DEVELOPMENT OF PHYSICAL TRAINING PROGRAM (COURSE) OF CHINA BEIJING LONGTAN MIDDLE SCHOOL BASED ON CROSS FIT

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การพัฒนาโปรแกรมการฝึกสมรรถภาพทางกาย (หลักสูตร) ของโรงเรียนมัธยมหลงถานในกรุงปักกิ่ง ประเทศจีน

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BY

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HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF EDUCATION IN EDUCATIONAL TECHNOLOGY AT SRINAKHARINWIROT UNIVERSITY

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The research objectives are as follows: (1) To develop physical training courses for middle school students based on Cross Fit training to enhance students' physical fitness. (2) To study the effect of using physical training courses to improve students' physical fitness. The research utilized both experimental and descriptive methodologies with a 16-week teaching experiment conducted at Beijing Longtan Middle School. Two classes were randomly selected as experimental and control groups, with 44 students in each group (23 boys and 21 girls per group). The research instruments included: (1) Cross Fit-based Middle School Physical Training Course Students' Learning Satisfaction Scale; (2) School Smart Playground Platform for collecting physical health indicator data; and (3) Swish Sports Intelligent System for real-time monitoring. The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) was employed for curriculum development. Statistical analysis was conducted using SPSS 23.0, including descriptive statistics, independent sample t-tests, and paired sample t-tests to analyze changes in students' physical health indicators across three dimensions: body shape, physical function, and physical fitness. The research results show that: (1) Based on ADDIE model, the physical training curriculum of middle school based on Cross Fit is developed from five aspects: analysis, design, development, implementation and evaluation.(2)In the experimental group compared to the control group. In terms of physical fitness indicators, Cross Fit training demonstrated significant positive effects on speed quality (50-meter run times improved significantly, $p<0.05$), flexibility quality (sitting body flexion scores increased significantly, $p<0.01$), and strength quality (pull-ups, standing long jump, and sit-ups all showed significant improvements, $p<0.01$). However, no significant differences were observed between groups regarding body shape indicators (height, weight, BMI) and body function (vital capacity), nor in endurance quality (1000m for boys, 800m for girls). The student satisfaction analysis showed an overall satisfaction score of 3.425 (on a 5-point scale), indicating moderate satisfaction. Students expressed above-average satisfaction with teacher teaching level (3.635), course content and quality (3.574), and course resources and environment (3.544), but showed lower satisfaction with management and support services (2.753). The study concluded that Cross Fit-based physical training courses significantly enhanced middle school students' speed, flexibility, and strength qualities, though improvements in body composition and cardiopulmonary endurance require longer intervention periods.

Keyword : Cross Fit, Middle school physical training courses, Physical health

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The writing ends here. At the completion of this paper, my graduate career is also coming to an end. Looking back on this fulfilling and unforgettable time, my heart is filled with gratitude, and many words flood into my heart.

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Paper is short, love is long. I only hope to turn this gratitude into motivation and forge ahead on the path of future life.

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CHAPTER 1
INTRODUCTION

1. Background

In 2021, the Ministry of Education of China launched a survey on the physical health of domestic students aged 6-22, and on September 3 of that year, the results of the Eighth National Survey on Students' Physical Fitness and Health were published. The survey results showed that the excellent rate of this group's physical health reached the standard was 23.8%, and it was mainly concentrated in the coastal areas with high economic development level in the east (Yang, 2025). In recent years, the state attaches great importance to students' physical health. In 2014, the Ministry of Education formulated and promulgated a unified standard for students' physical health management, namely "National Students' Physical Health Standard". Since then, students' physical health work has become more and more standardized, and the excellent rate of students reaching the standard has been significantly improved. After five years of hard work, the physical health level of students of all ages has improved compared with the results of the last survey. Statistics show that students aged 13 to 15 have increased by 5.1%, students aged 16 to 18 have increased by 1.8%, and students aged 19 to 22 have increased by 0.2%. It can be seen that among the three age groups, junior high school students aged 13 to 15 have the greatest improvement (Hao, 2025). This survey includes four items: the body shape items mainly include height, weight, chest circumference, vital capacity and other indicators, and the survey results show that this indicator has developed well, with junior high school students developing the fastest; In terms of physical fitness, students' strength, speed, endurance and flexibility have developed greatly, with primary and secondary school students developing the fastest; In terms of health status, the health level of students of all ages has improved significantly, and the malnutrition rate has decreased significantly. However, this survey also found that students have serious vision problems and overweight problems. The myopia rate and obesity rate of students in all regions have been greatly improved, and

the quality of students' grip strength has dropped significantly. The physical health level of students outside the southeast coast needs to be further improved.

In addition to ensuring adequate nutrition, reasonable exercise is also one of the important channels to improve students' physical health. Physical education in middle schools is an important position for students to master scientific exercise methods, develop exercise habits and form good psychological quality, which has an important impact on students' future development. With regard to physical education in primary and secondary schools, "Physical Education and Health Curriculum Standards for Compulsory Education (2022 Edition)" clearly stipulates the number of class hours, course content and teaching suggestions, and further emphasizes the important position of physical education in the compulsory education stage. Judging from the proportion of class hours, it is required that the total class hours of physical education courses must account for 10%-11% of the total class hours, which has obviously exceeded the class hours ratio of English subjects (Y. Lin, 2025). In terms of course content, the new curriculum standard clearly stipulates that the content of physical education and health course in compulsory education stage should include five parts, such as physical fitness. Physical fitness courses are mainly aimed at improving students' physical health. Through scientific training, students' strength, speed, endurance, balance and explosiveness are gradually improved, so that students' physical movements are more and more sensitive and coordinated. According to the relevant investigation, although a certain proportion of physical education and health courses have been set up in middle school physical education according to the requirements of the new curriculum standard, there are still some problems in the course content setting, with emphasis on theoretical knowledge and exam-oriented training. The role of physical fitness courses in improving students' physical health level has not been brought into play, which has affected the improvement of middle school students' physical health level to some extent. Therefore, it is necessary to study the physical training courses in the physical education curriculum system of middle schools in China, and explore ways to develop and design physical training courses.

Because of the traditional concept of exam-oriented education for a long time, some compulsory education schools only take theoretical knowledge as the evaluation content when evaluating students' academic performance in physical education and health courses, ignoring the evaluation of students' physical fitness indicators, and the evaluation method is unscientific. Students' long-term adherence to a single system of physical exercise will also improve their physical ability, but it will not promote the overall improvement of their physical fitness and improve their physical health. Middle school students' physical development is fast, and if they can't accept the guidance of sports science at this stage, it may affect their life. Therefore, it is necessary to set up a scientific and reasonable training system for middle school students to comprehensively improve their physical fitness and lay a solid foundation for their health. The Cross Fit training technology proposed by Greg Glassman can be introduced to solve the problems existing in the curriculum of physical education and health in middle schools. Cross Fit training technology aims at improving the comprehensive quality of trainers, and divides individual physical qualities into ten physical qualities, instead of implementing a single special training for trainers, which is highly consistent with the requirements of the new curriculum standard for physical fitness courses. However, at present, there is no middle school in China to develop middle school physical training courses under the guidance of Cross Fit training technology, and the research on the application of Cross Fit training technology to the improvement of middle school students' physical health level is relatively limited. Accordingly, this study chooses Beijing Longtan Middle School as the research object, and studies the process and function of developing physical training courses with Cross Fit training, with a view to improving the physical health status of middle school students in China and improving their physical health level.

2. Significance of the Study

Since human society entered the 21st century, countries all over the world have paid close attention to students' physical health and physical education and health

education, and all of them regard improving students' physical health as one of their important development goals. Middle school students' physical and psychological development is extremely rapid. Whether they can receive scientific and efficient physical training at this stage will directly affect the students' physical health level and will be related to their lifelong development. The research in this paper has outstanding significance in both theoretical construction and practical guidance.

From the theoretical point of view, the research results of physical training curriculum development in middle schools at home and abroad are very limited at this stage. This paper studies the physical training curriculum development in middle schools under the guidance of Cross Fit training theory, which can enrich the research theory of physical training curriculum development in middle schools and further improve the relevant theoretical system. From the perspective of practical significance, this study rationally adjusted the Cross Fit training system centering on the construction of middle school physical education and health curriculum, and completed the development of middle school physical training curriculum, tested students' physical fitness indicators before and after the experiment, analyzed the role and existing problems of middle school physical training curriculum under the guidance of Cross Fit training technology in improving students' physical health level, and put forward solutions to the problems, so as to provide theoretical guidance for improving middle school students' physical health level and promote the construction of middle school physical education and health curriculum system in China to achieve greater development.

