

The Application of Combination Training Method on The Speed Endurance Level in Physical Education for Freshmen Students in China

Leyao Zhang^{a*}
Nipaporn Sakulwongs^b

^{a*,b} Master of Education in Curriculum and Instruction,
Rangsit University, Thailand, Email: Leyao.z65@rsu.ac.th, Nipaporn.c@rsu.ac.th

Article Info
Received 9 January 2025
Revised 28 April 2025
Accepted 30 April 2025
Available online 30 April 2025

Abstract

This study aimed to compare speed endurance before and after using the Combination Training Method in Physical Education for the Freshmen in China, and investigate student satisfaction with this method. A mixed-method approach was used, and means and standard deviation were calculated by the computer software. The research combined literature review, questionnaires, and statistical analysis, focusing on 30 male Freshmen of physical education major from H College in Hunan Province. The students underwent a four-week Combination Training program designed to improve speed endurance.

The physiological and biochemical indices of the students before and after the experiment, along with their track and field performance, were analyzed. The results showed that: 1) Lactate clearance increased from 11.17% to 17.23%, compared to the pre-test rate of 1.44%; 2) Maximal heart rate decreased from 172 to 166 beats per minute, and heart rate recovery improved from 18% to 26.51% after 3 minutes; 3) Maximal anaerobic power of the lower extremities rose from 11.01 w/kg to 12.22 w/kg, with average power also improving from 8.46 w/kg to 8.85 w/kg; and 4) Track and field performance improved significantly in 100m, 800m, 1500m, triple jump, javelin, and shot put.

The conclusions were: 1) The Combination Training Method effectively improved lactate clearance, reducing fatigue and injury risk; 2) It accelerated heart rate recovery, aiding faster energy recovery after intense training; 3) It enhanced anaerobic capacity in athletes; 4) This method was a fast, scientific, and effective way to boost speed endurance.

Keywords: Combination Training Method, Speed Endurance Level, Physical Education

Introduction

Physical education students who specialized in track and field typically possess a relatively good ability to sustain fast running, maintain speed endurance, and demonstrate strong muscular strength. Their performance was generally stable, but when they reached a certain plateau or bottleneck, improvement tend to be slow and there were no significant advancements in a short period. The daily training regimen of track and field students usually relies on traditional single training methods, which was the primary reason for the slow progress in their performance (Ramos, 2021).

Fiorenza (2019) and other scholars, while researching the effects of combining various individual training methods on the special strength training of athletes engaged in jumping

sports within track and field, concluded that even when these athletes' physical abilities reach a plateau, performance could be improved by combining multiple training methods and techniques. This approach helped enhance the precision of movements, leading to improved sports performance.

As athletes face performance plateaus, it became imperative to innovate and incorporate varied training approaches. The research underscored the importance of combining different training techniques to address the limitations of traditional single-method training.

The overall trend in speed endurance quality training had experienced two distinct phases, transitioning gradually from an initial focus on aerobic metabolic capacity training to a more integrated approach that combines aerobic and anaerobic metabolism and the corresponding functional capacity conversion training (Cheng, 2018).

This research aimed to scientifically integrate various single training methods and apply them to the daily training routines of athletes. By tailoring each training method to the athletes' individual physical conditions, physiological situations, and the characteristics of their specific specialties, the goal was to develop a scientifically sound training program. Employing a Combination of different single training methods was expected to yield more significant results with less effort. The training program would be systematically applied to training sessions, allowing for the timely detection of issues during training experiments. This enabled the modification and adjustment of the training program to continually improve its effectiveness. Ultimately, the research seek to develop an optimal training program tailored to enhance the speed and endurance quality of track and field students (Haugen, 2019).

The purpose of this research was to thoroughly investigate and summarize a Combination Training Method that effectively enhanced speed and endurance through scientific analysis and practical testing. By doing so, it aimed to optimize the specific implementation of the Combination Training Method according to the unique demands of athletics. This tailored approach was expected to improve the speed and endurance quality of students selected for athletics, using a systematic application of various scientific training Combinations in the field of sports education and training (Reilly, 2018). The research seek to provide a comprehensive evaluation and verification of the Combination Training Method's effectiveness, thereby offering new insights and strategies for improving athletic training programs.

This was very conducive to enriching the overall training method theory system of athletics, and providing scientific theoretical references for coaches to guide the training of students who were specially selected for athletics in the future. In this research, for the need to improve the quality of speed and endurance, the development of a targeted Combination of training methods of quality training; for track and field events, the Combination of training method contained a quantitative research of training single, explored practical, effective, targeted Combination of training methods, and effectively improve the level of speed and endurance of track and field students selected (Lee & Yoon, 2020).

