Research on the Effect of Flipping Classroom Teaching Model in PE and Health Teaching in Rural Primary Schools

Jiliang Wang*, Ramir S. Austria, and Yiming Lei

***Abstract*—In recent years, China's education and teaching reform has become a hot issue. The emergence of flipped classroom teaching model has greatly changed the conventional teaching mode. This paper uses the methods of literature, questionnaire, teaching experiment, interview, classroom observation and mathematical statistics to study the effect of flipping classroom teaching mode in PE and Health Teaching in rural primary schools. The research shows that the flipped classroom teaching mode in PE and Health Teaching in rural primary schools is helpful for students to master movement technology and improve students' attitude and interest in PE learning. In contrast, the emotional performance and cooperative spirit of the experimental class students who adopt the flipped classroom teaching mode are improved more significantly. Compared with the conventional classroom teaching method, the flipped classroom teaching mode has no obvious difference in the influence of students' physical fitness test results. The research suggests that we should strengthen the skill training of PE teachers and constantly improve their teaching ability, constantly enrich teaching methods under the flipped classroom teaching mode. When implementing the flipped classroom teaching mode, we should design a more reasonable teaching scheme in combination with the characteristics of students in rural schools, encourage scholars to actively study the research of flipped classroom teaching mode, and promote the reform and development of PE and Health Teaching in rural primary schools.**

***Index Terms*—Flipped classroom teaching mode, rural primary school, PE and health teaching**

I. Introduction

On June 13, 1996, the State Council of the People's Republic of China promulgated the Decision of the State Council of the Central Committee of the Communist Party of China on Deepening Education Reform and Comprehensively Promoting Quality Education. The document clearly states that a healthy body is the basic prerequisite for young people to serve the motherland and the people, and is the embodiment of the vigorous vitality of the Chinese nation.

School leaders should strengthen physical education, school education should establish a healthy guiding ideology, and effectively strengthen physical education. The Physical Education and Health Curriculum Standards for Full-time Compulsory Education in General High Schools (Experimental Draft) (hereinafter referred to as the standards) were developed under the general background and ideological guidance of the development of this era. The curriculum standards emphasize that the design of the curriculum should be conducive to stimulating students' interest in sports, helping them develop the habit of persevering in physical exercise, forming the qualities of bravery, tenacity and resilience, and striving to promote the overall development of students' physical, mental and social adaptability.

In 2012, the CPC Central Committee and the State Council proposed to "deepen education reform and comprehensively promote quality education", formulate and promulgate the curriculum reform of basic education (hereinafter referred to as the new curriculum reform) [1]. The core purpose of the new curriculum reform is to build a basic education curriculum system in line with the requirements of quality education in the 21st century. It emphasizes the transformation from "teaching people to fish" to "teaching people to fish", that is, teaching students knowledge to teaching students learning methods. The new curriculum reform issued in 2012 draws lessons from the curriculum reform experience of advanced countries. It is a reflection on the traditional education model of the people's Republic of China and actively strengthens the curriculum reform to meet the needs of the development of socio-economic, political and cultural trends. In the six aspects of curriculum goal, structure, content, implementation, evaluation and management, we should vigorously break the tradition, dare to innovate and practice. Under the guidance of the scientific thought of "two centenaries", China has entered a new era of rapid development of science and technology and economic globalization. The material and cultural living standards and spiritual life of the whole society have been greatly improved as a whole. The central and western regions are gradually able to increase investment in educational resources. In the long growth process, it is gradually found that the national health status plays a vital role in the future development of the country. It is an important measure to promote social progress and the happiness of every citizen's life. Therefore, enhancing citizens' sports quality is a major event related to the national economy and the people's livelihood. PE curriculum is an important way and way to strengthen citizens' physical health. Therefore, the whole world attaches great importance to the reform and innovation of PE curriculum. In China's education system, due to the great differences in the level of economic development, the distribution of educational resources is also different.

The new curriculum reform has played a guiding role in teaching reform and innovation in various regions. Reform and innovation can promote the development of education in the new era and quickly improve the quality of curriculum teaching in various regions. It also enables the teaching in the central and western regions to keep up with the pace of the

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economically developed eastern regions and adapt to the development of the new era.

In the 21st century, with the development of Internet information technology to an unprecedented height, it provides a powerful guarantee for flipped classroom. In 2011, Salman Khan founded Khan college and said in his speech at Ted conference that the modern teaching mode is under the great change of the trend of the new era, which is a new opportunity. We should grasp this unprecedented opportunity. In the 1965, Qiu [2] put forward the model of "learning before teaching and trying teaching method". Combined with the Western flipped classroom, it can be seen that there is a foundation for the implementation of flipped classroom in China [3]. In recent years, Netease & China MOOC have sprung up. Flipped classroom teaching method has blossomed everywhere in China. The broad masses of the people have carried out video learning online through the network. The application of flipped classroom in school education can effectively break the shackles of traditional teaching mode, make students truly become the main body and greatly stimulate students' learning initiative.

At present, the flipped classroom teaching method has become a hot innovation topic in the world education circle. Under the background of the globalization of flipped classroom, it has become the focus of educators to think about the problems related to classroom design, design appropriate teaching mode and improve teaching quality [4].

The rest of the paper is structured as follows. Section II is the definition of related concepts, mainly including PE and health teaching, flipped classroom model, sources of flipped classroom and differences between flipped classroom and traditional classroom. Section III introduces the research objects and methods. Section IV is the research results and analysis, including analysis of the current situation of physical education teaching in rural primary and secondary schools in Duyun City, the basic data of students before the experiment, and the difference of student data after the experiment. Section V is the conclusion and suggestion.

II. Related Concepts

A. PE and Health Teaching

The research of PE and Health Teaching at home and abroad is very rich. Combined with the curriculum standards, from a macro point of view, PE teaching is an important part of school PE and the basic organizational form to achieve the goal of school PE. From a micro perspective, PE and Health Teaching is based on purposeful and planned physical cognition, physical exercise, emotion and communication activities of students and teachers.

B. Flipped Classroom Model

Flipped classroom model refers to the reasonable and effective adjustment of the time inside and outside the normal classroom teaching, and the transfer of the decision-making power of learning from teachers to students. The flipped classroom model is based on the rapid development of Internet technology in the 21st century. On the basis of the development of the Internet, the drastic reform of the traditional teaching model is a part of the innovation of educational reform. The indirect similarities with the existing hybrid, cooperative inquiry and other teaching methods and tools in content are all in order to enable students to learn better.