3. Purpose of the Study

The purpose of this study is:

3.1 Develop physical training courses for middle school students based on Cross Fit training to enhance students' physical fitness.

3.2 To study the effect of improving students' physique by using physical training courses.

4. Research Questions

The main research questions of this paper are as follows:

4.1 How to build a middle school physical training curriculum system based on Cross Fit training;

4.2 To explore the influence of establishing middle school physical training course based on Cross Fit training on middle school students' physical health? Influence on body shape? Effect on body function? Influence on physical fitness?

5. Research hypothesis

This paper puts forward the following research hypotheses:

5.1 The establishment of middle school physical training courses based on Cross Fit training has a significant impact on middle school students' physical health.

5.2 The establishment of middle school physical training courses based on Cross Fit training has a significant impact on the physical function of middle school students' physical health.

5.3 The establishment of middle school physical training courses based on Cross Fit training has a significant impact on the physical fitness of middle school students.

5.4 Students are satisfied with the creation of middle school physical training courses based on Cross Fit training.

6. Scope of the Study

In this paper, firstly, questionnaire survey and interview are used to determine the action indexes of Cross Fit training in middle school students' physical training courses from gymnastics, self-weight training, single-structure metabolic adaptability training and weightlifting. Then, a middle school physical training course based on Cross Fit training is developed, and students from Grade Two of Beijing Longtan Middle School are selected to conduct an experimental comparison between the general physical education course and the middle school physical training course based on

Cross Fit training. Among them, the experimental group is Grade Two (Class Three), with 23 boys and 21 girls. The control group is Grade Two (Grade One) class, with 23 boys and 21 girls (44). This paper analyzes the changes of students' physical health indexes in these two classes and discusses the influence of middle school physical training courses based on Cross Fit training on middle school students' physical health.

7. Definitions of Terms

7.1 Cross Fit training

Cross Fit training is a high-intensity, multi-station functional training aimed at the continuous cycle implemented by trainers. The training interval is short, and the training items include track and field, weightlifting and gymnastics.

7.2 Physical health

According to the National Physical Health Standard, physical health refers to all categories related to students' physical health and school physical education. According to the relevant explanations in the National Standards for Physical Fitness and Health, this paper holds that the concept of "physical fitness" and the concept of three-dimensional health have different connotations, so the category of "health" is defined by "physical fitness", which refers to the three categories of students' physical shape, function and quality.

7.3 Physical training

Physical exercise refers to the process of physical activity that is consciously implemented to develop the body, improve the health level and entertain the body and mind. Scientific and effective physical exercise plays a significant role in promoting physical development, adjusting mental state, eliminating fatigue, developing working ability, shaping good body shape and preventing common diseases.

Key Characteristics of Physical Training

Purposeful Activity - Consciously implemented with specific objectives and goals.

Science-Based Approach - Grounded in scientific principles and evidence-based methodology for optimal effectiveness.

Multi-dimensional Development - Encompasses comprehensive improvement across physical, mental, and social domains.

Preventive Function - Serves as a protective mechanism against diseases and health-related problems.

Quality of Life Enhancement - Improves work performance capacity and promotes psychological well-being.

7.4 Physical training courses

Physical training courses refer to a systematically designed 12-week curriculum based on Cross Fit training methodology for middle school students, comprising structured physical fitness development programs that integrate three core training modalities: Gymnastics (bodyweight exercises), Weightlifting (resistance training), and Metabolic Conditioning (cardiovascular training).

The curriculum is delivered through 45-minute sessions, three times per week (36 total hours), progressing through three distinct phases: Basic Stage (weeks 1-4), Consolidation Stage (weeks 5-8), and Intensive Stage (weeks 9-12). Each session follows a standardized structure of preparation (2 minutes), main training content (40 minutes incorporating Cross Fit elements), and cool-down (3 minutes).

Training modalities include various formats such as EMOM (Every Minute on the Minute), For Time protocols, AMRAP (As Many Rounds As Possible), and Tabata intervals, with intensity monitored through heart rate zones (110-180 bpm) and RPE scales (12-16). The program aims to systematically improve students' physical fitness across multiple domains including speed, flexibility, strength, and endurance through evidence-based, age-appropriate exercise progressions designed specifically for adolescent development and educational settings.

CHAPTER 2
LITERATURE REVIEW

1. Cross Fit training

1.1 Overview of Cross Fit training

Cross Fit is a relatively mature fitness training system in the United States in 2000, which refers to a multi-project mixed and comprehensive exercise model with the goal of specific sports ability development (Y. Q. Gao, 2025). Founder Greg Glassman believes that Cross Fit actually refers to "continuous high-intensity functional movements with variability" (Ye, 2025). In practice, it usually refers to a high-speed, multiple weight-bearing training system to improve physical fitness. The basis of implementing Cross Fit training is to carry out explosive action training in cycles, so that the trainees' neuroendocrine response can be strengthened during repeated stimulation. The basic movements of Cross Fit training involve track and field, gymnastics, weightlifting and other fields. In specific training, trainees need to complete a group of several movements in a specified time, and the more groups they complete within the specified time, the better the training effect. Cross Fit training system can significantly improve the trainees' physical functions, promote the trainees' physical quality level such as speed, endurance and strength, and make their bodies more flexible and coordinated.

Conventional physical training methods include repetitive training, cyclic training, cross training, etc. The training time and frequency are not fixed, and the training intensity will gradually increase with the deepening of training, such as increasing the load and prolonging the training time. Cross Fit training system has strict regulations on interval time. Trainees need to complete anaerobic aerobic exercise training many times outside the limited interval time, so that their organ functions are strengthened and their quality levels such as exercise speed, endurance and explosive power are improved. This training mode is very effective, so it is welcomed by the military and other fields and widely used in physical training in various fields. In fact, the Cross Fit training system also has the connotation of a group training at the same time, that is, the concept of Boot Camp group training. All members of this group jointly

complete the prescribed physical training tasks in suitable places, and members encourage each other during the training process. It can be seen that the Cross Fit training system also has the function of Group Therapy.

1.2 Advantages of Cross Fit Training

Xu Ruihong summed up the outstanding advantages of Cross Fit training mode in his achievement entitled "A Preliminary Study of Cross Fit Training Mode for Physical Fitness Training", including the following aspects (Q. C. Sun, 2024):

The first is practicality. Cross Fit training uses a variety of basic movements, such as pushing, pulling, lifting, jumping, etc. People need to complete these movements frequently in their daily lives, and compound training can be carried out for each joint to improve the physical functions of the trainees.

The second is efficiency. Cross Fit training system requires trainees to repeatedly complete high-intensity training tasks, and has clear requirements on the output power level of trainees during training. According to physiological theory, high-intensity training for the whole body is obviously better than isolated muscle group training in improving individual physical fitness and improving individual physical fitness level.

The third is extensiveness and content diversity. Cross Fit training requires a wide range of environments and adaptive objects, and does not require training in professional venues. There are no strict requirements on the physical level, age and identity of trainees. Professional athletes, UFC fighters, soldiers and police officers can adopt it, ordinary people can also adopt it, and even women and the elderly can carry out training. On the basis of making a scientific training plan in advance, this training mode can enrich the training content at any time according to the training objectives, and the movements of track and field, gymnastics, weightlifting and other sports can become the training content.

The fourth is comprehensiveness. Sports training in Cross Fit training mode aims at cultivating core strength, and takes track and field, gymnastics, weightlifting and

other sports as the basic movements. Through cyclic high-intensity training, the physical fitness of trainees is improved and the physical quality of trainees is gradually improved.

The fifth is continuous variability. Cross Fit training mode has no strict restrictions on training venues and objects. It can adjust the content at any time according to the changes of training venues and objects, change the training intensity according to the training situation, always keep stimulating the training potential of trainees, and promote the continuous improvement of training quality and efficiency.