Research Questions

1. Was there an improvement in speed endurance level training in Freshmen after the implementation of the Combination Training Method?
2. Would the Freshman students be satisfied with the Combination Training Method in Physical Education?

Literature Review

Studies Related to The Combination Training Method

The mono-training method does not mean that the athlete only uses a single item of practice in training, it was the development of only one indicator of physical fitness in a single training session or over a period of time, and the different training methods used for this physical fitness were not fully understood to be for the sole purpose of developing a single indicator, but rather for the purpose of the athlete's continuous training and development of this quality (Kormos & Csizer, 2014).

This training method was characterized by the scientific and reasonable arrangement of several relevant and effective single training methods together, complementary advantages, the proportion of training intensity size distribution should be appropriate, as well as a reasonable arrangement of rest time, so as to allow athletes to comprehensively and reasonably achieve the desired results.

Combined training was an organic combination of various training methods, based on reasonable and effective training methods, the interval between two groups of training to provide metabolic recovery was the basis of the training program, the training means to be selected depending on the situation, in order to achieve the overall effect of the training effect of the scientific training methods. and other two scholars in the study of short and medium-distance events in the theory of the strength training of the outstanding athletes found that another feature of the combined training methods In the use of the Combination Training Method, one of the single training intensity was not large, the intensity was based on the overall planning of a reasonable distribution, was arranged according to a reasonable proportion of the combination of the overall intensity of the medium intensity and higher intensity, in line with the intensity of the competition demand.

Benefits of The Combination Training Method

Combination training, often referred to as concurrent training, involves the integration of both strength and endurance exercises within the same training regimen. This method offers a variety of benefits, making it a popular choice for athletes and fitness enthusiasts alike. Here were some key benefits of combination training:

Improved Overall Fitness. Combination training enhances both aerobic and anaerobic capacities. By incorporating both endurance and strength elements, individuals could achieve a well-rounded fitness profile, improving cardiovascular health, muscle strength, and endurance simultaneously.

Enhanced Muscle Strength and Cardiovascular Health. Regular strength training increases muscle mass and strength, while endurance exercises improve heart and lung capacity. When combined, these benefits lead to improved heart health, better circulation, and stronger muscles, providing a comprehensive approach to fitness.

Efficient Use of Time. For individuals with limited time for exercise, combination training allows them to maximize their workouts by addressing multiple fitness goals in a single session. This efficiency could lead to better adherence to fitness routines and more consistent progress.

Increased Caloric Burn and Weight Management. Engaging in both types of exercise could increase the total number of calories burned during a workout. Strength training boosts the metabolic rate by increasing muscle mass, while endurance exercises burn a significant number of calories, contributing to effective weight management and fat loss.

Reduced Risk of Injury. Balancing different types of exercise could reduce the risk of overuse injuries associated with repetitive motion. Strength training could fortify muscles and connective tissues, making them more resilient to the stresses of endurance exercises.

Improved Metabolic Health. Combination training had been shown to improve various markers of metabolic health, including insulin sensitivity and lipid profiles. This could reduce the risk of developing chronic diseases such as type 2 diabetes and cardiovascular disease.

Enhanced Athletic Performance. For athletes, integrating both strength and endurance training could lead to improved performance in their specific sports. Strength training could enhance power and speed, while endurance training could improve stamina and recovery.

Greater Flexibility in Training. Combination training allows for a more varied and enjoyable exercise routine. This variety could keep workouts interesting and engaging, reducing the likelihood of boredom and burnout.

Balanced Body Composition. Combining strength and endurance exercises helps in achieving a balanced body composition. While strength training promotes muscle growth, endurance training helps in reducing excess body fat, leading to a leaner physique.

Cognitive Benefits. Regular exercise, particularly when combining different types, had been linked to improved cognitive function and mental health. The varied demands of combination training could stimulate brain function and help reduce symptoms of anxiety and depression.

Research Methodology

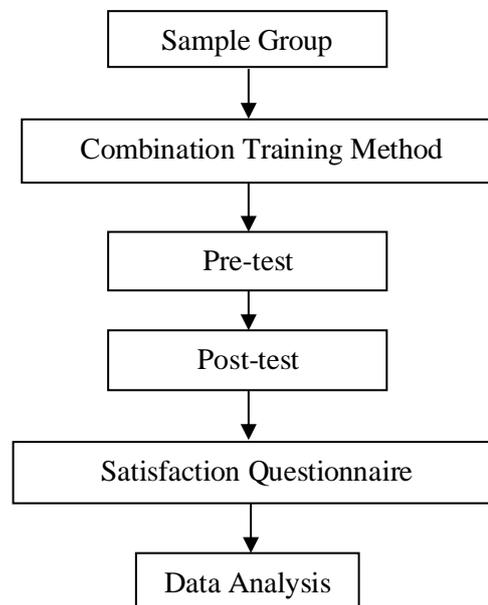


Figure 1: Research design of the research

Collecting data instruments were the equipment used in research. In order to collect information for the research topics in this research, lesson plans, achievement tests, and a satisfaction questionnaire were utilized. The sample group consisted of 30 students during the duration of the research. The next section discusses the research instruments that were utilized in this research to accomplish the goals.