Some courses are flipped in the classroom, and the teacher, as the "host", is mainly responsible for the organization and guidance of the classroom. More students are allowed to learn and explore problems by themselves, breaking the traditional teaching mode in which teachers are the main body of the classroom. This mode is a change that conforms to the development of the times and depends on the development and innovation of Internet technology.

C. Sources of Flipped Classroom

In 2007, Borman and Sams, two chemistry teachers in a high school in the U.S., were actually troubled. Sometimes students couldn't come to school, resulting in the problem of backward learning progress. In order to help these students catch up with the teaching progress, the two teachers recorded their lectures with videos, added presentations and uploaded them to the Internet. Later, they found that the teaching effect was better than that in class. More and more people began to use online video learning, and the prototype of flipped classroom began to appear [5].

Flipped classroom is rated as a major change affecting classroom teaching by The Globe and Mail in Canada, and provides new ideas and guidance for education all over the world.

D. Differences between Flipped Classroom and Traditional Classroom

Zhang [6] pointed out in the research on flipped classroom teaching model that the traditional classroom teaching process includes two stages: the teaching of knowledge and the internalization of knowledge. However, in the flipped classroom teaching mode, knowledge is taught through the teaching micro video recorded by teachers before class.

The internalization process of knowledge takes place in the classroom. Teachers, students and students carry out group cooperative learning, so that students can show themselves and conduct self-evaluation and mutual evaluation among students, so as to solve problems. This is the flipped classroom teaching mode [7]. The differences between flipped classroom teaching and traditional classroom are shown in Table I [8].

TABLE I: Differences between Flipped Classroom and Traditional Classroom

	Flipped Classroom	**Traditional Classroom**
Teacher	Learning instructor facilitator	knowledge transmitter
Student	Active investigator	Passive recipient
Instructional Mode	Pre-class study + classroom research	Explain homework in class
Course Content	Problem exploring	Knowledge explanation and instruction
Technology Application	Independent study, exchange of ideas, collaborative discussion	Exhibition Content
Evaluation Method	Multiple angles and multiple ways	Traditional testing

III. Research Object and Methods

A. Research Object

This paper takes the experimental effect of flipped classroom in PE teaching in rural primary schools as the research object, takes class 1 and class 2 of grade 3, class 1 and class 2 of grade 4 of Yundong No. 3 Primary School in Duyun City, Guizhou Province (hereinafter referred to as "Yundong No. 3 Primary School") as the experimental object, and sets up experimental classes and control classes, this paper analyzes the differences between the experimental class with flipped classroom teaching mode and the control class with conventional classroom teaching mode in sports learning interest, sports learning attitude, physical quality, skill learning, emotional performance and cooperative spirit [9].

B. Research Methods

1) Literature method

With CNKI and other retrieval platforms, access to relevant school PE, PE teaching, aerobics teaching, flipped classroom teaching and other books and materials, and read a large number of documents, so as to provide some theoretical support for the research of the paper.

2) Questionnaire survey method

According to the content and purpose of the study, there are four questionnaires for students. Among them, the questionnaire about the basic situation of students is only distributed before the experiment. Three questionnaires on students' learning interest, learning attitude, emotional performance and cooperative spirit of PE were distributed before and after the experiment, so as to get the difference of teaching effect before and after the experiment.

3) Experimental teaching method

According to the characteristics of students in Grades 1–6 of YunDong No. 3 primary school and comprehensive consideration, two classes in grade 3 and two classes in grade 4 are selected. All students in class 1 of grade 3 and all students in class 1 of grade 4 are selected as the control class, and the conventional teaching mode is adopted; All the students in class 2, grade 3 and class 2, grade 4 are experimental classes. The flipped classroom teaching mode is adopted: the control conditions are studied in a planned and purposeful way. After the experiment, the practical effect of flipped classroom in rural primary school PE teaching is verified according to the indexes measured in the experiment [10].

4) Classroom observation method

To observe and record students' learning in the classroom during lessons in two classes using the flipped classroom model and the traditional teaching model. This includes students' enthusiasm for learning, teacher-student interaction and classroom atmosphere to discover the different learning performance of students.

5) Interview methods

Five PE teachers from four primary and secondary schools in Duyun were interviewed. Objective: to understand the current situation of PE teaching in Township Primary and secondary schools in Duyun City. The interviewees are shown in Table II.

TABLE II: List of the Interviewees

No.	Name	Gender	Title
1	Zhang**	Female	Senior teachers in primary and secondary schools
2	Zheng**	Male	Primary and secondary school teachers
3	Wang**	Female	Primary and secondary school teachers
4	Tang**	Male	Primary and secondary school teachers
5	Huang**	Female	Primary and secondary school teachers

6) Mathematical statistics methods

This paper compares the differences between the experimental class and the control class before and after the experiment by using the independent sample T-test, and compares the differences between the experimental class before and after the experiment by using the paired sample T-test. The results are compared and analyzed by using the mean ±standard error (m ±SD) to compare the P-Value of the companion probability between the groups ($P > 0.05$ has no significant difference; $P < 0.05$ has significant difference; $P < 0.01$ has very significant difference). Use Excel for data input and SPSS 22.0 software processes the recovered and screened data to provide a certain guarantee for reasonable and scientific data results.

IV. Research Results and Analysis

A. Analysis on the Current Situation of PE Teaching in Township Primary and Secondary Schools in Duyun City

Since teaching is inseparable from teachers' teaching and students' learning, a basic survey was conducted on five teachers and 160 students. In terms of teachers, the interview method is mainly used to interview four aspects: the new teaching situation of students in the weekly PE class, the satisfaction of teachers with the current situation of PE teaching in rural schools, teachers' views on the school's PE reform, and how teachers view the flipped classroom. In terms of students, we mainly investigate whether they are left behind children, the importance of parents to students' physical exercise, the teaching forms students like, and the main ways of students' online learning at home

1) Aspects of teachers

a) Organize new classroom teaching every week

Through the interview with five primary and secondary school teachers in Duyun Township, it is learned that one teacher organizes new classroom teaching every week, and the other four teachers organize new classroom teaching every 1–2 weeks. Primary and secondary school students are in a critical period of growth and development, especially in primary school. This period is a good time to cultivate their interest in sports learning. This phenomenon is very unfavorable for students to learn sports health knowledge and skills. According to the interview, this phenomenon is due to the low attention of schools to PE, PE is sometimes replaced by other subjects, and the limited teaching environment in rural areas.

b) Satisfaction with the current situation of PE in rural schools and its reasons

Through the interview, we know that the satisfaction of five teachers with the current situation of PE teaching in rural schools is shown in Table III.