1.3 Cross Fit Training Research Status Abroad

A large number of empirical studies have been carried out in foreign academic research fields for Cross Fit training, and the results are quite rich, mainly in the following aspects: (1) Research on the influence of physical function and the change of body composition of different training subjects under Cross Fit training mode; (2) The Cross Fit training mode and routine training were compared, and the biochemical indexes of the trainees under different training modes were compared to analyze the function of the Cross Fit training mode; (3) The element decomposition of Cross Fit training is studied, and the different modes of Cross Fit training and the influence of different elements on the training effect are studied by changing the combination of elements. The representative research results are as follows: N. Eather et al. (2015) conducted an experimental study on 96 middle school students, and randomly selected 51 students to form the experimental group and 45 students to form the control group. The experiment lasted for 8 weeks, during which the students in the experimental group were given Cross Fit intervention training twice a week, and each training lasted for 60 minutes (Huang, 2025). The research conclusion confirmed that the standing long jump, endurance running, waist circumference, BMI, sitting forward and other indexes of the experimental group students changed obviously after Cross Fit training. By comparing the index data of the students in the experimental group before and after participating in the experiment, it is found that the Cross Fit training mode is effective in students' physical training, which is not only safe and effective, but also attractive to students. However, this study shows that Cross Fit training is also used, but the experimental

results of boys and girls are different, indicating that this training mode should be used to formulate training programs for boys and girls respectively. Poston W S et al. (2016) pointed out that the goal of Cross Fit training is not to maximize the level of aerobic exercise, but to promote the general physical preparation conditions. Because of questioning the effect of conventional physical training mode, Cross Fit has attracted more attention (Yu, 2025). Compared with the conventional training mode, the training intensity of Cross Fit is greater, the training time is shorter, and the training content is more diverse. These characteristics are in line with the requirements of military training, so it is widely used in the field of military training. By combing the existing research literature, it is found that the sports injury rate of Cross Fit training is equivalent to that of conventional physical training, and the gap is not obvious compared with football, rugby and other sports. Drake N et al. (2017) conducted a Cross Fit training study with six men as experimental subjects. The training intervention lasted for four weeks. By comparing the indexes before and after the training, it was found that the trainees' body composition did not change obviously, and the MBI (body fat index) of the lean-weight trainees did not change obviously. The two indexes of the trainees' fat weight (FM) and body fat percentage (BF%) did not change much before and after the experiment. Will it affect them? In the aspect of cardiovascular system index changes, the probability of trainees' diastolic blood pressure being affected is 81.1%; Before and after intervention training, the trainees' physical fitness changed to some extent, but the changes of upper limb strength and lower limb strength were not significant, and there was no clear conclusion about the influence of anaerobic capacity. Using TMD and POMS scales to measure the psychological changes of trainees, it is found that the psychological changes of trainees are not obvious after intervention training; It was found that the changes of serum CK and CRP of trainees were not obvious; In terms of influencing the nutritional composition, there is no significant change in the nutritional level of the trainees before and after the intervention training (Huang, 2025). Mate-Munz J et al. (2017) selected 34 people who had never received Cross Fit ill training to carry out experimental research on gymnastics, weightlifting and metabolism training, and tested

the lactic acid level of the subjects after each training task, based on which the muscle fatigue degree of the exercise training subjects was evaluated (C. W. Zhang, 2025). The research conclusion shows that under the condition of gymnastics and weightlifting as the basic training content, the subjects' quality test scores such as speed and explosive force are lower than before the experiment; With metabolic training as the training content, the changes of various quality indexes of the subjects are not obvious. Cosgrove et al. (2019) selected 45 people, including 23 women and 22 men, to conduct experimental research, and all the participants had short-term experience of receiving high-intensity functional training (RIFT) (F. Li, He, K., & Zhu, R., 2025). After 6 months of continuous training, it was found that the implementation of Cross Fit training will significantly affect women's physical fitness indicators, among which the most obvious impact is cardiopulmonary function, endurance, flexibility, explosive force and other indicators; After training in the same mode, men's endurance, explosiveness and flexibility change most significantly; For women with less experience in high-intensity functional training, the level change of 1.5 mile running after Cross Fit training is the most significant. Brian J Lanza (2022) pointed out that Cross Fit, as a training mode, has obvious characteristics of specialization and community, which can help enterprise staff improve their physical condition and improve their physical function indicators (Pardo, 2025).

1.4 Cross Fit Training Research Status in China

In recent years, Cross Fit fitness training theory has only been introduced into China, and the related academic research is limited and the results are few. After consulting China National Knowledge Infrastructure (CNKI), it is found that there are less than 50 related research results of Cross Fit training in China. In the early stage of research, domestic scholars mainly explained the concept connotation of Cross Fit training and analyzed its characteristics based on foreign research results. The main achievements are as follows: Han Tianshu (2014) introduced Cross Fit training systematically in his achievements, including its training system origin, development process, content and mode, etc. In fact, this achievement can be regarded as a

collation and summary of the research literature on Cross Fit training. After this achievement was published, Cross Fit training began to attract the attention of domestic scholars (S. J. Wang, 2025). Although the researchers did not elaborate the formation mechanism, components and implementation methods of Cross Fit training in this achievement, it laid an important foundation for later scholars to conduct in-depth research on these issues. Xu Ruihong (2014) summarized the characteristics of Cross Fit training in his research, and thought that this training mode was not only practical, efficient, comprehensive and extensive, but also varied in training content and highly inclusive (Wu, 2025). Qiao Tong and Li Yongming (2019) pointed out that Cross Fit provides an important commercial carrier for HIFT. In this study, the author makes a detailed review of the formation and development of CF, introduces and examines its management and training system, and points out that although CF training has achieved remarkable results, it will inevitably lead to injuries of trainees, which will have a certain impact on trainees' physical and psychological health (Yang, 2025). In just over ten years, CF can be popularized all over the world, which is closely related to the business system built around coach certification, joining and organizing competitions, as well as the training concept and strict and scientific training system that meet the fitness needs of modern people. However, there are some shortcomings in its business model and training system, which have adverse effects on the safety and scientificity of training. Relevant research shows that CF training will cause injuries to trainees, and there is no significant difference in the injury rate compared with other sports. There are few researches on CF training from the physiological point of view, and most of the existing researches focus on the universally popularized training plan or special training plan. Whether it can be regarded as the achievement of the research on CF training needs further demonstration, whether CF training will affect the physiological and psychological changes of human body needs further study, and many problems need to be solved in the domestic academic field.

In recent years, domestic scholars have conducted research on the application of Cross Fit training in physical training of military schools, universities and special

sports, and discussed its role and effect in physical training by comparing the experimental results. The main results are as follows: Xia Qi, Yan Junfeng and Xin Jian (2019) pointed out in their research that the Cross Fit training mode can be used in physical training of military students, which is a very effective new training method (Tuorila et al., 2025). On the basis of Cross Fit training, the researchers also introduced traditional training methods such as HIIT training and functional training to construct a new training system for military personnel's physical training. Experimental research shows that Cross Fit training can significantly improve the physical functions of trainees, such as strength, cardiopulmonary function and so on. This achievement provides a theoretical reference for the optimization of physical training mode for military cadets. Wu Weidong (2022) mainly studied the physical training of college basketball players under the Cross Fit training system. The researchers selected 20 basketball players in Minxi Vocational and Technical College and then randomly divided them into two groups, the experimental group and the control group with 10 players each(Qiao, 2025). During the whole experiment, the members of the experimental group were trained by Cross Fit training mode, while the members of the control group were trained by conventional training mode. Before and after the experiment, the body fat rate, FMS, 3/4 full-court sprint, vertical jump and bench press of the two groups were monitored, and then the data of the two groups were compared. The comparative analysis found that all the indicators of the athletes in the observation group were obviously improved, the body fat rate decreased greatly, FMS increased, and the other three indicators were level. The experimental results show that Cross Fit training has a remarkable effect on improving athletes' body composition and sports performance. Cross Fit training mode can be widely popularized in athletes' daily physical training, and differentiated training schemes should be made for athletes based on this mode to ensure the training effect. Liang (2023) systematically expounded the concept, characteristics and other contents of Cross Fit training system in his research, and then emphatically analyzed the role of this system in the physical training of football, pointing out that the Cross Fit training program should be designed reasonably in combination with the characteristics of

football, emphasizing that the perfect infrastructure and sufficient training funds should be provided for Cross Fit training, and the training teachers should be ensured, and the training program should ensure the scientific and reasonable training time and intensity(Jiang, 2025). Based on this theory, the researcher carried out an experimental study, and compared the relevant indicators of the experimental group and the control group. It was found that the Cross Fit training mode was more effective than the conventional training mode in football physical training.