The researcher designed the Likert Schle questionnaire with the scale including 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree, respectively.

Population and Sample

The two best majors at the H College of Physical Education and Sports Science were Physical Education and Sports Training. Both majors were "first-class" undergraduate construction sites in Hunan Province. The research's target population comprised 613 students ranging in year from freshman to senior, with roughly 121 of them being freshmen.

By using a clustered random sampling technique, the sample group consisted of a group of 30 students were all male Freshmen students, their basic information: age, height, weight, years of exercise were as followed:

Table 1: Basic Information

Name	Age	Heigh(cm)	Weight(kg)	Years of exercise
NO.1	19	176	68	5
NO.2	20	176	70	4
NO.3	20	172	60	5
NO.4	20	183	75	4
NO.5	20	178	71	5
NO.6	18	173	70	3
NO.7	20	177	68	5
NO.8	20	182	80	5
NO.9	20	175	67	5
NO.10	21	180	78	5
NO.11	19	187	73	4
NO.12	20	183	72	5
NO.13	19	174	67	4
NO.14	21	178	70	5
NO.15	21	178	67	5
NO.16	19	176	71	4
NO.17	19	187	78	4
NO.18	20	183	70	5
NO.19	19	174	67	4
NO.20	20	179	70	3

Table 1: Basic Information

Name	Age	Heigh(cm)	Weight(kg)	Years of exercise
NO.21	20	187	71	5
NO.22	18	178	70	4
NO.23	20	173	68	5
NO.24	20	183	80	4
NO.25	20	174	67	5
NO.26	21	178	78	5
NO.27	19	178	73	4
NO.28	20	176	71	4
NO.29	18	173	70	3
NO.30	20	177	68	3
\bar{X}	19.75	178.55	70.6	4.45

Data Analysis

The researcher applied two different methods to analyze the data, each aligned with the two research objectives. The researcher utilized quantitative data derived from pre-test and post-test scores, as well as the results of the questionnaire to assess student performance in the area of speed endurance before and after training using the combination training method. SPSS was utilized to analyze the data and assess the improvement in the students' physical performance.

Table 2: The Range of Mean Score Interpretation

Mean Score Range	Perceptions Level
4.21-5.00	Highest
3.41-4.20	High
2.61-3.40	Moderate
1.81-2.60	Low
1.00-1.80	Lowest

Source: Moidunny, 2009

Research Finding

The fundamental requirement of the training of trainees using the combination training method was to be able to improve the trainee's speed and endurance quality in a short period of time. In the course of each training, in principle, the development of the athlete's various special abilities should be the main focus, and the training methods and the amount of loads set were all designed to satisfy the special abilities. Specialized deepening emphasizes that the muscular system and the motor nervous system could be highly coordinated, as well as could make reasonable use of the elastic potential energy of muscle fibers, and with the trainee highly skilled technical movement system. But from the motor nervous system and muscle system and so on many different aspects to analyze, they would go to ask for time, which makes the trainee using a combination of training methods must follow the process of

systematic science, but also had to take into account the principle of physiological adaptive mechanism and the principle of human body recovery mechanism, to sum up the above athletes followed the principle of deepening the specialization and at the same time followed the principle of integration and balancing.

Table 3: Blood Lactate Test Data

Name	Pre-test blood lactate	Post-test blood lactate	Different
NO.1	16.79	14.78	2.01
NO.2	13.93	12.26	1.67
NO.3	14.84	13.06	1.78
NO.4	13.41	11.80	1.61
NO.5	13.3	11.70	1.6
NO.6	15.35	13.51	1.84
NO.7	16.6	14.61	1.99
NO.8	13.33	11.73	1.60
NO.9	11.66	10.26	1.40
NO.10	12.8	11.26	1.54
NO.11	13.97	12.29	1.68
NO.12	14.79	13.02	1.77
NO.13	13.48	11.86	1.62
NO.14	15.27	13.44	1.83
NO.15	14.88	13.09	1.79
NO.16	13.12	11.55	1.57
NO.17	11.47	10.09	1.38
NO.18	12.27	10.80	1.47
NO.19	13.97	12.29	1.68
NO.20	13.57	11.94	1.63
NO.21	12.61	11.10	1.51
NO.22	13.12	11.55	1.57
NO.23	13.99	12.31	1.68
NO.24	13.87	12.21	1.66
NO.25	11.28	9.93	1.35
NO.26	10.87	9.57	1.30
NO.27	11.48	10.10	1.38
NO.28	9.57	8.42	1.15
NO.29	13.57	11.94	1.63
NO.30	14.28	12.57	1.71
\bar{x}	13.45	11.83	1.61

