

Research on the Application of the Flipped Classroom Teaching Model in University Table Tennis Teaching

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Abstract

In order to explore the application effect of the divided classroom teaching model in college table tennis elective courses, this study adopts research methods such as literature review, teaching experiments, and statistical analysis. The study was conducted on two classes of public elective courses at Xinyang Normal University, with a total of 64 students participating in an 18-week teaching experiment. The results after the experiment showed that the experimental group students performed better than the control group in forehand drives, backhand pushes, serves, and learning satisfaction. This indicates that in college table tennis elective course teaching, adopting the divided classroom teaching model is more effective than the conventional classroom teaching model in improving students' sports skills and class satisfaction.

Keywords

Split-class teaching; teaching model; table tennis; teaching effect

1. Introduction

In October 2020, the General Office of the State Council issued the "Opinions on Comprehensively Strengthening and Improving School Physical Education in the New Era," which pointed out that physical education courses at the higher education level should be integrated with innovative talent training to cultivate high-quality talents. As an important part of higher education, university public physical education courses not only bear the responsibility of improving students' physical fitness and sports skills but should also focus on cultivating students' overall quality, taking moral education as the fundamental task, and serving as an important path to promote the modernization of a strong sports nation[1]. Currently, the teaching process of university physical education courses generally adopts a one-size-fits-all traditional teaching method, which ignores individual differences among students and is not

conducive to the development of their personalities[2]. In contrast, integrating the three teaching stages of "explanation, internalization, and discussion" in a flipped classroom teaching model, combining in-class and after-class learning, allocating half the time to the teacher and half to the students, can fully utilize students' initiative, stimulate their learning interests, and reduce teachers' lesson preparation workload. Therefore, this study examines the application effects of the flipped classroom in table tennis teaching, hoping to provide new ideas for university table tennis education.

2. Research Subjects and Methods

2.1. Experimental subject

A total of 64 students from the 2024 class of the Law School at Xinyang Normal University were selected as experimental subjects, divided into an experimental group and a control group, with 32 students in each group. None of the subjects had received professional training, and there were no significant differences in height, weight, or age, as shown in Table 1.

Table 1. Statistical Table of Basic Information of Experimental Subjects

Test items	Experimental Group (n=32)	Control group (n=32)	T	P
Height(cm)	164.09±5.01	163.91±5.22	0.147	0.90
Weight(kg)	55.20±6.86	55.48±6.79	-0.165	0.94
Age (years)	18.44±1.16	18.50±0.88	-0.243	0.10

2.2. Teaching Experiment Design

2.2.1. Teaching Time and Location

A 16-week teaching experiment will be conducted at the East Playground of Xinyang Normal University, with one class per week, totaling 32 class hours. The experimental group and the control group will have classes on Monday and Tuesday mornings from 9:55 to 11:30, respectively.

2.2.2. Teaching Workflow

Before the teaching experiment commenced, a basic survey was conducted on the 64 students included in this experiment to ensure that the participants did not engage in specialized table tennis training in their spare time. The control group used the conventional classroom teaching model, while the experimental group used a split-classroom teaching model. The teaching content for both the control group and the experimental group was the same, but the teaching process differed.

The teaching process for the control group was: review the technical movements learned in the previous class - teacher explains and demonstrates new technical movements - teacher organizes student practice. The teaching process for the experimental group mainly consisted of: review table tennis technical movements in

fixed small groups - small group discussion of questions assigned by the teacher - whole-class discussion to solve problems - consolidate technical movements in small groups - teacher explains and demonstrates new technical movements - teacher organizes student practice - students engage in self-directed learning after class.

2.3. Indicators and Test Methods

2.3.1. Table Tennis Specific Skill Test Indicators

The final assessment standards for the public physical education elective courses at Xinyang Normal University are used to select table tennis-specific technical test indicators, including forehand drive, backhand push, and serving. Before the test, students are given explanations and demonstrations of the three table tennis test actions and are required to perform the tests according to the specified techniques.