TABLE III: TEACHERS' SATISFACTION WITH THE CURRENT SITUATION OF PE IN RURAL SCHOOLS

	Satisfied	Commonly	Dissatisfied	Total
Teacher (N)	1	1	3	5

It can be seen from Table III that most of the five teachers are dissatisfied with the current situation of PE in rural schools, mainly due to the lack of training in teachers' knowledge and ability, and the school's PE resources are relatively limited.

c) Views on school PE reform

Through the interview with five primary and secondary school teachers in Duyun Township, it is learned that the four teachers very much hope that the faster the school PE reform. Because most teachers lack reflection and communication on the teaching of PE and cannot get satisfactory teaching results, most teachers look forward to the PE reform in rural schools.

d) Views on flipped classroom

Through the interview with five primary and secondary school teachers in Duyun Township, it is learned that one of them is not optimistic about the flipped classroom, because he is used to the traditional teaching mode and is reluctant to try the flipped classroom teaching mode. Most teachers are willing to try new teaching models and improve students' learning quality through their own efforts.

2) Understanding of students' basic situation

a) Is the case of left behind children

Since the implementation of flipped classroom requires students to watch teaching micro videos on their parents' mobile phones in their spare time, whether they are left behind children relatively affects whether students can watch teaching micro videos, thus affecting the implementation effect of flipped classroom. Therefore, this paper makes a general understanding and analysis of whether the students are left behind children, and analyzes the solutions and countermeasures according to the actual situation. The proportion distribution of left behind children in the experimental class (80 people) is shown in Fig. 1.

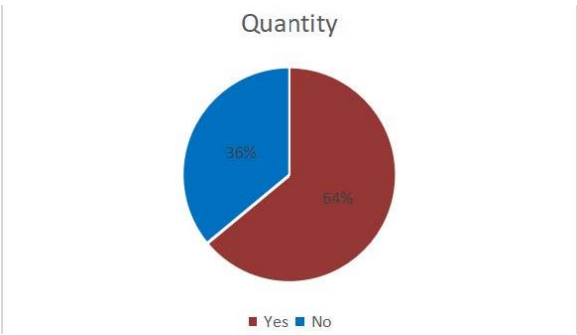

Fig. 1. Proportion distribution of left behind children in experimental class.

As can be seen from Fig. 1, the number of left behind children in the experimental class accounted for 36% of the total, and the number of non left behind children accounted for 64% of the total. It can be seen that the number of left behind children is also an issue that must be paid attention to. According to the actual situation, starting from the teaching aspect, carry out targeted adjustment. When applying the flipped classroom teaching mode, the students are divided into groups. Since most of the students of Yundong No. 3 Primary School are from the same village, the students who can't watch the teaching micro video at home in the group can go to the students who can watch the teaching micro video together in their spare time. Through group practice and group comparison, they can realize the importance of teamwork and make them feel the joy of cooperation with their peers, so that the shaping of students' character can be better improved and developed.

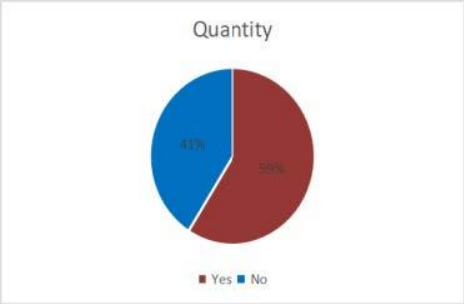

Fig. 2. Proportion distribution of left behind children in control class.

As can be seen from Fig. 2, the number of left behind children in the control class accounts for 41% of the total, and the number of non left behind children accounts for 59% of the total. It can be seen that the proportion of left behind children in the control class is also large, but the teaching method used in the control class is a conventional teaching mode, which does not involve watching micro videos. Therefore, the proportion of left behind children in the control class does not affect the implementation of teaching experiments.

b) Parents' attention to students' physical exercise

Parents' attention to students' physical exercise also relatively affects the implementation of flipped classroom teaching mode. The proportion of parents' attention to students' physical exercise is shown in Fig. 3.

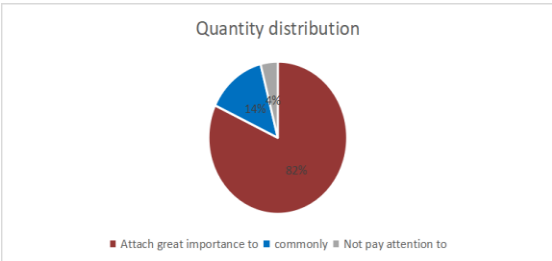

Fig. 3. Proportion distribution of parents' attention to students' physical exercise.

As shown in Fig. 3, 82% of the total number of parents attach great importance to students' physical exercise, 14% of the total number of parents attach general importance to students' physical exercise, and only 4% of parents do not attach importance to students' physical exercise. It can be seen that most parents attach great importance to students' physical exercise, which is very conducive to the

implementation of flipped classroom.

c) Distribution of teaching forms students like

The distribution of teaching forms preferred by students is shown in Fig. 4.

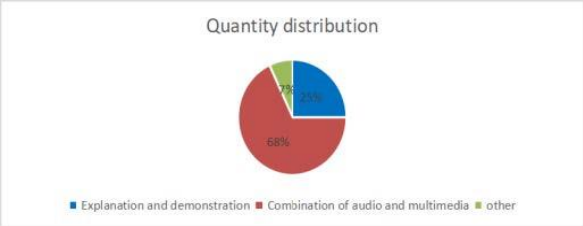

Fig. 4. Distribution proportion of teaching forms preferred by students.

As can be seen from Fig. 4, 68% of the students like audio, video and multimedia teaching forms, 25% like explanation and demonstration teaching forms, and 7% like other teaching forms. It can be seen that most students like the teaching form of the combination of audio, video and multimedia. The flipped classroom teaching mode is the teaching micro video combining audio, video and multimedia. Therefore, this situation is very conducive to the implementation of the flipped classroom teaching mode and improve students' interest in learning.

d) The main ways for students to study online at home

Since the implementation of flipped classroom teaching mode needs to be applied to electronic devices to watch teaching micro videos, the main ways of students' online learning at home are investigated. The survey results of the experimental class are shown in Fig. 5.

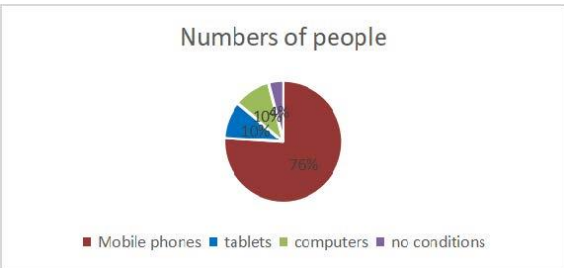

Fig. 5. Distribution of main ways of students' online learning at home.