Table 4: Heart Rate Indicator Test Data

Name	Pre-test heart rate	Post-test heart rate	Different
NO.1	179	158	21
NO.2	160	141	19
NO.3	175	154	21
NO.4	168	148	20
NO.5	184	162	22
NO.6	169	149	20
NO.7	156	137	19
NO.8	180	158	22
NO.9	180	158	22
NO.10	171	150	21
NO.11	176	155	21
NO.12	179	158	21
NO.13	169	149	20
NO.14	168	148	20
NO.15	168	148	20
NO.16	166	146	20
NO.17	163	143	20
NO.18	167	147	20
NO.19	175	154	21
NO.20	162	143	19
NO.21	156	137	19
NO.22	160	141	19
NO.23	168	148	20
NO.24	180	158	22
NO.25	169	149	20
NO.26	165	145	20
NO.27	168	148	20
NO.28	167	147	20
NO.29	166	146	20
NO.30	158	139	19
\bar{X}	169	149	20

Table 5: Lower Extremity Anaerobic Power Index Test Data

Name	Pre-test lower extremity anaerobic power index	Post-test lower extremity anaerobic power index	Different
NO.1	9.69	8.53	1.16
NO.2	10.9	9.59	1.31
NO.3	11.91	10.48	1.43
NO.4	10.44	9.19	1.25
NO.5	13.94	12.27	1.67
NO.6	9.42	8.29	1.13
NO.7	12.88	11.33	1.55
NO.8	9.87	8.69	1.18
NO.9	9.96	8.76	1.20
NO.10	13.12	11.55	1.57
NO.11	12.24	10.77	1.47
NO.12	11.37	10.01	1.36
NO.13	12.19	10.73	1.46
NO.14	10.72	9.43	1.29
NO.15	11.77	10.36	1.41
NO.16	12.28	10.81	1.47
NO.17	12.57	11.06	1.51
NO.18	10.3	9.06	1.24
NO.19	11.49	10.11	1.38
NO.20	11.18	9.84	1.34
NO.21	11.48	10.10	1.38
NO.22	11.93	10.50	1.43
NO.23	10.17	8.95	1.22
NO.24	9.64	8.48	1.16
NO.25	8.36	7.36	1.00
NO.26	9.6	8.45	1.15
NO.27	9.28	8.17	1.11
NO.28	9.59	8.44	1.15
NO.29	10.17	8.95	1.22
NO.30	10.11	8.90	2.21
\bar{X}	10.95	9.65	1.36

Table 6: Upper Extremity Anaerobic Power Index Test Data

Name	Pre-test upper extremity anaerobic power index	Post-test upper extremity anaerobic power index	Different
NO.1	650	572	78
NO.2	472	415	57
NO.3	472	415	57
NO.4	605	532	73
NO.5	497	437	60
NO.6	428	377	51
NO.7	575	506	69
NO.8	422	371	51
NO.9	561	494	67
NO.10	577	508	69
NO.11	490	431	59
NO.12	654	576	78
NO.13	678	597	81
NO.14	508	447	61
NO.15	594	523	71
NO.16	432	380	52
NO.17	487	429	58
NO.18	432	380	52
NO.19	534	470	64
NO.20	585	515	70
NO.21	469	413	56
NO.22	487	429	58
NO.23	472	415	57
NO.24	605	532	73
NO.25	497	437	60
NO.26	428	377	51
NO.27	575	506	69
NO.28	422	371	51
NO.29	561	494	67
NO.30	469	413	56
\bar{x}	521	459	63