Forehand drive test method: Students hit the ball on the right half of the table (dominant hand must be the right hand), and the teacher serves 10 times from the opposite side of the table to test their success rate.

Backhand push test method: Students hit the ball on the left half of the table (dominant hand must be the right hand), and the teacher serves 10 times from the opposite side of the table to test their success rate.

Serving test method: Students serve 5 times from the left half of the table and 5 times from the right half, for a total of 10 serves.

2.3.2. Psychological Scale Test

The experimental subjects completed Gu Haiyong's College Students' Interest in Physical Education Learning Scale[3] before and after the experiment. The scale includes four dimensions: positive interest, negative interest, exercise participation, and attention to physical education. The questionnaire uses a five-point Likert scale (1 - strongly disagree, 2 - disagree, 3 - uncertain, 4 - agree, 5 - strongly agree) to express responses.

2.4. Data Statistical Method

SPSS 27 software was used to conduct independent-sample and paired-sample t-tests. After the teaching experiment, the differences in the subjects' skill levels and pre- and post-experiment psychological scale scores were analyzed. ($p > 0.05$) indicates no significant difference, while ($p < 0.05$) indicates a significant difference.

3. Research Results

3.1. Table Tennis Skill Test Results

Before and after the experiment, the test results of forehand attacks, backhand pushes, and serves of students in the experimental group and the control group were compared between groups, as shown in Table 2.

Before the experiment, there were no statistically significant differences in the three indicators between the two groups of students, allowing the experiment to be conducted. After the experiment, the scores of forehand attacks for the experimental group and the control group were 3.03 ± 1.26 and 2.31 ± 0.82 , respectively, $P < 0.05$; the scores of backhand pushes for the experimental group and the control group were 2.41 ± 1.10 and 2.00 ± 0.84 , respectively, $P < 0.05$; the scores of serves for the experimental group and the control group were 2.41 ± 0.87 and 1.97 ± 0.65 , respectively, $P < 0.05$.

Table 2. Ping Pong Tennis Skill Test Results for the Experimental Group and the Control Group

	Test Indicators	Experimental Group	Control Group	t	p
Before the experiment	Forehand attack	2.03 ± 1.12	1.88 ± 1.21	0.54	0.813
	Backhand push and flick	1.69 ± 1.03	1.50 ± 1.11	0.70	0.623
	Serve	1.47 ± 0.71	1.53 ± 0.95	-0.30	0.767
After the experiment	Forehand attack	3.03 ± 1.26	2.31 ± 0.82	2.71	0.001**
	Backhand push and flick	2.41 ± 1.10	2.00 ± 0.84	1.66	0.037*
	Serve	2.41 ± 0.87	1.97 ± 0.65	2.28	0.026*

As shown in Table 3, after the experiment, the test results of the three indicators of students in the experimental group were compared with their pre-experiment results. The forehand attack increased from 2.03 ± 1.12 to 3.03 ± 1.26 , $P < 0.05$; the backhand push increased from 1.69 ± 1.03 to 2.41 ± 1.10 , $P < 0.05$; and the serve increased from 1.47 ± 0.72 to 2.41 ± 0.87 , $P < 0.05$. For students in the control group, the three indicators were also compared with their pre-experiment results. The forehand attack increased from 1.88 ± 1.21 to 2.31 ± 0.82 , $P < 0.05$; the backhand push increased from 1.50 ± 1.11 to 2.00 ± 0.84 , $P < 0.05$; and the serve increased from 1.53 ± 0.95 to 1.97 ± 0.65 , $P < 0.05$.

Table 3. Ping Pong Skills Test Results Before and After the Experiment

	Test Indicators	Before the experiment	After the experiment	t	p
Experimental Group	Forehand attack	2.03 ± 1.12	3.03 ± 1.26	-2.92	0.006**
	Backhand push and flick	1.69 ± 1.03	2.41 ± 1.10	-2.70	0.011*
	Serve	1.47 ± 0.72	2.41 ± 0.87	-4.56	0.000***
Control Group	Backhand push and flick	1.88 ± 1.21	2.31 ± 0.82	-1.58	0.124*
	Serve	1.50 ± 1.11	2.00 ± 0.84	-2.27	0.030*
	Backhand push and flick	1.53 ± 0.95	1.97 ± 0.65	-2.24	0.032*

3.2. Psychological Scale Test Results

As shown in Table 4, before and after the experiment, the results of the physical education learning interest scale for students in the experimental group and the control group were compared and analyzed between groups.