1.5 Summary

To sum up, the domestic academic research on Cross Fit training is mostly based on foreign research results, focusing on its concept, characteristics, advantages and methods, and the relevant empirical research is very limited, with few results. Cross Fit training is not only practical and efficient, but also very inclusive. It does not need professional venues and equipment, and has a wide range of adaptability. It has great promotion value in the field of physical education and health education in middle schools in China, and has important research significance in improving the physical health level of middle school students.

2 Physical health of middle school students

2.1 The historical origin of Chinese students' physical health

Since the founding of New China, the Party and the state have paid close attention to the physical health of all students. In different historical periods, the state has formulated a clear evaluation mechanism for students' physical health based on the social, political, economic and cultural development level at that time, and the clear requirements put forward by the state for adolescents' physical health are consistent with the needs of national construction and social development at that time. In order to continuously improve students' physical health level, encourage students to take the initiative to participate in physical exercise and comprehensively promote the development of national sports, the relevant state departments have formulated and implemented a number of systems and policies for many years, such as the Labor and Health System. In view of the standards that students should meet in physical exercise,

the relevant state departments have specially issued documents such as College Students' Physical Education Qualification Standards, Middle School Students' Physical Education Qualification Standards and Pupils' Physical Education Qualification Standards, and formulated relevant systems for junior high school graduates' physical education examinations(Gao, 2025).After 2002, the Standard of Students' Physical Health has gradually become the unified standard of students' physical health education in China. By formulating, promulgating and implementing various policies and systems, the state not only provides an important basis for the development of school physical education, but also lays a solid foundation for comprehensively improving students' physical health. In 2014, according to the actual level of students' physical health in China, the relevant state departments supplemented and improved the contents of the National Students' Physical Health Standard. The revised National Students' Physical Health Standard (hereinafter referred to as the Standard) is more comprehensive, and the relevant standards are more scientific and reasonable, which provides clear guidelines for schools across the country to actively carry out physical education and health education.

2.2 Components of middle school students' physical health

Physical health includes physical fitness and health. Physical health in a broad sense includes individual physical health, individual mental health, and good social adaptability, and all three aspects can be called "health"(Bai, 2025). The definition of "health" in "National Standards for Students' Physical Health" refers to health in a narrow sense, that is, physical health. Whether an individual is healthy or not requires comprehensive evaluation from three aspects: body shape, function and quality, which is a specific standard for evaluating physical health. The basis of maintaining the body's healthy state is physical health, that is, the ideal "state" can only appear on the basis of ensuring "quality". Body shape, body function and physical quality are called the three indispensable elements of physical health(Li, 2025).

Tian maijiu believes that body shape refers to the sum of the internal and external characteristics of an individual's body; The external morphological

characteristics of human body include length, height and width. Based on this theory, Shi Conggang further pointed out that human body shape can reflect the level of growth and development and motor skills(Lin, 2025). Scholar Zhao Yanping agrees that the external morphological characteristics of human body can be used as a reference index for evaluating the level of growth and development. The external morphological characteristics of human body can not only reflect the level of physical development, but also reflect the nutritional health status, which can be used as a reference index for evaluating individual nutrition and hygiene(Chen & Yuan, 2024). Height and weight are two important indexes of human body shape, which can directly reflect the longitudinal development of human body shape, and are easy to measure, and have been widely valued in academic research. According to the height index, we can see the longitudinal development of human bones, and it belongs to external characteristics, so it is difficult to measure, and it is often used as a reference index in evaluating individual growth and development level or sports speed level. According to the weight index, we can see the symmetry degree of the external shape of the human body, and make a comprehensive evaluation of the individual body shape characteristics accordingly.

Physical function refers to the level at which various organs and systems of human body complete their functions during operation, mainly referring to the functions of respiratory system and cardiovascular system(Zhong et al., 2025). It is of great scientific research significance to reasonably determine the reference index to measure individual physical function, and to monitor individual indexes with the help of scientific instruments and technical means, and to scientifically evaluate individual physical function level on this basis. In this paper, according to the relevant provisions of the National Physical Health Standard, the vital capacity of the subjects was measured, and the physical fitness level of the subjects was evaluated based on this.

Regarding the concept of physical fitness, the explanations given in the Dictionary of Sports Anatomy and Sports Medicine are as follows: 1. Physical fitness refers to the level of people's ability to complete specific actions. 2. Physical fitness refers to the level of muscle activity during human exercise, which is generally measured

from four aspects: speed, strength, flexibility and sensitivity. 3. Physical quality refers to the level of labor or sports characteristics in people's lives, such as strength and speed. Physical fitness is the direct expression of people's physical health level, so it is usually used as a reference index to evaluate individual physical health level. Physical quality includes five contents: first, speed quality refers to the level of people's ability to move their bodies quickly; The second is strength quality, which refers to the ability of human muscles to break through resistance and complete movements; The third is endurance quality, which refers to the ability level of people to complete certain quality sports movements many times and maintain sports load for a long time; Fourth, flexibility refers to people's ability to use joints, muscles and ligaments in different directions to complete actions; fifth, sensitivity and coordination refers to people's ability to quickly change their movements in the face of changing environmental conditions.

2.3 Middle school students' physical health evaluation index

The middle school stage is the key stage of teenagers' physical development. At this stage, students' nervous system and motor system develop rapidly and their bodies become stronger day by day(Zhang & Zhao., 2025). However, the survey found that there is still a certain gap between the physical health level and the standard level of middle school students in China. In order to improve the physical health of middle school students, in 2002, the Ministry of Education promulgated and implemented the "Student Physical Fitness Standard (Trial Scheme)", which made clear requirements for the physical health of middle school students, played an important role in improving the physical health of teenagers in China, and also led to great changes in the corresponding evaluation standards; In 2007, the Ministry of Education summarized the trial results of the above scheme, and at the same time, referring to the successful domestic practices, formulated and promulgated the Standards, which clearly stipulated the evaluation standards of students' physical health in China. In 2014, the Ministry of Education supplemented and revised the Standards, and adjusted the implementation strategies based on practical experience. The revised version of the Standards in 2014

was thus formed, and the newly revised Standards clearly defined the physical shape, function and quality measurement indicators of students at all stages.

In this study, the main basis for determining the physical health test index is the National Student Physical Health Standard (revised in 2014) and the Physical Function Training Action Manual, and at the same time, it refers to the concept connotation of physical health, as well as the compulsory education physical education and health curriculum standard (2022) and other relevant regulations. In order to ensure that the measurement indicators are scientific and effective, which is conducive to the successful completion of the research task, this study interviewed experts and adjusted the determined content items with reference to experts' suggestions, and finally determined the following indicators, as shown in Table 1.

Table 1 Indicators of Physical Health Test

Test type	Evaluating indicator	Test purpose
Body shape	Height, weight, BMI	Evaluate students' physical development level
Body function	Vital/breathing capacity	Evaluate the level of students' aerobic exercise
Physical quality	50-meter run	Evaluate the students' movement speed and nerve reaction sensitivity.
	Sit and reach	Evaluate the stretching level of joints, muscles and ligaments in students' sports.
	Pull-up	Evaluate the strength level of students' upper limbs
	Sit-up	To evaluate the strength level of students' waist, abdomen and back muscles and the coordination level of whole body muscles.
	Standing long jump	Evaluate the strength level and explosive power level of students' lower limbs.
	800 m (female) /1000 m (male)	Evaluate students' endurance level

2.4 Physical health status of middle school students in China

The existing research results show that junior high school students in all provinces in China are in poor physical health, spend less time in physical exercise, and their physical activity level is far from meeting the requirements of the Standard. Most students go to and from school by bus or private car. In addition, due to the heavy academic burden, students often do not exercise for a long time, and the trend of overweight is obvious. The unreasonable diet structure of some students leads to malnutrition or over nutrition, which seriously affects students' body shape. Some students pay insufficient attention to extracurricular activities, participate in physical exercise and go through the motions, and fail to achieve the purpose of exercise.