Table 7: Pre-Test Athletics Specialized Test Data

Name	100m	800m	1500m	Triple jump	Javelin	Shot-put
NO.1	12.26	2.19	4.43	12.25	35	10.15
NO.2	12.35	2.18	4.35	12.03	30	9.53
NO.3	12.09	2.19	4.38	12.21	33	9.32
NO.4	12.42	2.23	4.35	11.95	28	9.13
NO.5	12.26	2.21	4.41	12.33	26	10.15
NO.6	12.26	2.16	4.37	12.25	31	10.18
NO.7	12.45	2.16	4.38	12.08	31	9.57
NO.8	12.31	2.23	4.29	12.18	27	10.35
NO.9	12.03	2.16	4.35	12.03	28	11.05
NO.10	12.09	2.19	4.38	12.21	33	9.32
NO.11	12.42	2.23	4.35	11.95	28	9.13
NO.12	12.43	2.19	4.39	12.26	31	10.15
NO.13	12.26	2.22	4.38	12.26	31	9.58
NO.14	12.42	2.23	4.35	11.95	28	9.13
NO.15	12.26	2.22	4.28	11.88	30	10.15
NO.16	12.31	2.17	4.46	12.18	27	9.32
NO.17	12.27	2.18	4.42	12.25	26	10.15
NO.18	12.35	2.19	4.35	11.95	31	10.18
NO.19	12.26	2.18	4.38	12.26	31	9.54
NO.20	12.09	2.13	4.41	12.31	29	10.35
NO.21	12.26	2.19	4.35	12.25	28	10.32
NO.22	12.42	2.23	4.38	12.26	31	10.15
NO.23	12.42	2.23	4.35	12.03	28	11.05
NO.24	12.26	2.22	4.28	12.21	33	9.32
NO.25	12.31	2.17	4.46	11.95	28	9.13
NO.26	12.43	2.19	4.35	12.26	31	9.58
NO.27	12.26	2.22	4.28	12.03	28	11.05
NO.28	12.42	2.23	4.46	11.95	28	9.13
NO.29	12.26	2.22	4.41	11.88	30	10.15
NO.30	12.26	2.22	4.38	11.95	28	9.13
\bar{X}	12.30	2.20	4.37	12.12	29	9.85

Table 8: Post-Test Athletics Specialized Test Data

Name	100m	800m	1500m	Triple jump	Javelin	Shot-put
NO.1	11.87	2.12	4.29	12.40	36	10.53
NO.2	11.95	2.11	4.21	12.18	31	9.89
NO.3	11.70	2.12	4.24	12.36	34	9.67
NO.4	12.02	2.16	4.21	12.10	29	9.48
NO.5	11.87	2.14	4.27	12.48	27	10.53
NO.6	11.87	2.09	4.23	12.40	32	10.57
NO.7	12.05	2.09	4.24	12.23	32	9.93
NO.8	11.91	2.16	4.15	12.33	28	10.74
NO.9	11.64	2.09	4.21	12.18	29	11.47
NO.10	11.70	2.12	4.24	12.36	34	9.67
NO.11	12.02	2.16	4.21	12.10	29	9.48
NO.12	12.03	2.12	4.25	12.41	32	10.53
NO.13	11.87	2.15	4.24	12.41	32	9.94
NO.14	12.02	2.16	4.21	12.10	29	9.48
NO.15	11.87	2.15	4.14	12.03	31	10.53
NO.16	11.91	2.10	4.32	12.33	28	9.67
NO.17	11.87	2.11	4.28	12.40	27	10.53
NO.18	11.95	2.12	4.21	12.10	32	10.57
NO.19	11.87	2.11	4.24	12.41	32	9.90
NO.20	11.70	2.06	4.27	12.46	30	10.74
NO.21	11.87	2.12	4.21	12.40	29	10.71
NO.22	12.02	2.16	4.24	12.41	32	10.53
NO.23	12.02	2.16	4.21	12.18	29	11.47
NO.24	11.87	2.15	4.14	12.36	34	9.67
NO.25	11.91	2.10	4.32	12.10	29	9.48
NO.26	12.03	2.12	4.21	12.41	32	9.94
NO.27	11.87	2.15	4.14	12.18	29	11.47
NO.28	12.02	2.16	4.32	12.10	29	9.48
NO.29	11.87	2.15	4.27	12.03	31	10.53
NO.30	11.87	2.15	4.24	12.10	29	9.48
\bar{X}	11.90	2.13	4.23	12.27	30	10.22

Collect and organize the experimental data of the experimental subjects, and analyze and process the experimental data by using SPSS 27.0 and Excel. In the process of pre- and post-testing of the experiment, the obtained students' index test scores were effectively

Table 9: Test Scores of Blood Lactate Indicators

Blood Lactate Indicators	Pre-test		Post-test	
	\bar{X}	S.D.	\bar{X}	S.D.
Immediate post-exercise blood lactate values	14.41	1.92	14.21	1.81
Blood lactate value after exercise in 15-min	12.80	2.32	12.71	2.18

counted and analyzed by means of SPSS27.0 application calculation and tabulation, etc. The data were expressed as mean + standard deviation (\bar{X} + S.D.).