Before the experiment, there were no statistically significant differences in the physical education learning interest scale between the two groups of students, indicating that the experiment could be conducted on these two groups. After the experiment, the scores of students' positivity in the experimental group and the control group were 19.31 ± 3.42 and 17.75 ± 2.55 , respectively, $P < 0.05$; the scores of students' backhand push shots in the experimental group and the control group were 18.16 ± 1.97 and 17.18 ± 1.82 , respectively, $P < 0.05$; the scores of students' negativity in the experimental group and the control group were 16.09 ± 2.76 and 16.22 ± 2.37 , respectively, $P < 0.05$; the scores of students' negativity in the experimental group and control group were 18.41 ± 2.86 and 16.78 ± 2.72 , respectively, $P < 0.05$; the scores of students' negativity in the experimental group and control group were 14.50 ± 1.93 and 13.47 ± 1.83 , respectively, $P < 0.05$; the scores of students' negativity in the experimental group and control group were 12.22 ± 1.66 and 11.22 ± 1.83 , respectively, $P < 0.05$.

Table 4. Test Results of Interest in Physical Education in the Experimental and Control Groups

	Test items	Experimental group	Control group	t	p
Before the experiment	Positivity	16.78±3.52	16.50±3.36	0.33	0.745
	Negativity	16.09±2.76	16.22±2.37	-0.19	0.847
	Skill learning	15.56±3.36	15.28±3.20	0.34	0.733
	Hobbies	12.72±2.33	12.50±2.37	0.37	0.711
	Interest in sports	10.56±2.40	10.38±1.81	0.353	0.725
After the experiment	Positivity	19.31±3.42	17.75±2.55	2.07	0.043*
	Negativity	18.16±1.97	17.18±1.82	2.04	0.045*
	Skill learning	18.41±2.86	16.78±2.72	2.33	0.023*
	Hobbies	14.50±1.93	13.47±1.83	2.19	0.032*
	Interest in sports	12.22±1.66	11.22±1.83	2.29	0.025*

As shown in Table 5, after the experiment, the results of the Physical Education Learning Interest Scale for students in the experimental group were compared with those before the experiment. Enthusiasm increased from 16.78 ± 3.52 to 19.31 ± 3.42 , $P < 0.05$; negativity increased from 16.09 ± 2.76 to 18.16 ± 1.97 , $P < 0.05$; skill learning increased from 15.56 ± 3.36 to 18.41 ± 2.86 , $P < 0.05$; hobbies increased from 12.72 ± 2.33 to 14.50 ± 1.93 , $P < 0.05$; and attention to physical education increased from 10.56 ± 2.40 to 12.22 ± 1.66 , $P < 0.05$. For the control group, the Physical Education Learning Interest Scale results were compared with those before the experiment. Enthusiasm increased from 16.50 ± 3.36 to 17.75 ± 2.55 , $P < 0.05$; negativity increased from 16.22 ± 2.37 to 17.18 ± 1.82 , $P < 0.05$; skill learning increased from 15.28 ± 3.20 to 16.78 ± 2.72 , $P < 0.05$; hobbies increased from 12.50 ± 2.37 to 13.47 ± 1.83 , $P < 0.05$; and attention to physical education increased from 10.38 ± 1.81 to 11.22 ± 1.83 , $P < 0.05$.