In 2014, the relevant departments conducted a survey on the physical health level of students from all over the country. The results showed that the overall level of students' physical health has improved, but the physical health level of college students has continued to decline significantly. The poor eyesight rate and obesity rate of students at all stages are high, and the trend of youthfulness is more and more obvious(Wang, 2024). Wu and Wang(2024). summarized and reviewed the changes of students' physical function and physical quality in China from 1985 to 2014. In the report, they pointed out that the physical quality and physical function of students aged 7 to 22 in China decreased obviously during these 29 years, but this downward trend eased after 2005. Speed quality showed a downward trend before 2005, and then gradually increased; The quality of explosive power was on the rise before 2005, and then began to decline; The test results of pull-ups are always in a state of decline, indicating that the endurance quality has been declining, while the flexibility quality level has been rising. Zhang Yang and others made a statistical analysis of the results of four national physical fitness monitoring conducted by relevant state departments from 2000 to 2014. The conclusion shows that the physical fitness of adolescents in China has been on the increase, and the detection rate of obesity has increased year by year; Before 2005, the indexes such as young people's vital capacity were in a state of decline, and by 2010, this decline was alleviated, some indexes began to stop falling,

and some indexes even began to rise; The level of poor eyesight continues to rise, and younger age has become a general trend. Wu Fei and others believe that the weight index of Han adolescents aged 7-18 will increase all the time from 2019 to 2024, so it is necessary to intervene the weight problem of adolescents in time. Du Cong and others pointed out in their research that although the physical health level of teenagers in China has been on the rise in recent years, some indicators such as vital capacity are still declining, and the level of teenagers' sports quality has not improved significantly, and even middle-aged and elderly people have common diseases such as hypertension.

Judging from the study on the regional differences of teenagers' physical health, Zhou Peng selected students from schools in various jurisdictions of Yingshang County as the research object and conducted a sampling survey. The results showed that the problems of high and low body shape indexes of local rural middle school students were obvious and needed intervention. The overall level of cardiopulmonary endurance index is low, and the level of strength and flexibility quality index is also different from the standard level. In the study, Gu Zhaoli made a detailed analysis of the physical fitness monitoring data of students aged 13 to 16 in Yancheng from 2015 to 2017. The study pointed out that the average height level of this group has been rising, and the number of students with abnormal weight has been increasing. The proportion of students with abnormal heart rate in urban students is large, which indicates that the student group has also become the incidence group of cardiovascular diseases. In his research, Li Hongqiang focused on the physical health and existing problems of middle school students in Lanzhou, and concluded that the physical function level of local middle school students was obviously declining, especially the indexes such as cardiopulmonary endurance and speed quality. Zhou Zuhui studied and analyzed the physical health monitoring data of 459,423 middle school students in Longnan from 2013 to 2015. The conclusion shows that the physical health level of local boys is generally declining, and the physical health level of rural boys in junior high school is higher than that of urban boys, but the most obvious decline of physical health level among urban and rural students is junior high school students. The average height of

students is lower than the national average, and the quality level of junior middle school boys and girls has dropped greatly. Minliao research pointed out that there is a big gap between urban and rural primary school students' body shape index level and standard level, and the overweight rate and obesity rate are higher than those of junior high school. The number of junior and senior high school students whose weight exceeds the normal range has increased year after year. Li Chuqiu studied the students' physical health in six secondary vocational schools in a city. The conclusion of the study pointed out that the higher the grade, the lower the students' physical health level.

To sum up, there are some problems in the physical health of teenagers in China at present. The eyesight level of teenagers continues to decline, and the number of people with poor eyesight increases year by year, and the trend of younger age is becoming more and more serious. In terms of body shape, obesity has become one of the important factors that plague the health of teenagers, and the obesity rate continues to rise, which seriously interferes with the healthy development of teenagers. In terms of sports quality, the level of teenagers' sports ability also shows a downward trend. Although the speed and extent of decline have eased, the problem is still very serious.

2.5 Physical health status of foreign middle school students

At first, many foreign countries focused on the physical health of student groups for the purpose of training soldiers and athletes. However, with the rapid development of economic level, they gradually shifted their focus on the physical health level to solving the physical health problems for the public. This change is because the health of national constitution is an important manifestation of a country's comprehensive national strength. Compared with the domestic research, the research on students' physical health abroad is rich and ahead of time. This paper selects Japan, the United States and Russian countries to analyze students' physical health problems.

In 1879, Japan formally established a national monitoring system for children's health, and in its official documents, the physical health of children was expressed as the concept of physical health. As one of the countries with the most complete data resources in the field of adolescent physique research in the world, the Japanese

government has been continuously committed to optimizing the evaluation system of adolescent physique health. The Notice of Teenagers' Physical Health Examination issued in Meiji period (1888) marked the beginning of Japanese teenagers' physical fitness monitoring system, and then in 1897 and 1939, two important laws and regulations, namely, Physical Examination Standard for Senior High School Students and Physical Strength Chapter Verification, were successively promulgated. These policy documents systematically standardize the evaluation criteria of students' sports ability, including but not limited to the evaluation system of basic sports skills such as running, jumping and climbing. As a landmark policy document, Physical Strength Chapter Verification has established a standardized testing framework for the assessment of students' physical health in senior high schools in Japan.

With the continuous improvement of the education evaluation system, Japan established a unified national standard system of physical fitness evaluation in 1999. The composition of its test items is highly similar to that of China's current physical fitness evaluation system, but it pays more attention to the evaluation of core qualities such as 20-meter turn-back running, lateral mobility, muscle strength and endurance in the selection of specific indicators. Since the 21st century, the New Physical Fitness Test Act promulgated by the Ministry of Education, Culture, Sports, Science and Technology of Japan has formally incorporated physical fitness assessment into the curriculum evaluation system of middle schools, making it an indispensable part of the basic education stage. This has greatly promoted the development of students' physical and mental health, and greatly promoted the development of Japan's economy and national physical quality. With the improvement of middle school students' physical health quality, the Japanese government constantly improves and develops the system of physical health on this basis, and always urges the citizens to take action to enhance their physical health. In 2010, the Japanese government promulgated the Strategy of Building a Country through Sports, aiming at improving middle school students' participation in physical exercise and optimizing their physical and mental health. This policy puts forward clear guidelines for school physical education workers and

standardizes their teaching practice in promoting students' physical health. In 2012, the Japanese government further launched the Basic Sports Plan (2012-2022), which listed "expanding the participation opportunities of young children in school and community sports activities" as the core task of the national sports development strategy. The plan sets a phased goal, which requires that the physical health level of teenagers will be continuously improved within five years, and it will be restored to the benchmark level in 1985 within ten years. In addition, the policy has formulated a detailed implementation path to ensure the achievement of the set goals, and made clear system provisions for the staff of education committees and sports organizations in various regions of the country. The implementation of these policies and plans has greatly improved the national health level. It can be seen that only when the state attaches importance to health issues and promulgates relevant systems can schools and society be combined to promote cooperation and exchanges, help middle school students and citizens to better improve their physical health, and lay a good foundation for the long-term development of the country and the promotion of comprehensive national strength.

As a country with a leading level of comprehensive development in the world, the United States has been widely recognized for its dominant position in the fields of politics, economy, science and technology, military and national defense, and its contribution in the field of adolescent health promotion is also worthy of attention. Historical documents show that as early as the end of the 19th century, the United States took the lead in carrying out systematic research on middle school students' physical health, and became the first country in the world to establish a student physical fitness evaluation system. In order to scientifically evaluate the physical development of teenagers, American educational institutions have formulated a set of standardized sports test programs, which cover many indicators such as 50-meter sprint, hanging arm flexion, upper limb traction (pull-ups), softball throwing, vertical jump in situ, push-ups and 600-meter endurance running.

Academic research shows that the concept system of "Physical Fitness" was first formally put forward and defined by American sports medicine in 1965. Since then,

AAHPERD has innovatively constructed a two-dimensional physique evaluation framework, and established an evaluation system from two levels of Health-related Fitness and Skill-related Fitness, with special emphasis on the standardized measurement of muscle strength and flexibility, so as to comprehensively reflect the body composition, cardiopulmonary endurance, core muscle group stability and joint activity of the subjects.

With the deepening development of physical health research, the United States completed the paradigm shift of evaluation system in 1980, and realized the transformation of evaluation indicators from sports skills-oriented to health promotion-oriented. In 1981, the American Sports Commission further promoted the "student health record" system, and established a personalized physical development tracking record for each student. Because of its scientificity and operability, this innovative measure has been highly recognized by educators and guardians, which has significantly promoted the overall improvement of the physical health level of American teenagers. The U.S. Department of Physical Education named this activity as FITNESSGRAM, and it was widely promoted and designed as mobile phone software by subsequent health propagandists to better help sports workers record the health status of students, make test reports for each student's health problems, and give specific improvement measures. The feature of this software is that it can record the result data of students under different tests, judge whether the students meet the standard requirements while completing health activities, and provide personalized guidance and suggestions, including increasing or decreasing sports. On the level of nutrition intervention, the American government has formulated a scientific and systematic dietary guidance program, aiming at stimulating students' self-awareness of participating in physical exercise, enhancing their physiological functions and cultivating healthy behavior patterns. The system enables parents to monitor their children's health index data in real time through the digital platform, and forms a collaborative intervention mechanism with educational institutions to jointly implement health promotion measures. Based on the systematic study of the physical health evaluation system of American middle school

students, a more accurate adolescent health evaluation model can be constructed. This study not only helps to objectively evaluate the current physical development of adolescents, but also provides theoretical basis for the health promotion of adolescents in China and guides the formulation of a scientific evaluation standard system in line with China's national conditions.