As shown in Fig. 5, most students use mobile phones to study online at home, a small number of students use tablets and computers to study online, and very few students don`t have the conditions to study online at home. In view of this situation, when applying the flipped classroom teaching mode, the students are grouped. Since most of the students of Yundong No. 3 Primary School are from the same village, the students who can't watch the teaching micro video at home in the group can go to the students who can watch the teaching micro video at home in their spare time to watch the teaching micro video together.

B. Basic Data of Students before the Experiment

1) Physical fitness

According to the National Students' Physical Health Standard, the physical qualities of all students in grade 3 and grade 4 of Yungdong No. 3 Primary School, including 50M running, sitting forward flexion and 1-minute sit ups, were tested. Two classes with the same physical quality level in grade 3 and grade 4 of Yundong No. 3 Primary School were selected, of which class 2 and class 2 of grade 3 and class 2 of grade 4 were experimental classes, and class 1 and class 1 of grade 3 and class 1 of grade 4 were control classes. The P-test physical fitness test data of the experimental class and the control class, the P-test data and analysis of the grade 3 experimental class and the control class are shown in Table IV, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table V.

TABLE IV: INDEPENDENT SAMPLE T-TEST RESULTS OF PHYSICAL FITNESS TEST DATA BEFORE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	50 M (s)	Seat body Anteflexion (cm)	Sit Ups (times/min)
Experimental Class	38	10.59±1.76	7.86±4.92	28.55±7.21
Control Class	38	10.70±1.83	8.20±4.45	27.18±6.65
T-Value		0.294	0.328	−0.782
P-Value		0.770	0.744	0.436

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table IV that after passing the t-value test, the P-Value of the students in the two classes of grade 3 in the three tests of physical fitness are 0.770, 0.744, and 0.436 respectively, and the P-Value of the three items are > 0.05, which shows that there is no significant difference between the students in the two classes of grade 3 in these three physical qualities. It can be considered that the students in the two classes of grade 3 are at the same level in physical fitness.

TABLE V: T-TEST RESULTS OF INDEPENDENT SAMPLES OF PHYSICAL FITNESS TEST DATA BEFORE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	50M (s)	Seat body Anteflexion (cm)	Sit Ups (times / min)
Experimental Class	42	9.58±1.08	6.36±4.69	30.68±10.78
Control Class	42	9.56±1.19	6.98±5.04	31.70±11.55
T-Value		−0.093	0.569	0.420
P-Value		0.926	0.574	0.675

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table V that after passing the t-value test, the P-Value of the students in the two classes of grade 4 in the three tests of physical quality are 0.926, 0.574, and 0.675 respectively, and the P-Value of the three items are > 0.05, which shows that there is no significant difference in physical quality between the students in the two classes of grade 4. It can be considered that the students in the two classes of grade 4 are at the same level in physical quality.

2) Aerobics technical level

Before the teaching experiment, the aerobics technical level of the students in the experimental class and the control class of Yundong No. 3 Primary School was investigated. "Have you ever studied aerobics", choose the form of questionnaire to understand the students' Aerobics technical level. The survey results are shown in Fig. 6.

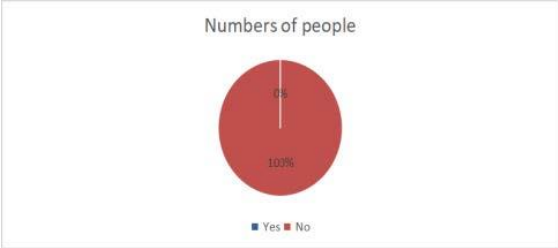

Fig. 6. Proportion distribution of whether you have studied aerobics.

As can be seen from Fig. 6, the proportion of people who have not studied aerobics in the experimental class and the control class of Yundong No. 3 Primary School is 100%. Therefore, it can be concluded that the students in the experimental class and the control class have not studied aerobics, so the aerobics technical level of the students in the experimental class and the control class is 0, there is no significant difference.

3) Sports learning attitude

For reference, the self-assessment scale of primary school students' sports learning attitude (2005) prepared by Wang [11] is borrowed. This scale includes three dimensions: learning style, interest and participation and classroom performance. For the score of each dimension, the greater the score, the better. The three dimensions of learning style, interest and participation and classroom performance of grade 3 experimental class and control class students and grade 4 experimental class and control class students in Yundong No. 3 Primary School were tested before the experiment. The scores of the two groups were compared by independent sample T-test. The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table VI, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table VII.

TABLE VI: T-TEST RESULTS OF INDEPENDENT SAMPLES OF PE LEARNING ATTITUDE TEST DATA BEFORE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Learning Style	Interests and Ways	Classroom Performance
Experimental Class	38	10.52±4.41	9.89±3.36	9.43±3.18
Control Class	38	10.12±3.78	10.89±3.91	9.96±2.74
T-Value		−0.396	1.179	0.757
P-Value		0.693	0.242	0.452

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table VI that before the teaching experiment, the P-Value of learning style, interest and participation, and classroom performance of the students in the experimental class and the control class in the three dimensions related to the students' sports learning attitude in the experimental class respectively 0.693, 0.242, and 0.452, P-Value > 0.01, which shows that there is no significant difference between the students of the two classes in grade 3 in the three related dimensions of sports learning attitude. It can be considered that the students of the experimental class and the control class in grade 3 are at the same level in terms of sports learning attitude.

TABLE VII: T-TEST RESULTS OF INDEPENDENT SAMPLES OF PE LEARNING ATTITUDE TEST DATA BEFORE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Learning Style	Interests and Ways	Classroom Performance
Experimental Class	42	12.35±4.38	11.46±3.36	11.58±3.38
Control Class	42	11.39±3.29	12.35±3.49	10.96±2.67
T-Value		–1.122	1.158	−0.925
P-Value		0.265	0.250	0.358

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table VII that before the teaching experiment, the P-Value of learning style, interest and participation and classroom performance of the students in the experimental class and the control class in the three related dimensions of PE learning attitude are 0.265, 0.250, and 0.358, P-Value are > 0.05, indicating that there is no significant difference between the students of the two classes in grade 4 in the three related dimensions of sports learning attitude. It can be considered that the students of the experimental class and the control class in grade 4 are at the same level in sports learning attitude.