Table 5. Test Results of Interest in Physical Education Before and After the Experiment

	Test items	Before the experiment	After the experiment	t	p
Experimental	Positivity	16.78±3.52	19.31±3.42	-2.53	0.017*
	Negativity	16.09±2.76	18.16±1.97	-3.62	0.001**

group	Skill learning	15.56±3.36	18.41±2.86	-4.13	0.000**
	Hobbies	12.72±2.33	14.50±1.93	-3.05	0.005**
	Interest in sports	10.56±2.40	12.22±1.66	-2.98	0.006**
Control group	Positivity	16.50±3.36	17.75±2.55	-2.06	0.048*
	Negativity	16.22±2.37	17.18±1.82	-2.14	0.040*
	Skill learning	15.28±3.20	16.78±2.72	-2.25	0.032*
	Hobbies	12.50±2.37	13.47±1.83	-2.09	0.045*
	Interest in sports	10.38±1.81	11.22±1.83	-2.14	0.040*

4. Discussion and Analysis

4.1. Analysis of the Impact on Table Tennis Skills

In table tennis skills, serving, forehand attacking, and backhand pushing are basic techniques, and they are also important skills for various playing styles in table tennis. Serving in table tennis is not only a powerful tool to take the initiative and gain the upper hand, but also one of the main means of scoring in table tennis. Therefore, studying the impact of two different teaching models on students' learning of table tennis skills revealed that after the experiment, both the split-class teaching model and the conventional curriculum teaching model significantly improved performance in forehand attacking, backhand pushing, and serving. However, the teaching effect of the split-class teaching model was more pronounced than that of the conventional curriculum model, indicating that in the teaching of public table tennis courses in general colleges, the split-class teaching model has more advantages in enhancing students' athletic skills. The following provides a detailed analysis and discussion of the impact of the two different models on students' forehand attacking, backhand pushing, and serving skills.

After the teaching experiment, the students in the experimental group showed a very significant improvement in forehand drives, and a significant improvement in backhand pushes and serves. The analysis suggests two reasons for this: first, it stems from the core concept of differentiated classrooms. Through the three interconnected stages of 'lecturing, internalizing, and discussing,' a closed loop of active learning was constructed, transforming the traditional teacher-centered knowledge transmission into a process of exploration and construction jointly participated in by both teachers and students [4]. In the process of teaching technical movements, teachers do not need to spend a lot of time explaining the techniques in detail. Instead, they can use a small amount of time to provide focused instruction on the key points and difficulties of the movements, and pose questions. For example, in serving lessons, teachers can discuss the different types of spin and how to toss the ball more consistently, leaving room for students to think, look up information, and fill in gaps. In this process, students develop a deeper understanding of the framework of the movements, improving learning efficiency.

Second, the discussion segment of the split-classroom teaching model can encourage students to actively learn the key points of skills and expand their knowledge after class. By receiving feedback from peers, students enjoy sharing their views in class

and, through communication, understand that standardizing technical movements is the foundation and guarantee for playing well. This also makes the classroom atmosphere more lively and fully reflects the students' primary role. In contrast, in the conventional classroom teaching model, students' learning methods are relatively single, their understanding of movements is not in-depth, and the emphasis on skill standardization is low, with most comprehension and practice coming solely from the teacher's explanation.

Therefore, compared to the one-size-fits-all approach of conventional classroom teaching, the split-classroom teaching model, through an integrated approach of 'explanation' - 'internalization' - 'discussion,' represents a new teaching model suited to China's national conditions. It highlights the students' active role, fosters a harmonious classroom learning environment, and achieves the goal of significantly improving students' table tennis skills.

4.2. Analysis of the Factors Affecting Interest in Sports Learning

Psychological theories hold that interest is an intrinsic psychological tendency that drives individuals to prioritize attention to and actively explore specific objects. It originates from positive emotions arising in cognition or practice and can be transformed into a persistent motivational system that sustains attention and guides behavior[5]. College students' interest in physical education also affects their attitude and persistence toward learning sports. If students can develop a strong interest in certain sports, they are more likely to master these sports quickly and continue to exercise, laying a solid foundation for lifelong physical fitness. Therefore, this paper explores the impact of two different teaching models on college students' learning in physical education. Through teaching experiments, it was verified that both teaching models significantly influence college students' interest in physical education, but the split-class teaching model has a more pronounced effect. This indicates that in general college table tennis teaching, applying the split-class teaching model has greater advantages in enhancing students' interest in physical education.