Since 1925, Russia has attached importance to the national physique. The system of labor and defending the country (hereinafter referred to as "the system of labor and defending the country") has provided strong policy support for the healthy development of the people all over the country, stimulated the enthusiasm of the people to keep fit, and inspired middle school sports workers to help middle school students develop physically and mentally. Russia's GTO standard system has undergone six systematic revisions from its establishment in 1931 to 2014, and finally formed the current standardized version. The current system mainly covers five core dimensions: national physical health promotion, healthy lifestyle promotion, sports social organization cultivation, sports financial support and sports infrastructure improvement. The system adopts the principle of age stratification design, and divides the test items into two categories: basic assessment content and extended assessment content. Among them, the items that must be tested include speed test, endurance test and body flexibility test; Expansive projects include coordination and practical skills. The two kinds of test items provide broad choice space and interest for middle school students' physical development. This model is more colorful than the current physical test items in China, and the purpose of physical test is more clear. At present, European countries adopt unified standards to test the physical health level of teenagers in their respective countries. The advantage of this unified standard is that it can be used to compare the physical health status of teenagers and people in different countries, which is helpful to improve the physical health level of our citizens according to the comparison results. At present, European countries have set up physical health committees and signed physical health agreements with students, and invited well-known experts in sports to guide and coordinate the physical health problems of their teenagers. These experts

analyze and evaluate the data of teenagers' physical health test in different countries, and put forward reasonable and targeted suggestions from the aspects of physical dog planning for you, muscle strength and aerobic food deprivation to help teenagers improve their physical health. The reform measures of European Union countries in promoting teenagers' physique have a positive guiding role in improving the health of Chinese teenagers.

2.6 Summary

The data of international adolescent physical health research show that developed countries generally put the health quality of citizens, especially the healthy development of adolescent groups, at the national strategic level. This attention stems from the significant positive correlation between the physical and mental development level of teenagers and the economic, social and cultural development of the country. In order to improve the national health level, these countries have established a dynamic and perfect physique monitoring system, whose characteristics are mainly reflected in the following aspects: first, continuously optimize the physique evaluation index system; Secondly, strictly implement the standardized testing process; Finally, through the longitudinal comparative analysis of physical test data over the years, combined with the actual problems existing in school physical education, targeted health promotion policies are formulated. This systematic intervention model has effectively promoted the overall improvement of the national physical health level. At present, there is still room for improvement in the physical health of middle school students in our country. We should combine the excellent experience of foreign physical examination reform and our own national conditions to find a policy that is in line with the healthy development of teenagers in our country. Only in this way can we promote the improvement of students' physical health in our country according to local conditions.

3 Middle school students' physical training

3.1 Overview of physical exercise

The word "physical exercise" has a long history. Caspersen(1985) and others profoundly explained the inherent meaning of physical exercise from the physiological

level. He believed that physical exercise relied on sports to help people to carry out repetitive movements to strengthen their physique and keep their physical health at a stable level. Based on the theory of energy metabolism, Anshel et al. (1991) defined physical exercise as a human activity mode with energy consumption significantly higher than the basal metabolic level. From the perspective of bioenergy, this definition emphasizes that the improvement of metabolic rate during exercise is the key physiological index to distinguish physical exercise from resting state.

Comrade Mao Zedong clearly pointed out in his early work "Research on Sports" (1917): "The essence of sports lies in the way of self-cultivation". This exposition profoundly reveals the essential function of sports, and emphasizes the strategic significance of teenagers' physical health to the long-term development of the country. Professor Lu Yuanzhen (2015), a famous sports scholar in China, pointed out through empirical research that systematic physical exercise can not only significantly improve the level of individual physiological functions, but also play a significant positive role in promoting mental health and enriching social and cultural life. Various studies show that physical exercise helps us to live a better life in many ways. It not only provides us with a healthy body, but also helps us to love life and work more to a great extent. According to the statistical analysis of literature, physical exercise has four essential attributes: first, physical exercise aims to help people strengthen their physique, improve people's bad living habits and promote the all-round development of people's physical and mental health; Second, physical exercise has clear basic principles, which stipulate people's exercise behavior and help people improve their health by scientific means; Third, physical exercise is not only about exercise, it is a sports activity integrating leisure, entertainment and fitness; Fourth, physical exercise is not a simple exercise, not a short-term exercise, but a long-term, regular and purposeful long-term activity. For example, Du Jianjun (2019) described in his article that physical exercise is a long-term activity to enhance physical fitness, improve people's physical and mental health, and promote people's all-round development in a regular and planned way. Its content is rich and colorful, including not only physical sports, but also spiritual activities and other aspects

of entertainment. Liu Hui (2016) said that adhering to scientific and regular physical exercise can help improve physical fitness, enrich people's psychological world, help people better adapt to social activities, increase people's love for life, help people develop personal interests while having a healthy body, and enrich people's spiritual world and emotional world.

It can be seen that physical exercise has a positive impact on students' mental health, adaptability and willpower training. Physical exercise is conducive to cultivating students' adaptability in interpersonal relationships, cultivating students' flexibility and willpower, cultivating indomitable excellent quality and better adapting to the development of society.

3.2 Foreign Research on Middle School Students' Physical Exercise

In the field of middle school students' physical exercise development, many scholars have conducted in-depth research on their physical activities. For example, Truelove S(2017) and others found in their research that the physical activity mode of teenagers is mainly active play. He believes that this mode can not only help teenagers grow up healthily, but also promote teenagers' social activities and social adaptability. Active play mainly includes spontaneous behaviors such as games and climbing. These activities can fully mobilize the liveliness of teenagers and let them naturally exercise their health and coordination in activities. This kind of activity fully conforms to teenagers' lively nature, and makes them naturally exercise their physical coordination and reaction ability in the process of playing. Liu Y(2018) and other research surveys show that about 40% of teenagers will participate in unorganized active play activities at least four times a week. These unorganized free activities provide teenagers with the ability and interest to explore the world freely, which is of far-reaching significance to their physical and mental health development. Many foreign countries, such as developed countries such as Canada, Australia and Germany, have formulated special guidelines for the physical activities of teenagers. These guidelines emphasize that young children should have at least 60 minutes of outdoor free activities every day, so as to ensure that young people can actively participate in physical activities, promote

their physical and mental health development, relieve the pressure brought by their studies, and promote the all-round development of young people's morality, intelligence, physique and beauty.

3.3 Domestic Research on Physical Exercise of Middle School Students

Domestic scholars have found that physical exercise plays an important and positive role in individual development, which can not only promote individual's physical and mental health development, but also promote individual's better adaptation to society. For example, it has a positive guiding role in improving individual happiness, self-esteem and life satisfaction; In addition, physical exercise can also increase the trust between people and even enhance the individual's sense of identity with the country. It can be seen that physical exercise is an important means and method to cultivate individual's healthy physical and mental development and urge individuals to actively respond to social activities. Since then, many scholars have found that there are many differences in physical exercise in terms of gender and school year. For example, Liu Haiyan (2007) thinks that there are differences in physical exercise in terms of gender. She thinks that physical exercise in middle school is different in terms of exercise intensity except the basic activities. The activity intensity of boys is greater than that of girls, and the proportion of girls participating in physical activities every week is higher than that of boys. On the academic year level, the activity intensity of junior high school students occupies a leading position, which is higher than that of primary school and senior high school students, because physical education test is a part of senior high school entrance examination in China; In addition, from the time analysis, the current physical education curriculum in China is generally about 30 minutes; From the frequency of physical exercise, both boys and girls are guaranteed to participate in physical exercise at least four times a week; Judging from the intensity of physical exercise, the proportion of students in all academic periods, whether male or female, who take part in physical exercise is more than 70%, and with the increase of the school year, the proportion of male and female students who take part in physical exercise is also rising. The empirical study of Li Lingshu (2018) shows that under the situation of

low-intensity physical training, the subjects present specific physiological and psychological response characteristics. This study adopts standardized exercise intensity grading method (refer to ACSM standard), and finds that although the immediate effect of low-intensity training is limited, it plays a fundamental role in cultivating long-term exercise habits. Zhang Shiping (2020) thinks that this is because the short-term low-intensity physical exercise can't activate the body and can't fully awaken the body. On the contrary, it may be counterproductive to some extent, leading to the double pressure on the body and mind. Analyzing from the cognitive dimension, Shi Weijin's (2020) research on middle school students' physical exercise shows that there are differences in gender and age in physical exercise: girls' identity with physical exercise is lower than that of boys, which may be due to the influence of traditional concepts, which think that physical exercise is the exclusive field of boys; According to the analysis of the study period, the physical exercise intensity of senior students is lower than that of junior students, which may be related to the higher age and the greater academic pressure. Although there are cognitive differences in age, middle school students in all stages have positive recognition of the value of physical exercise, especially among middle school students, they are found to be more enthusiastic about physical exercise. The data shows that more than 60% of middle school students think that physical exercise can relieve academic pressure.