4) Interest in PE

A questionnaire survey was conducted on students with reference to the evaluation scale of primary school students' interest in PE (2005) presided over by Wang, Ji, and Zhang [12]. This scale includes four dimensions: sports participation, positive interest, negative interest and attention to PE. For the score of each dimension, the greater the score, the better. The P-test was conducted on the four dimensions of sports participation, positive interest, negative interest and attention to sports of the third grade experimental class and control class students of Yundong No. 3 Primary School and the fourth grade experimental class and control class students in sports learning interest. The scores of the two groups of samples were compared through independent sample T-test. The P-test data and analysis of the third grade experimental class and the control class are shown in Table VIII, and the P-test data and analysis of the fourth grade experimental class and the control class are shown in Table IX.

TABLE VIII: T-TEST RESULTS OF INDEPENDENT SAMPLES OF PE LEARNING INTEREST TEST DATA BEFORE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Sports Participation	Positive Interest	Negative Interest	Pay Attention to Sports
Experimental Class	38	26.58 ±5.69	21.98 ±4.69	19.07 ±3.66	17.18 ±4.01
Control Class	38	26.29 ±6.06	20.72 ±4.35	18.94 ±3.47	16.58 ±4.23
T-Value		−0.210	−1.196	-0.156	−0.630
P-Value		0.834	0.235	0.876	0.531

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table VIII that before the teaching experiment, the P-Value of the four dimensions of sports participation, positive interest, negative interest and attention to sports of the students in the experimental class and the control class are 0.834, 0.235, 0.876, and 0.531, P-Value are >0.05, indicating that there is no significant difference

between the students of the two classes in grade 3 in the four related dimensions of PE learning interest. It can be considered that the students of the experimental class and the control class in grade 3 are at the same level in PE learning interest.

TABLE IX: INDEPENDENT SAMPLE T-TEST RESULTS OF PE LEARNING INTEREST TEST DATA BEFORE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Sports Participation	Positive Interest	Negative Interest	Pay Attention to Sports
Experimental Class	42	23.52 ±4.90	18.28 ±3.66	16.39 ±3.76	13.76 ±3.69
Control Class	42	23.06 ±5.73	18.33 ±4.75	14.94 ±4.58	12.42 ±3.94
T-Value		−0.388	−0.052	−1.611	−1.614
P-Value		0.699	0.959	0.111	0.110

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

As can be seen from Table IX, before the teaching experiment, the students in the experimental class and the control class in grade 4 of Yundong No. 3 Primary School are in the four dimensions related to the students' interest in Physical Education Learning in the experimental class and the control class, the P-values of the four dimensions of sports participation, positive interest, negative interest and attention to physical education are 0.699, 0.959, 0.111, and 0.110, and the P-value are >0.05, indicating that there is no significant difference between the students of the two classes in grade 4 in the four dimensions related to the interest in physical education learning, It can be considered that the students of grade 4 experimental class and control class are at the same level in physical education learning.

5) Emotional expression and cooperative spirit

A questionnaire survey was conducted with reference to the (2008) self rating scale for affective performance and cooperative spirit of primary school students compiled by Wang, Ji, and Jin [13]. This scale includes two dimensions: affective performance and cooperative spirit. For the score of each dimension, the greater the score, the better. The affective performance and cooperative spirit of the grade 3 experimental class and the control class of Yundong No. 3 Primary School and the grade 4 experimental class and the control class were tested before the experiment. The scores of the two groups of samples were compared by independent sample T-test. The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table X, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table XI.

TABLE X: INDEPENDENT SAMPLE T-TEST RESULTS OF AFFECTIVE PERFORMANCE AND COOPERATIVE SPIRIT DATA BEFORE THE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Emotional Expression	Cooperative Spirit
Experimental Class	38	10.19±2.98	12.24±3.46
Control Class	38	9.90±2.98	12.45±3.10
T-Value		−0.431	0.275
P-Value		0.668	0.784

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table X that before the teaching experiment, among the two dimensions related to emotional performance and cooperative spirit of students in the experimental class and the control class, the P-Value of emotional performance and cooperative spirit are 0.668, and 0.784 respectively, and the P-Value are > 0.05, indicating that there is no significant difference between the two dimensions related to emotional performance and cooperative spirit. It can be considered that the grade 3 experimental class and the control class are at the same level in emotional performance and cooperative spirit.

TABLE XI: INDEPENDENT SAMPLE T-TEST RESULTS OF AFFECTIVE PERFORMANCE AND COOPERATIVE SPIRIT DATA BEFORE THE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Emotional Expression	Cooperative Spirit
Experimental Class	42	10.48±2.62	12.56±2.85
Control Class	42	10.77±2.65	12.73±3.22
T-Value		0.493	0.285
P-Value		0.624	0.776

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XI that before the teaching experiment, the P-Value of affective performance and cooperative spirit in the two dimensions related to affective performance and cooperative spirit of students in the experimental class and the control class are 0.624 and 0.776 respectively, and the P-Value are >0.05, indicating that there is no significant difference between the two dimensions related to affective performance and cooperative spirit. It can be considered that the grade 3 experimental class and the control class are at the same level in emotional performance and cooperative spirit.

C. Differences in Student Data after the Experiment

1) Change of skill learning effect

After 12 weeks of teaching experiment, this paper tests the students of the grade 3 experimental class and control class of Yundong No. 3 Primary School and the students of the grade 4 experimental class and control class and the full score is 10 points.

The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table XII, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table XIII.

TABLE XII: INDEPENDENT SAMPLE T-TEST RESULTS OF AEROBICS TECHNICAL LEVEL TEST DATA AFTER THE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Aerobics Performance
Experimental Class	38	8.62±0.66
Control Class	38	7.97±0.96
T-Value		−3.324
P-Value		0.001

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XII that after the teaching experiment, the P-Value results of "Popular Aerobics Level-1" between the experimental class and the control class of grade 3 of Yundong No. 3 Primary School is 0.001, and the P-Value is < 0.01, indicating that there is a very significant

difference between the students of the experimental class and the control class of grade 3 of Yundong No. 3 Primary School in the results of "Popular Aerobics Level-1". From the average value, it can be seen that the average score of the grade 3 experimental class is higher than that of the control class, so the test score of the grade 3 experimental class is significantly higher than that of the control class after adopting the flipped classroom teaching mode.

TABLE XIII: INDEPENDENT SAMPLE T-TEST RESULTS OF AEROBICS TECHNICAL LEVEL TEST DATA AFTER EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Aerobics performance
Experimental Class	42	8.68±0.46
Control Class	42	7.99±0.85
T-Value		−4.795
P-Value		0.000

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XIII that after the teaching experiment, the P-Value results of "Popular Aerobics Level-1" between the grade 4 experimental class and the control class is 0. 000, and the P-Value is <0.01, indicating that there is a very significant difference between the students of the grade 4 experimental class of Yundong No. 3 Primary School and the control class in the test result of "Popular Aerobics Level-1", which can be seen from the average value, the average score of the grade 4 experimental class is higher than that of the control class. Therefore, after adopting the flipped classroom teaching mode, the test score of the grade 4 experimental class is significantly higher than that of the control class.