The blood lactate related indexes were selected by reviewing the information related to speed endurance, combining the opinions of coaches and experts, and taking into account the actual situation, and finally picking out the values of blood lactate concentration in the immediate post-exercise period, and the value of blood lactate concentration in the 15-min post-exercise period.

Table 10: Test Scores of Heart Rate Indicators

Heart Rate Indicators	Pre-test		Post-test	
	\bar{X}	S.D.	\bar{X}	S.D.
Maximum heart rate	172	8	171	8
Heart rate after exercise in 3-min	140	8	140	7

The heart rate related indexes were selected by reviewing the information related to speed endurance, combining the opinions of coaches and experts with the actual situation, and finally picking out the values of the maximum heart rate and the 3-minute post-exercise heart rate.

Table 11: Test Scores of Upper Limb Anaerobic Power

Upper Limb Anaerobic Power	Pre-test		Post-test	
	\bar{X}	S.D.	\bar{X}	S.D.
Maximum Anaerobic Power	525.5	77.8	535.4	72.1
Average Anaerobic Power	277.4	20.0	275.8	19.4

The anaerobic power related indexes were selected by reviewing the information related to speed endurance and combining the opinions of coaches and experts, and finally picking out the values of maximal power of the upper limb, average power of the upper limb, maximal power of the lower limb, and average power of the lower limb.

Table 12: Test Scores of Upper Limb Anaerobic Power

Lower Limb Anaerobic Power	Pre-test		Post-test	
	\bar{X}	S.D.	\bar{X}	S.D.
Maximum Anaerobic Power	11.01	1.39	11.12	0.72
Average Anaerobic Power	8.46	0.77	8.52	0.85

In conclusion, according to Pre-test and Post-test, there was no significant difference between the participants in the test in terms of physical indicators and sports performance, indicating that they belonged to the same level and met the basic requirements of the experiment.

At the beginning of each training session, the subjects should arrive at the training ground 15 minutes in advance to warm up. In the training process, there were two auxiliary staff to assist in the training, and the training movements and contents were strictly controlled and responsible to ensure that the majority of the players could successfully complete the training contents.

Thinking from a psychological point of view, "interest was a psychological characteristic of human beings when they acquire knowledge of a certain kind and learn, and interest was the best tutor for students". For physical education, interest was "a signpost to guide people to engage in physical exercise, but also for students to be strong and healthy to better engage in the foundation of learning, when students had a strong interest in a subject, they would certainly be very serious and hard to learn this course until the subject had greater progress, the development of interest was a process, mainly divided into three stages: Interest development was a process, which was divided into three stages: finding interesting, generating interest, and tendency to interest, therefore, in the sprinting course, teachers should first let students feel interesting, and then stimulate their interest in learning, and in the process of cultivating interest in learning, they could improve the students' motivation to learn and independent initiative, and through the learning process, the students' attitude towards learning also changes from I could learn, to I would learn". Whether the teaching could be

successful, the teaching effect was good or bad, and students' interest in learning had a close correlation. Therefore, students' interest in learning was especially important in this experiment. The learning interest of the two groups of students in the combination training method pre and post-test was shown in the table below:

Table 13: Statistical of Students' Learning Interest

Items	Scores					X ²
	5	4	3	2	1	
	Sample Number					
I liked the learning process of the combination training method.	20	8	2	0	0	26.323
I was interested in the results of the combination training method.	20	10	0	0	0	5.719
The combination training method improved my physical fitness.	23	7	0	0	0	9.769
I took the initiative to ask questions during the learning process of the combination training method.	20	9	1	0	0	3.071
I consulted information and research problems in the process of learning the combination training method.	21	9	0	0	0	24.45

“The ability to discover, analyze and solve problems was a comprehensive ability, and its core objective was to cultivate students' ability of creative thinking, specifically including the ability of experimental investigation and observation, the ability of experimental investigation and research and the ability to ask questions, the ability to use the scientific method to solve practical problems, etc., people want to solve a problem, then they need to analyze and solve the problem through the reasons for the problem. Explore, think about the process of the problem occurs, find the root cause to discover the problem, so as to analyze and solve the problem, in this process, respectively, using the human ability to discover the problem, analyze the problem and solve the problem, and in the solution of sprinting problems, it was the same”. When teachers use the combination teaching method to teach, they had to “let students go to active problem solving, in a freer learning environment, students could take the initiative to discover problems, analyze problems, explore and communicate problems, find out the answers by searching for relevant teaching materials and contents, so as to solve the problems”.

