000	1.963	0.056
totals	107.630±2.683	84.130±3.180	23.500	27.667	0.000

The results showed that the students of both classes showed  $p < 0.01$  in the four dimensions of positivity, negativity, skill learning, and after-school activities, and the total scores showed  $p < 0.01$ , the difference was highly significant, and the difference of the mean in the dimension of skill learning was the largest, which indicated that the level of interest in physical education and sports learning in the experimental class was significantly higher than that in the control class after the experiment.

#### 4.2. Comparative Analysis of Test Data between Experimental and Control Classes before and after the Experiment

The 2 tests and surveys of students' physical fitness and

students' interest in physical education were conducted throughout the teaching experiment. Therefore, the retained data before the experiment and the test data after the experiment were subjected to a paired-sample t-test in order to understand the effect of the conduct of this teaching experiment from multiple perspectives.

##### 4.2.1. Comparative Analysis of Students' Physical Fitness before and after the Experiment

The differences in the physical fitness test data before and after the experiment for both classes were tested for normality and analyzed using the paired samples t-test to obtain the results shown in the table below.

**Table 4.** Differential test of students' physical fitness before and after the experiment

classes or grades in school	sports event	pre-laboratory $\bar{x} \pm SD$	post-experimental $\bar{x} \pm SD$	mean difference (pre-experimental - post-experimental)	t-value	p-value
experimental class	50-meter dash (s)	7.667±0.609	7.425±0.495	0.242	5.276	0.000
	Standing long jump (cm)	228.750±20.547	236.580±14.392	-7.830	-4.085	0.000
	Pull-ups (pcs)	3.460±3.575	4.250±4.089	-0.790	-3.969	0.001
	1000 meter run (min)	273.670±40.105	263.080±33.719	10.590	5.099	0.000
control subjects	50-meter dash (s)	7.642±0.466	7.454±0.486	0.188	3.715	0.001
	Standing long jump (cm)	237.080±19.547	242.040±14.001	-4.960	-3.167	0.004
	Pull-ups (pcs)	3.575±3.655	5.250±4.504	-1.675	-3.347	0.003
	1000 meter run (min)	283.710±31.099	272.960±28.451	10.750	4.298	0.000

The results showed that the before and after results of the four items of the physical fitness test of the students in both classes presented  $p < 0.01$ , and the differences in the test data of both classes were highly significant. It showed that the physical fitness of the students in both classes gained improvement after 16 weeks of instruction.

##### 4.2.2. Comparative Analysis of Students' Interest in Physical Education Learning before and after the Experiment

The paired sample t-test was conducted after the normality test for the difference in the data of the survey of students' interest in physical education learning before and after the experiment in the two classes, and the results were obtained

as shown in the table below.

The results showed that the differences in the five dimensions and total scores of physical education learning interest of students in the experimental class before and after comparison were highly significant. The difference in the total score of physical education learning interest of the control class was highly significant, but only in the two dimensions of negativity and after-school activities. The results showed that after 16 weeks of teaching, the physical education learning interest of the students in both classes increased, but the experimental class was more comprehensive and profound.

**Table 5.** Differential test of students' interest in physical education learning before and after the experiment

classes or grades in school	sports event	pre-laboratory $\bar{x} \pm SD$	post-experimental $\bar{x} \pm SD$	mean difference (pre-experimental - post-experimental)	t-value	p-value
experimental class	negativity	18.000±1.769	22.920±1.176	-4.920	-13.265	0.00
	zeal	21.250±1.452	26.830±1.435	-5.580	-12.404	0.00
	Skill acquisition	14.960±2.010	22.790±1.179	-7.830	-17.137	0.00
	extracurricular activity	14.880±1.801	20.460±1.444	-5.580	-14.159	0.00
	Sports Focus	12.880±2.252	14.630±1.861	-1.750	-3.946	0.00
	totals	81.960±3.532	107.630±2.683	-25.670	-30.720	0.00
control subjects	negativity	17.210±1.532	18.380±1.313	-1.170	-3.620	0.001
	zeal	21.290±1.781	21.420±1.998	-0.130	-0.309	0.760
	Skill acquisition	15.500±1.351	15.080±1.176	0.420	1.115	0.260
	extracurricular activity	14.380±1.610	15.630±1.637	-1.250	-3.952	0.001
	Sports Focus	12.750±1.775	13.630±1.663	-0.880	-1.937	0.065
	totals	81.130±3.261	84.130±3.180	-3.000	-4.305	0.000

## 5. Conclusion and Recommendations

### 5.1. Conclusion of the Study

The improvement of students' tennis skill and interest in physical education in PT teaching is significantly better than that of traditional teaching. However, the difference in the improvement of students' physical fitness is not significant, but this also indicates that PT teaching has no obvious shortcomings compared with traditional teaching.