3.4 Summary

The above research shows that physical exercise directly affects the development of middle school students' physical and mental health, whether from the level of physical health or mental health. From the perspective of physical health, physical exercise can significantly promote the development of middle school students' physical function, help middle school students pass the senior high school entrance examination smoothly, help to strengthen their physique and be used for healthy body; From the perspective of mental health, physical exercise can effectively relieve academic pressure, help students improve their emotions, reduce negative emotions, and help students establish a correct outlook on life for a positive attitude towards life.

4. Physical training courses

4.1 The concept source of physical training courses

The ontological study of curriculum theory has always been the core topic of concern in China's educational circles, and the related research results have formed a systematic theoretical system. Zhong Qiquan (2015), a famous educational scholar, summarized the definition of curriculum concept into three dimensions through literature research: discipline knowledge dimension (traditional cognitive paradigm), goal planning dimension (technical rational orientation) and experience experience dimension (humanistic orientation). Zhong Qiquan (2015) further pointed out that the research on contemporary curriculum theory presents six remarkable development characteristics: the shift of experience center (emphasizing learners' subjectivity), the prominence of process value (focusing on dynamic generation), the integration of multiple elements (teacher-student-environment-textbook system), the equal emphasis on explicit and implicit courses (cooperation between actual courses and empty courses), and the linkage of courses inside and outside the school (expansion of learning field). Shi Liangfang (2018) constructed a more detailed classification framework of curriculum definition in Introduction to Curriculum Theory, including six theoretical paradigms: the theory of subject content, the theory of teaching activities, the theory of learning results, the theory of experience acquisition, the theory of cultural reproduction and the theory of social transformation, which reflected the multi-methodological characteristics of curriculum research. In his research, Jin Yule emphasized the importance of social culture and academics, and thought that there were different orientations of physical training courses, and he paid more attention to the technicality of teaching process. More emphasis on the importance of personal experience. To sum up, this paper uses Zhong Qiquan's three definitions of physical training to formulate the overall plan for physical education and physical learning.

A systematic analysis based on literature research shows that the academic circles in China have not yet established a standardized theoretical framework for the concept of physical training courses (Li Moumou, 2023). The absence of this theory is mainly due to the fact that physical training has not been set as an independent

curriculum module in the curriculum system of basic education in China. The Physical Education and Health Curriculum Standard for Compulsory Education (2022 Edition) promulgated by the Ministry of Education clearly stipulates five core curriculum content areas: basic sports skill development, physical quality training, health knowledge education, special sports skill training and interdisciplinary integrated learning. Among them, the physical fitness training module contains 11 key index dimensions: body composition regulation, cardiopulmonary function endurance, muscle strength quality, muscle endurance performance, joint flexibility, nerve reaction speed, displacement rate, movement coordination, body sensitivity quality, explosive power level and balance control ability.

From the perspective of international comparative pedagogy, the representative curriculum models related to physical training curriculum ideas include: German Sports Curriculum system, British sports curriculum framework, American SPARK curriculum model and Japanese Trops teaching model. German physical education curriculum system presents three typical implementation paradigms: diversified sports integration model, sports behavior ability development model and experience participation-oriented model. The core feature of British sports curriculum framework is to highlight the basic position of sports concept, and its curriculum objectives show a significant trend of transformation from competitive orientation to health promotion and leisure and entertainment. SPARK curriculum model in the United States aims at improving teenagers' physical health, and focuses on cultivating learners' positive behavior tendency and attitude towards sports activities. Trops teaching mode in Japan adopts reverse teaching design idea, and realizes the goal of popularization of national sports participation by constructing a non-competitive sports participation environment.

What needs to be pointed out in particular is that although the above-mentioned international curriculum models are similar to physical training courses to some extent in concept, there are still significant differences in the essential attributes of the courses. These models mainly stay at the level of curriculum implementation paradigm, and have not yet formed a systematic curriculum typology system. Therefore, these international

experiences can only provide limited reference value for the concept definition and theoretical construction of physical training courses in China.

4.2 Physical training courses abroad research status

By systematically sorting out the international literature, we can conclude various expressions of the concept of Physical Fitness in academic circles, including Physical Capacity, Physical Ability and strength training and conditioning (Smith et al., 2021). Among them, Physical Fitness, as the most representative expression, its core connotation refers to the adaptability of human organs and systems in response to changes in the external environment (WHO, 2020). (2015) Based on the theoretical framework of constructivism, a set of physical education model with physical activity as the core was developed. Through the systematic design of three stages (cognitive understanding stage, ability training stage and evaluation feedback stage), the model integrates the historical origin and philosophical basis of physical training into the course content, aiming at helping learners to establish a systematic understanding of the nature of physical fitness, master scientific evaluation methods, and finally achieve the educational goal of coordinated development of body and mind. Vanhelst et al. (2016) conducted a longitudinal study on French teenagers, which showed that the percentile evaluation values of indexes such as cardiopulmonary function, muscle endurance and sensitive quality can effectively reflect the development level of health-related physical fitness in physical education classroom teaching. The results of the study confirmed that there was a significant positive correlation between the physical performance of adolescent students and their age growth ($p<0.01$). A cross-border comparative study by Jiekang and Diwang(2016) shows that there are significant differences in the physical development patterns of adolescents in China compared with developed countries such as the United States and Japan. By designing a controlled experiment, the researcher confirmed the positive effect of targeted physical training program on improving teenagers' physical health level (effect $d=0.45$, $p<0.05$).

The American Sports Medical Association (ACSM, 2020) defines Physical fitness as a multidimensional concept, which mainly includes core elements such as

cardiopulmonary fitness, muscle fitness, flexibility and body composition. It is worth noting that the American Physical Fitness Training Association (NSCA) focuses more on explaining the connotation of physical fitness from the professional perspective of strength training and sports quality development (NSCA, 2021).

Literature analysis shows that foreign scholars' research on the concept of physical fitness mainly focuses on the category of health-related physical fitness (Johnson, 2019). On the practical level, the foreign education system has formed a distinctive physical training model, which is characterized by:

1. Reform of the curriculum system oriented to health and fitness.

2. Research on the correlation between physical fitness and sports performance.

3. The organic combination of sports ability development and theoretical knowledge teaching.

These training modes together constitute an important target system of foreign school physical education curriculum (OECD, 2020). 2.4.3 Physical Training Curriculum Research Status in China.

The author searched the literature about physical fitness courses through China National Knowledge Infrastructure (CNKI), and collected more than 200 articles, of which only a dozen were about physical fitness courses in middle schools. Through reading and analyzing the representative achievements of these dozens of documents, Du Cong, Liu Haitao (2017) and others used the methods of literature review to explore the feasibility of promoting physical training in the "Sunshine Hour" activities in primary and secondary schools. According to the research, it is found that most physical education courses in primary and secondary schools in China cannot be guaranteed. At present, physical education workers in primary and secondary schools are lacking, physical teachers are weak, physical fitness in primary and secondary schools is different, and the difficulty of physical education courses is unbalanced. Most courses are not targeted and cannot adapt to the physical development of primary and secondary school students. Therefore, China's physical education departments should

intensify efforts to improve this problem, promote the supervision of regulatory authorities, enhance the main role of school education students, improve the education level of school physical education workers, increase the training opportunities of physical education workers, promote the exchange of experience among physical education workers in different regions, and improve physical education courses for students of different ages. Han Jinming, Pan Jianfen and Chen Yanfei (2021) put forward that physical exercise class is a class type in the new development stage of school physical education and health curriculum reform. Meng Kebin (2020) analyzed the problems existing in the teaching of physical fitness module in senior high school physical education and health courses, and found that the current physical training courses are boring, the completion of physical fitness projects is limited, and the teachers of physical fitness educators are weak. On this basis, the countermeasures are put forward: students-oriented, grasping the law of students' healthy development, and promoting the common development of school physical education and sports skills; Strengthen the training of physical education workers, improve the current physical education curriculum, promote the all-round development of middle school students and improve the professional quality of physical education workers.