Table 14: Statistical of Students' Ability to Discover, Analyze, And Solve Problems

Items	Scores					X ²
	5	4	3	2	1	
	Sample Number					
I asked my teacher for guidance in solving problems in the process of learning the combination training method.	22	8	0	0	0	26.458
I would take the initiative to research after class to solve the unsolved problems in class.	19	10	1	0	0	11.257
I could use what I had learned to solve problems in the process of learning the combination training method.	21	9	0	0	0	18.600
I could find my own mistakes and try to solve them in the process of learning the combination training method.	23	7	0	0	0	15.434
I could take the initiative to make plans in the process of learning the combination training method.	20	9	1	0	0	12.972
I could reflect on the learning process in the combination training method learning process, and summarize the learning experience.	23	7	0	0	0	22.125

The reasons were as follows: students' ability to discover, analyze and solve problems was cultivated through continuous thinking in learning, and the combination teaching method creates a thinking situation for students by creating a situation, so that students could continuously think in the teaching situation, improve their ability to discover, analyze and solve problems in the situation, and express their own views on problem solving in a group, and then combine with other people in the group to solve problems. Through the group, express their views on problem solving, and then combined with the views and suggestions of other people in the group, and finally find a solution to the problem, in this teaching process, the students through the teacher to create a scenario to find problems, problem solving, in the scenario through the framework of their own knowledge to find problems, problem solving, and finally through the group way to the problem to explore and exchange". In teaching, the use of video uploaded to the microblogging group, each person could download and watch their own or others' mastery of technical movements, the second class in the classroom when the group discussion and exchange, report on their own analysis of the situation, and put forward solutions.

Physical education was "a discipline with strong practicality, students majoring in physical education would have some unique personality traits compatible with this discipline due to their long-term engagement in physical education. Compared with students of other majors, students majoring in physical education were extroverted, cheerful, sociable, and had strong teamwork and collaboration ability, and students majoring in physical education would usually go to the sports games and related events when they were held. would go to participate in them, and they communicate and compete with each other either as opponents or teammates, and the experiences of these competitions also paint a strong picture of their character traits".

Table 15: Statistical of Students' Sense of Cooperation and Communication

Items	Scores					X ²
	5	4	3	2	1	
	Sample Number					
I was very willing to share the joy of harvesting with my classmates in the learning process of the combination training method.	20	9	1	0	0	18.318
In the group discussion, I was serious and actively participate in the discussion to increase the spirit of cooperation among classmates.	22	8	0	0	0	6.857
In group discussions, I normally actively communicated with my classmates.	24	5	1	0	0	10.522
I liked to communicate with my classmates in the research of combination training method.	19	11	0	0	0	11.779
I normally shared my views on the combination training method with my teachers and classmates.	21	8	1	0	0	5.567
I would do my best to win in the group competition of the combination training method.	25	5	5	0	0	21.258
The combination training method helped me to develop my own training level.	24	6	0	0	0	5.69

It could be seen that: of the seven questions in the questionnaire on students' cooperative communication and innovation ability, the analyzed \bar{X} of questions 1, 3, 4 and 6 were all less than 4.50, which indicates that there was a significant difference and statistically significant; the analyzed \bar{X} of questions 2, 5 and 7 were all greater than 5.30, which makes the difference non-significant and needs to be further analyzed. It shows that the combination teaching method was effective in improving students' ability in cooperative communication and creativity.

“Knowledge application ability was relative to both knowledge production and innovation ability and skill application ability. Knowledge production and innovation ability was the main ability to carry out cognitive practice, the core of which was based on the problem orientation of knowledge logic, solving the cognitive problems such as faults, gaps and updating in the chain of knowledge, while knowledge application and innovation ability was based on professional knowledge and skills, able to creatively solve complex and changing practical problems. On the basis of professional knowledge and skills, it was the ability to creatively solve complex and changing practical problems. Physical education belongs to the activity course, which was a subject with the basic attributes of activity course with the basic features of physical practice, and physical education had the characteristics of strong practicability, and it was a comprehensive course form combining the theory and practice”.