To sum up, it can be seen that the aerobics test scores of the experimental class adopting the flipped classroom teaching mode are significantly higher than those of the control class. The reason is that the experimental class adopting the flipped classroom teaching mode has a WeChat group that specially uploads teaching micro videos. Students can learn independently by watching Teaching micro videos before class. What problems students have when watching teaching micro videos can be reflected in the WeChat group in time, teachers give timely feedback on the problems encountered by students, so that students' problems can be solved in time. In class, students' practice time is longer than that of the control class using the conventional classroom teaching mode. After class, students can watch the teaching micro video at home for review at any time. Therefore, the aerobics test score of the experimental class is significantly higher than that of the control class.

2) Attitude of PE learning change

For reference, the self-assessment scale of primary school students' sports learning attitude (2009) prepared by Wang, Ji, and Jin [13] is borrowed. This scale includes three dimensions: learning style, interest and participation and classroom performance. For the score of each dimension, the greater the score, the better. This paper makes an experimental T-test on the three dimensions of learning style, interest and participation and classroom performance of the grade 3 experimental class and control class students of Yundong No. 3 Primary School and the grade 4 experimental class and control class students in sports learning attitude, and tests the score comparison of the two groups of samples through independent sample T-test. The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table XIV, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table XV.

TABLE XIV: INDEPENDENT SAMPLE T-TEST RESULTS OF PE LEARNING ATTITUDE TEST DATA AFTER THE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Learning Style	Interests and Ways	Classroom Performance
Experimental Class	38	15.62±3.17	16.32±2.75	15.69±2.86
Control Class	38	13.07±3.15	12.82±3.30	12.80±2.76
T-Value		−3.542	−5.092	−4.554
P-Value		0.001	0.000	0.000

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XIV that after the teaching experiment, the P-Value of learning style, interest and participation and classroom performance of the students in the experimental class and the control class in the three dimensions related to sports learning attitude are 0.001, 0.000, and 0.000 respectively, and the P-Value are all < 0.01, indicating that the students in the two classes in grade 3 are in the three dimensions related to learning style, interest and participation and classroom performance in sports learning attitude, from the average value, it can be seen that the scores of the experimental class are higher than those of the control class. Therefore, the performance of the students in the grade 3 experimental class in terms of PE learning attitude after adopting the flipped classroom teaching mode is significantly higher than that of the students in the control class using the conventional classroom teaching mode. Therefore, the flipped classroom teaching mode can better improve the students' PE learning attitude compared with the conventional teaching mode.

TABLE XV: INDEPENDENT SAMPLE T-TEST RESULTS OF PE LEARNING ATTITUDE TEST DATA AFTER THE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Learning Style	Interests and Ways	Classroom Performance
Experimental Class	38	15.63±3.18	16.26±2.71	15.61±2.84
Control Class	38	13.08±3.18	12.76±3.26	12.72±2.74
T-Value		−3.542	−5.092	−4.554
P-Value		0.001	0.000	0.000

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XV that after the teaching experiment, the P-Value of learning style, interest and participation and classroom performance of the students in the experimental class and the control class in the three dimensions related to sports learning attitude are 0.001, 0.002, and 0.000 respectively, and the P-Value are all <0.01, indicating that the students in the two classes in grade 4 are in the three dimensions related to learning style, interest and participation and classroom performance in sports learning attitude, There are very significant differences. From the average value, it can be seen that the scores of the experimental class are higher than those of the control class. Therefore, the performance of the students in the grade 4

experimental class in terms of PE learning attitude after adopting the flipped classroom teaching mode is significantly higher than that of the students in the control class using the conventional classroom teaching mode. Therefore, the flipped classroom teaching mode can better improve the students' PE learning attitude compared with the conventional teaching mode.

The reason for this result is that in the process of adopting the flipped classroom teaching mode, the students in the experimental class watch the teaching micro video for independent learning before class. In class, the students are first allowed to display the results in groups. The teachers find and solve the problems, and the students practice again. The students practice for a longer time than the control squad leader adopting the conventional classroom teaching mode, and the students are more participatory, give full play to students' subjectivity; In the control class with conventional teaching mode, teachers should complete the explanation and demonstration of actions in class. It takes a long time for students to learn new actions in class, which shortens the time for students to practice. Compared with the conventional classroom teaching mode, the flipped classroom teaching mode can better improve students' attitude towards PE learning.

3) Changes in interest in PE learning

A questionnaire survey was conducted on students with reference to the evaluation scale of primary school students' interest in PE (2009) prepared by Wang, Ji, and Jin [13]. This scale includes four dimensions: sports participation, positive interest, negative interest and attention to PE. For the score of each dimension, the greater the score, the better. This paper makes an experimental T-test on the four dimensions of sports participation, positive interest, negative interest and attention to sports of the grade 3 experimental class and control class students of Yundong No. 3 Primary School and the grade 4 experimental class and control class students in sports learning interest. The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table XVI, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table XVII.

TABLE XVI: INDEPENDENT SAMPLE T-TEST RESULTS OF PE LEARNING INTEREST TEST DATA AFTER THE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Sports Participation	Positive Interest	Negative Interest	Pay Attention to Sports
Experimental Class	38	37.56 ±4.72	28.69 ±3.85	25.95 ±2.86	19.45 ±3.55
Control Class	38	28.34 ±6.55	23.82 ±3.66	20.37 3.02	18.58 ±3.40
T-Value		−7.038	−5.700	−8.447	−1.037
P-Value		0.000	0.000	0.000	0.303

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XVI that after the teaching experiment, the P-Value of sports participation, positive interest, negative interest and attention to sports are 0.000, 0.000, 0.000, and 0.303 respectively in the four dimensions related to the students' interest in sports learning in the experimental class and the control class of grade 3 of Yundong No. 3 Primary School. Among them, the P-Value of sports participation, positive interest and negative interest are < 0.01 and the P-Value of attention to sports > 0.05, It shows that there are very significant differences in the three dimensions of sports participation, positive interest and negative interest between the two classes in grade 3, it can be seen from the average value that the scores of the students in the experimental class are higher than those in the control class, and there is no significant difference in the dimension of paying attention to sports. It shows that the performance of the three dimensions of sports participation, positive interest and negative interest of the students in the grade 3 experimental class in terms of sports learning interest after adopting the flipped classroom teaching mode is significantly higher than that of the students in the control class using the conventional classroom teaching mode.