### 5.2. Application Recommendations

**Enhancing Teachers' Ability.** TBL and PBL are seldom applied in tennis teaching, and there is a certain uncontrollability in the classroom process. Teachers need to improve the curriculum guarantee system, arrange the teaching plan reasonably, prepare the lesson finely and improve the control ability and teaching skills to guide students to change the classroom habits, so that the superiority of PT mode can be played more effectively. **Exercise students' abilities.** The process of skill learning in the classroom has a great deal of autonomy and requires more effort, which requires students to take responsibility for their own learning. Students need to learn how to learn, master the learning skills and achieve all-round development. **Focus on tennis practice.** Tennis teaching should focus on the students' participation and interest in learning, and they can only really learn to play tennis by swinging the racket freely on the court, which can maintain their high interest in the sport.

## Acknowledgments

Subjects: Construction and Empirical Research of Intelligent Physical Education Teaching Application Scenarios in Colleges and Universities under the Background of Intelligent Education

Subject No.: Shandong Province Education Science "14th Five-Year Plan" Planning Project in 2023 (224).

Approval Unit: Shandong Academy of Educational Sciences.

## References

- [1] Education system to study the spirit of the report of the 20th Party Congress-accelerating the construction of a high-quality education system [N]. People's Daily.2022-11-20.
- [2] Circular of the General Office of the Ministry of Education on the Issuance of the Guideline for the Teaching Reform of Physical Education and Health (for Trial Implementation) [EB/OL]. [2021-06-23]. [http://www.moe.gov.cn/srcsite/A17/moe\\_938/s3273/202107/t20210721\\_545885.html](http://www.moe.gov.cn/srcsite/A17/moe_938/s3273/202107/t20210721_545885.html).
- [3] Opinions of the Ministry of Education on Comprehensively Deepening Curriculum Reform and Implementing the Fundamental Task of Establishing Moral Education [EB/OL]. [2014-04-08]. [http://www.moe.gov.cn/srcsite/A26/jcj\\_kcjcg/201404/t20140408\\_167226.html](http://www.moe.gov.cn/srcsite/A26/jcj_kcjcg/201404/t20140408_167226.html).
- [4] Barrows, Tim Lane. problem-based learning: an approach to medical education [M].Spring Publishing Company, 1980.
- [5] Michaelsen LK,Knight AB,Fink LD.Team-based learning:atransform ative use of small groups[M]. Westport(CT): Green wood Publishing Group,2002:3 -50.
- [6] Liu Chuncheng.Exploration and practice of PBL teaching mode in engineering training teaching[J]. Experimental Technology and Management,2012,29(04):158-161.
- [7] Li Qixia, The application and research of PBL joint TBL teaching mode in junior high school art teaching [D]. Jimei University,2021.
- [8] Circular of the General Office of the Ministry of Education on the Issuance of the Guideline for the Teaching Reform of Physical Education and Health (for Trial Implementation) [EB/OL]. [2021-6-23]. [http://www.moe.gov.cn/srcsite/A17/moe\\_938/s3273/202107/t20210721\\_545885.html](http://www.moe.gov.cn/srcsite/A17/moe_938/s3273/202107/t20210721_545885.html).
- [9] J. Zhang, J.W. Bai. Physical Education and Health - Small Ball Tutorial [M]. Beijing: Beijing Sport University Press, 2016: 61-62.
- [10] GU Haiyong,XIE Chao. The development of evaluation scale for college students' interest in physical education[J]. Journal of Guangzhou Sports Institute,2012,32(03):122-124.
- [11] CHAI Jiao, YANG Zhuo, REN Hailai. Evaluation indexes and criteria of tennis forehand hitting sports skills and its empirical research[J]. Journal of Xi'an Institute of Physical Education,2013,30(02):222-227+236.