Table 16: Statistical of Students' Ability of Specialized Knowledge and Apply It

Items	Scores					Items
	5	4	3	2	1	
	Sample Number					
After the training of the combination training method, my physical fitness was improved.	29	1	0	0	0	9.634
My physical fitness was improved through the combination training method.	22	8	0	0	0	12.398
My training endurance was improved through the combination training method.	25	5	0	0	0	15.023
My running speed was improved through the combination training method.	23	7	0	0	0	10.482
My heart rate level was increased as a result of the combination training method.	22	8	0	0	0	9.725
My ability to study endurance was improved as a result of the combination training method.	23	7	0	0	0	21.861
My ability to study speed was improved through a combination of training methods.	26	4	0	0	0	18.872
After training with the Combined Training Method, my study of endurance was improved.	23	7	0	0	0	15.328
My ability to study speed was improved as a result of the combination training method.	27	3	0	0	0	17.571

It could be seen that: in the nine topics of the questionnaire on the application of specialized knowledge, all the test results had a \bar{X} less than 5.00, indicating a significant difference and statistical significance. It shows that the combination training teaching method had a good effect on improving students' ability to apply specialized knowledge. The reasons were analyzed as follows.

According to the classroom teaching process of the combination training teaching method, the content to be studied was assigned to the students in the form of posing questions, and the students collected relevant information outside the classroom and put forward the corresponding requirements (such as consulting the reference books related to the study) the next day in class to discuss the content of the study in small groups, and finally check the effect of the student's discussion by the following way: arranging the classroom time for each group to Show the results, followed by students and teacher questions and discussion, and finally the teacher commented on the explanation, this mode of learning greatly exercise the skills of students to collect information, but also cultivate the students to summarize, summarize the ability, in the period of the display, the questions, discussion and to the teacher's comments, could prompt the students to recognize their own strengths and weaknesses, and to further improve their practical ability.

Discussion/Conclusion

The combination training method significantly improves the blood lactate clearance rate, heart rate recovery, anaerobic work capacity, and overall speed endurance among athletes, especially track and field students. This method involves structured phases: initial general endurance, followed by a phase focused on enhancing speed endurance, and culminating in a maintenance stage. Within these stages, different training techniques are applied—short-distance interval training targets lactate tolerance, while long-distance repetitions support both lactate and aerobic energy systems. The strategic use of aerobic and anaerobic exercises supports quicker heart rate recovery, improved endurance, and faster lactate elimination, reducing post-training fatigue.

Studies confirm that combination training increases both upper and lower body anaerobic power and allows athletes to sustain high-intensity activities longer. After a four-week experimental period, students showed statistically significant improvements in blood lactate clearance rates and heart rate recovery compared to a control group. Heart rate metrics, including recovery rate and maximal heart rate reduction, indicated better physiological adaptations, likely due to increased parasympathetic activity.

Furthermore, combination training is advantageous for the 800-meter race and other speed-endurance events, which demand both speed and endurance qualities. This training program aligns with the physiological needs of athletes for speed endurance, effectively improving both aerobic and anaerobic capacities through targeted exercises, such as high-intensity interval running and strength-enhancing circuits. However, limitations in the study (e.g., sample size and geographic scope) suggest that more extensive research could provide a comprehensive understanding of its effects across varied demographics and athletic disciplines.

References

- Cheng, Y., & Tsai, C. (2018). Effects of combined physical training on physical and mental health in adolescents. *International Journal of Sport and Exercise Psychology*, 16(3), 225-237.
- Fiorenza, M., Lemminger, A. K., Marker, M., Eibye, K., Iaia, F. M., Bangsbo, J., & Hostrup, M. (2019). High-intensity exercise training enhances mitochondrial oxidative phosphorylation efficiency in a temperature-dependent manner in human skeletal muscle: Implications for exercise performance. *FASEB Journal*, 33(8), 8976–8989. <https://doi.org/10.1096/fj.201900073R>
- Haugen, T., Seiler, S., Sandbakk, Ø., & Tønnessen, E. (2019). The training and development of elite sprint performance: An integration of scientific and best practice literature. *Sports Medicine - Open*, 5(1), 44. <https://doi.org/10.1186/s40798-019-0221-0>
- Kormos, J., & Csizer, K. (2014). The interaction of motivation, self-regulatory strategies, and autonomous learning behavior in different learner groups. *TESOL Quarterly*, 48(2), 275-299.
- Lee, D., & Yoon, S. N. (2020). Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. *International Journal of Environmental Research and Public Health*, 18, Article No. 271. <https://doi.org/10.3390/ijerph18010271>

- Ramos, G. P., Nakamura, F. Y., Penna, E. M., Mendes, T. T., Mahseredjian, F., Lima, A. M., Garcia, E. S., Prado, L. S., & Coimbra, C. C. (2021). Comparison of physical fitness and performance characteristics between professional and amateur athletes. *The Journal of Strength & Conditioning Research*, 35(8), 2302–2308.
<https://doi.org/10.1519/JSC.0000000000003071>
- Reilly, J. (2018). Physical education and cardiovascular fitness in adolescents. *Journal of Adolescent Health*, 63(1), 44-49.
-