TABLE XVII: INDEPENDENT SAMPLE T-TEST RESULTS OF PE LEARNING INTEREST TEST DATA AFTER THE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Sports Participation	Positive Interest	Negative Interest	Pay Attention to Sports
Experimental Class	42	32.58 ±4.80	26.82 ±3.56	23.03 ±3.29	15.04 ±2.68
Control Class	42	28.44 ±4.71	22.60 ±5.83	17.91 ±3.82	14.47 ±3.14
T-Value		−3.967	−3.972	−6.522	−0.888
P-Value		0.000	0.000	0.000	0.377

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XVII that after the teaching experiment, the students in the experimental class and the control class of grade 4 of Yundong No. 3 Primary School, Among the four related dimensions of students' interest in PE Learning in the experimental class and the control class, The P-Value of sports participation, positive interest, negative interest and attention to sports are 0.000, 0.000, 0.000, and 0.377 respectively, the P-Value of the three dimensions of sports participation, positive interest and negative interest are all <0.01, P-Value of focusing on Sports >0.05. It shows that there are very significant differences in the three dimensions of sports participation, positive interest and negative interest between the two classes in grade 3, it can be seen from the average value that the scores of students in the experimental class are higher than those in the control class. The performance of the three dimensions of sports participation, positive interest and negative interest is significantly higher than that of the students in the control class who adopt the conventional classroom teaching mode.

Investigate the reasons for the above situation, because in the process of adopting the flipped classroom teaching mode, students learn in advance by watching teaching micro videos. In class, students will show in groups through the organization of teachers, practice and other methods, on the premise that students can have more time to practice. Improve students' participation in sports, so as to mobilize students' enthusiasm for PE learning. Relatively speaking, students' negativity to PE learning will be reduced. Compared with the conventional classroom teaching mode, the flipped classroom teaching

mode can better improve students' interest in PE learning.

4) Expression of affection and change of cooperative spirit

A questionnaire survey was conducted with reference to the self rating scale for affective performance and cooperative spirit of primary school students (2009) prepared by Wang, Ji, and Jin [13], this scale includes two dimensions: affective performance and cooperative spirit. For the score of each dimension, The higher the score. After the experiment, the students in the grade 3 experimental class and the control class of Yundong No. 3 Primary School and the students in the grade 4 experimental class and the control class were tested in the two dimensions of emotional performance, cooperative spirit and cooperative spirit. The score comparison of the two groups of samples was tested by independent sample T-test. The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table XVIII, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table XIX.

TABLE XVIII: INDEPENDENT SAMPLE T-TEST RESULTS OF AFFECTIVE PERFORMANCE AND COOPERATIVE SPIRIT DATA AFTER THE EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	Emotional Expression	Cooperative Spirit
Experimental Class	38	15.14±2.71	18.87±2.79
Control Class	38	12.11±2.29	14.87±3.12
T-Value		−5.221	−5.856
P-Value		0.000	0.000

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XVIII that after the teaching experiment, In the two dimensions related to emotional performance and cooperative spirit of students in the experimental class and the control class. The P-Value of affective expression and cooperative spirit were 0.000 and 0.000 respectively, and the P-Value were <0.01. It shows that in the two dimensions related to emotional performance and cooperative spirit, the students of two classes in grade 3. There are very significant differences in emotional performance and cooperative spirit. As can be seen from the average value, the scores of students in the experimental class were higher than those in the control class. It can be considered that the grade 3 experimental class students' performance in emotional performance and cooperative spirit after adopting the flipped classroom teaching mode is significantly higher than that of the control class students who adopt the conventional classroom teaching mode.

TABLE XIX: INDEPENDENT SAMPLE I TEST RESULTS OF AFFECTIVE PERFORMANCE AND COOPERATIVE SPIRIT DATA OF GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS AFTER THE EXPERIMENT

Group	N	Emotional Expression	Cooperative Spirit
Experimental Class	42	14.56±2.24	17.11±2.00
Control Class	42	11.96±2.78	13.70±3.28
T-Value		−4.771	−5.761
P-Value		0.000	0.000

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XIX that after the teaching experiment, the students in the experimental class and the control class of grade 4 of Yundong No. 3 Primary School, in the two dimensions related to emotional performance and cooperative spirit of students in the experimental class and the control class, The P-Value of affective expression and cooperative spirit were 0.000 and 0.000 respectively, and the P-Value were <0.01. It shows that in the two dimensions related to emotional performance and cooperative spirit, the students of two classes in grade 4. There are significant differences in emotional performance and cooperative spirit. It can be seen from the average value that the scores of students in the experimental class are higher than those in the control class. It can be considered that the performance of affective performance and cooperative spirit of the students in the grade 4 experimental class after using the flipped classroom teaching mode is significantly higher than that of the students in the control class using the conventional classroom teaching mode.

The reason is that in the process of adopting the flipped classroom teaching mode, Students learn independently by watching teaching micro videos, which shortens the time for teachers to demonstrate in class and increases students' practice time, there is more and more interaction within and between groups. Therefore, compared with the conventional classroom teaching mode, the flipped classroom teaching mode can better improve students' emotional performance and cooperative spirit.

5) Changes in physical fitness

a) Changes of physical fitness in experimental class before and after

School PE should establish the guiding ideology of "Health First". Promoting students' physical health is an important aspect of PE teaching, the above research shows that the flipped classroom teaching model can promote the improvement of primary school students' sports learning attitude, sports learning interest, emotional expression and cooperative spirit, However, the development of students' physical quality is also an important part. According to the national student physical health standard, the students in the grade 3 experimental class and the grade 4 experimental class of Yundong No. 3 Primary School were tested after the experiment. The comparison of various physical fitness tests of students in the grade 3 experimental class before and after the experiment is shown in Table XX. The comparison of various physical fitness tests of students in the grade 4 experimental class before and after the experiment is shown in Table XXI.

TABLE XX: T-TEST RESULTS OF PAIRED SAMPLES OF PHYSICAL FITNESS TEST DATA BEFORE AND AFTER THE EXPERIMENT IN THE THIRD GRADE EXPERIMENTAL CLASS

Project	N	Before Experiment	After the Experiment	T-Value	P-Value
50 m (s)	38	10.59±1.76	10.22±1.51	2.488	0.017
Seat body Anteflexion (cm)	38	7.86±4.92	8.71±4.29	−4.264	0.000
Sit Ups (times/min)	38	28.55±7.21	29.55±7.55	−0.841	0.406

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XX that the students in the grade

3 experimental class are in the 50m running and sitting forward flexion in physical fitness, The results of data analysis before and after the experiment showed that the P-Value were 0.017 and 0.000 respectively. All P-Value were <0.05, among which the P-Value of sitting forward flexion was <0.01, with a very significant difference. It can be seen from the average value that the score after the experiment is significantly higher than that before the experiment; From the data analysis results before and after the one minute sit ups experiment, the P-Value was 0.406, P-Value > 0.05, there was no significant difference.