After the experiment, compared to before, students in both the experimental group and the control group showed differences in several dimensions. The experimental group showed highly significant differences in negativity, hobbies, and attention to physical education, extremely significant differences in skill learning, and significant differences in positivity.

The two factors of positivity and negativity are completely opposite. The questions respectively test students' feelings of boredom or enthusiasm and enjoyment toward physical education classes. Students in the experimental group showed significant improvements in both negativity and positivity, which is believed to be because students previously experienced frustration in physical activities or lacked a sense of participation in PE classes, leading them to find sports boring and develop resistance. The flipped classroom, which follows a student-centered teaching philosophy, allows

students to take the lead in discussions, helping them acquire the correct learning methods, master standard technical movements, and improve their learning confidence. When students experience immersive learning in class, time seems to pass quickly, and they begin to enjoy PE classes. These factors are key to increasing students' motivation for PE class learning.

Questions on skill learning reflect the purpose of students learning skills—whether it is merely to master the skill or to understand, become proficient in, and apply sports skills. The intrinsic motivation comes from the joy of mastering the skills. In the flipped classroom teaching model, during the segment of focused instruction and creating space for exploration, teachers explain the core content, essentially drawing a 'map,' which students can use to explore knowledge on their own. This process can stimulate students' intrinsic motivation. Furthermore, during the internalization, absorption, and discussion phases, students apply what they have learned in class discussions, transforming practice into feedback. This process not only enhances students' sense of achievement but also allows them to identify their shortcomings, promoting deeper exploration of knowledge.

The topic of hobbies reflects a student's active and mature state in learning physical education and to some extent indicates whether the student genuinely loves sports. The flipped classroom teaching model, by providing a detailed explanation of the material to lower the learning threshold and then leaving blank spaces for students to study independently, allows students to explore knowledge on their own and promotes active learning. When classroom discussions among students and between students and teachers follow, addressing students' questions, it not only meets students' personalized learning needs but also develops their social skills. In contrast, traditional classrooms focus too much on teaching efficiency, failing to meet students' individual needs and unable to sustain their interest in sports.

The attention given to sports tests whether students independently seek out sports-related information after class, including events, sports news, books, etc., indirectly reflecting their passion for sports and the strength of their intrinsic motivation to learn physical education. Students must genuinely enjoy one or more sports to be inclined to learn information about sports beyond just skills. The flipped classroom teaching model significantly enhances students in this regard, mainly due to the roles of self-study and discussion. Teachers no longer deliver content in a filler-style manner; instead, they dedicate most of the class time to students. After class, students review the material on their own, and any gaps are addressed during classroom discussions. This approach does not suppress students' individual development and, especially for general course students without professional training, can boost their learning confidence and sense of accomplishment, continuously stimulating intrinsic motivation for acquiring knowledge, transforming the experience from taking PE classes to learning PE.

5. Conclusion

Currently, college public table tennis courses generally adopt the conventional teaching model. Although the conventional teaching model has its irreplaceable aspects, with societal development and the increase in the number of college students, its disadvantages have become increasingly apparent. As China advances towards becoming a strong sports nation, the reform of college physical education courses must keep pace with social development. Therefore, this study verified the application effect of the split-class teaching model in table tennis courses at ordinary universities. Compared with conventional classes, the split-class teaching model showed more significant improvement in skills such as forehand attacks, backhand pushes, and serves. In terms of the college students' physical education learning scale, the split-class teaching model was also significantly better than conventional classes, indicating that the split-class teaching model has greater advantages in the teaching effectiveness of table tennis courses in ordinary colleges. The split-class teaching model combines both lecture-based and discussion-based approaches, taking their advantages to construct three interconnected processes: "lecture internalization discussion." Teaching experiments have proven that this model can fully stimulate students' initiative, enhance their interest in learning, help them master advanced sports skills, and provide new ideas for college physical education courses.

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