TABLE XXI: T-TEST RESULTS OF PAIRED SAMPLES OF PHYSICAL FITNESS TEST DATA BEFORE AND AFTER THE EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS

Project	N	Before Experiment	After the Experiment	T-Value	P-Value
50 m (s)	42	9.58±1.08	9.77±1.06	1.355	0.183
Seat body Anteflexion (cm)	42	6.36±4.69	7.51±4.33	−6.5	0.000
Sit Ups (times/min)	42	30.68±10.78	30.52±10.38	−0.145	0.885

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XXI that the data analysis results before and after the sitting forward flexion experiment of the grade 4 experimental class students in physical fitness show that the P-Value is 0.000, $P < 0.01$, with very significant difference. From the average value, it can be seen that the score after the experiment is significantly higher than that before the experiment; It can be seen from the data analysis results before and after the 50m running and one minute sit ups experiment, The P-Value were 0.183 and 0.885 respectively, and the P-Value were >0.05.

The reason is that in aerobics teaching, in addition to allowing students to practice Aerobics with music, teachers have time to lead students in static stretching in each class, and the sensitive period of flexibility quality is in the period of children, so the performance of sitting forward flexion is significantly better than that before the experiment.

Since aerobics is mainly practiced in class. The speed practice and waist and abdomen practice of students are rarely involved, so there is no significant difference in the results of students' 50m running and one minute sit ups before the experiment. The results of sitting forward flexion in the physical quality of the students in the experimental class were significantly higher than those before the experiment. As for the impact of experimental intervention, it also needs to be compared with the control class.

b) Comparison of physical fitness changes between experimental class and control class

The physical fitness test data of the experimental class and the control class after the experiment. The P-test data and analysis of the grade 3 experimental class and the control class are shown in Table XXII, and the P-test data and analysis of the grade 4 experimental class and the control class are shown in Table XXIII.

TABLE XXII: INDEPENDENT SAMPLE T-TEST RESULTS OF PHYSICAL FITNESS TEST DATA AFTER EXPERIMENT IN GRADE 3 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	50 M (s)	Seat body Anteflexion (cm)	Sit Ups (times/min)
Experimental Class	38	10.22±1.51	8.71±4.29	29.55±7.55
Control Class	38	10.47±1.48	8.79±3.99	27.84±6.91
T-Value		0.766	0.083	−1.030
P-Value		0.446	0.934	0.306

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

It can be seen from Table XXII that after passing the t-value test, the students in the two classes of grade three in the three tests of physical fitness: 50m running, sitting forward flexion and one minute sit ups, The P-Value obtained were 0. 446, 0. 934, and 0. 306 respectively, and the P-Value of the three terms were >0.05, This shows that there is no significant difference between the students of the two classes in grade 3 in the three physical qualities of 50m running, sitting forward flexion and one minute sit ups.

TABLE XXIII: INDEPENDENT SAMPLE T-TEST RESULTS OF PHYSICAL FITNESS TEST DATA AFTER EXPERIMENT IN GRADE 4 EXPERIMENTAL CLASS AND CONTROL CLASS

Group	N	50 m (s)	Seat Body Anteflexion (cm)	Sit Ups (times/min)
Experimental Class	42	9.77±1.06	7.51±4.33	30.10±10.38
Control Class	42	9.50±1.02	7.76±4.68	31.05±10.26
T-Value		−0.315	0.252	0.432
P-Value		0.754	0.802	0.673

Note: $P > 0.05$: No Significant, $P < 0.05$: Significant, $P < 0.01$: Very Significant

As can be seen from Table XXIII, after passing the t-value test, The students of two classes in grade 4 have been tested in three tests: 50m running, sitting forward flexion and one minute sit ups, The P-Value obtained are 0.754, 0.802, and 0.673 respectively, and the P-Value of the three terms are >0.05, This shows that there is no significant difference between the students of the two classes in grade 4 in the three physical qualities of 50m running, sitting forward flexion and one minute sit ups.

It also reminds us that any teaching model has its advantages and limitations, how to further improve the teaching effect, we must make great efforts to stimulate students' independent exercise and appropriately increase the exercise load.

V. CONCLUSIONS AND SUGGESTIONS

A. Conclusion

By quoting the flipped classroom teaching model in the PE teaching of rural primary schools, the experimental class with flipped classroom teaching mode and the control class with conventional classroom teaching mode, after a 12 weeks teaching experiment, students' interest in PE, physical quality, skill learning and attitude towards PE learning, the performance of affection is different from that of cooperative spirit. Through the analysis of the data, the following

conclusions are drawn.

1) Flipped classroom teaching mode has a positive impact on improving students' attitude towards physical exercise, compared with the conventional classroom teaching mode, the improvement of students' physical exercise attitude in the experimental class using the flipped classroom teaching mode is more obvious.
2) Flipped classroom teaching mode has a significant impact on the learning effect of students' skills, compared with the conventional teaching mode, the aerobics skills of students in the experimental class using the flipped classroom teaching mode are significantly better than those in the control class.
3) Flipped classroom teaching mode has a positive impact on improving students' emotional performance and cooperative spirit, compared with the conventional classroom teaching mode, the emotional performance and cooperative spirit of the experimental class students who adopt the translation classroom teaching mode are improved more significantly.
4) The flipped teaching mode has a positive impact on the improvement of students' interest in PE, compared with the conventional classroom teaching mode, the flipped classroom teaching mode has a particularly obvious effect on improving the interest in participating in PE learning, Students' interest in PE has been greatly improved.
5) Compared with the conventional classroom teaching mode, there is no significant difference in the impact on students' physical fitness test results.

B. Recommendations

1) In the process of implementing the flipped classroom teaching mode, we should combine the teaching environment of rural schools with the characteristics of students, and design a more reasonable implementation plan, so as to promote the development of students.
2) There is little research on flipped classroom teaching model in rural primary school PE, I hope that more people can participate in it in the future to jointly promote the reform and development of PE in rural primary schools.
3) The innovation and development of PE in rural primary schools need the support of the government, It is suggested that the education bureau should increase the skill training of PE teachers, continuously improve teachers' teaching ability, and encourage rural teachers to try to reverse the classroom teaching mode.
4) Under the flipped classroom teaching mode, we should constantly enrich teaching methods, The teaching methods involved in this paper are group teaching method. In the future attempts, we need to constantly enrich effective teaching methods to make students get better development.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

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