The curriculum of physical exercise in the basic education stage needs to meet the practical requirements of four dimensions: first, it should be connected with the training system of subject core literacy; Secondly, earnestly implement the specific requirements of Physical Education and Health Curriculum Standards for Compulsory Education; Thirdly, meet the standard requirements of students' physical health test indicators; Finally, we should meet the practical needs of the current physical fitness assessment examination.

The theoretical support of this course mainly comes from four aspects: first, the theory of physical sustainable development based on the concept of lifelong education; Secondly, the biological basic theory of human action development stage; Thirdly, the stage development model of the formation of motor skills; Fourthly, the critical period theory of physical quality development (sensitive period theory). These theories together

constitute the scientific theoretical basis of physical exercise curriculum. Physical training course can be designed from four aspects: course type, module content, core elements and diagnosis and assessment. Physical training courses are facing practical challenges in terms of professional teachers, development and design, curriculum resources and collaborative promotion. In his research, Jiang Guole (2023) used the professional knowledge of physiology and sports training to design the curriculum design, content design and evaluation method of other physical training for middle school students from the perspective of middle school students' physical quality, and combined with the theories of step-by-step physical education model and pyramid physical model to help middle school students carry out physical training.

In a word, the domestic literature on physical training courses is mainly concentrated after 2017, and the release of new curriculum standards makes the research on physical training in China mostly concentrated in the higher education stage, but little in the middle school stage.

4.3 Summary

This study is based on the innovative application of Cross Fit training system in the field of basic education in China. As a new functional training mode, the practical exploration of Cross Fit in the field of physical education in China is still in its infancy, especially the research on the integration of physical training courses in middle schools is still a blank field (Wang Moumou, 2023). Considering that teenagers (12-15 years old) are in the critical window of growth and development, their physiological functions and sports ability are obviously plastic (State Sports General Administration, 2022), it is of great theoretical and practical value to carry out relevant research.

This study fills the gap in the research of Cross Fit training in the field of basic education, and has important practical guiding significance for promoting the improvement of teenagers' physical health level. The research results will provide theoretical basis and practical reference for optimizing the curriculum system of physical training in middle schools.

5 Teaching design model

5.1 ADDIE model

ADDIE instructional design model was originally developed by the Education Research Center of Florida State University in the 1970s, with the original intention of providing a scientific guiding framework for military training system (Molenda, 2003). With the continuous improvement of the theoretical system, the model is gradually introduced into the field of enterprise human resources development, which is used to systematically analyze the training needs of employees, optimize the design of training programs, and finally improve the training efficiency and work performance of organizations (Peterson, 2004). ADDIE, as an acronym, completely covers five key links: demand Analysis, instructional Design, resource Development, scheme Implementation and evaluation (Branch & Merrill, 2012). In the field of modern educational technology, this model has developed into a complete framework of teaching system design (ISD), and its specific application processes include: analysis of learning needs and background, design of teaching contents and strategies, development of teaching materials and resources, implementation of teaching methods and activities, formative and summative evaluation.

ADDIE model can be further divided into general model and basic model. Among them, ADDIE universal model belongs to a nonlinear teaching mode, and its obvious advantage lies in that the evaluation link is not restricted by a fixed process, and it can cut into any stage of analysis, design, development and implementation at any time, and can also change from the evaluation link to other stages at any time. However, the complexity and flexibility of the evaluation process make it difficult to accurately control the process, which easily leads to misunderstanding of its connotation. ADDIE's basic model focuses on the linear process of teaching activities, which is characterized by the completion of the previous stage before entering the next stage. The evaluation link of ADDIE basic model includes both formative evaluation and summative evaluation, and each link is closely connected and logically rigorous. This study is carried out under the guidance of ADDIE basic model.

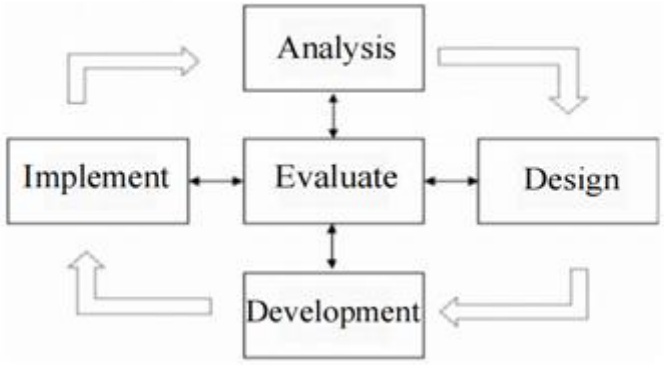

Figure 1 ADDIE general model diagram

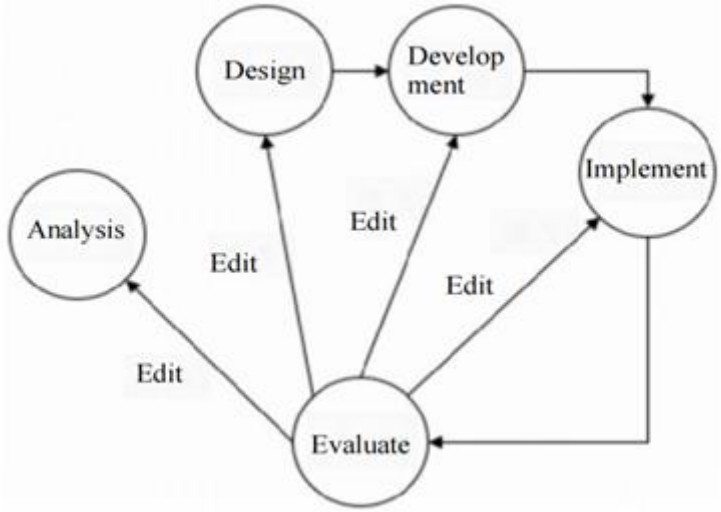

Figure 2 Basic model diagram of ADDIE

5.2 Treatment process of ADDIE model

The specific processing process of ADDIE model is as follows:

1) Analysis

In the process of instructional design, the analysis stage, as the primary link of ADDIE model, bears the basic diagnostic function (Smith & Ragan, 2005). At this stage, through the systematic investigation of teaching goal system, teaching task characteristics, audience characteristics, teaching environment elements and performance expectations, it provides scientific basis for subsequent teaching design.

Specifically, the analysis stage includes four core elements: learning needs diagnosis, learner characteristics analysis, learning content analysis and teaching resources evaluation (Gustafson & Branch, 2007).

Deep analysis of learning needs diagnosis: the essence of learning needs diagnosis is to identify the significant gap between learners' current ability level and expected teaching goals (Dick et al., 2015). From the perspective of educational metrology, when there is a statistically significant difference between learners' actual performance and teachers' expectations or self-expectations, there is a substantial learning demand. In view of the high school education stage, this demand is mainly manifested in the dialectical relationship between the achievement of teaching objectives and the improvement of individual learning efficiency (Anderson et al., 2001).

Multi-dimensional analysis of learners' characteristics: The analysis of learners' characteristics adopts diversified evaluation methods, and systematically measures key variables such as learners' cognitive development level, intrinsic motivation intensity, initial ability benchmark, personal development expectation and existing learning experience (Jonassen & Grabowski, 2012). Based on the cluster analysis of measurement results, instructional designers can formulate differentiated teaching strategies and targeted intervention measures (Merrill, 2013).

Systematic analysis of learning content: the analysis of learning content follows the principle of teaching goal orientation and focuses on the structural construction of knowledge system (Gagné et al., 2005). At the operational level, it is necessary to clarify the logical relevance between knowledge points and scientifically define their cognitive breadth and conceptual depth (van Merriënboer & Kirschner, 2018). This analysis involves not only combing the surface knowledge structure, but also exploring the deep cognitive law (Sweller et al., 2019).

2) Design

In the design stage, after fully grasping the situation in the analysis stage, the relevant data should be integrated, and then the specific teaching design scheme should be worked out. At this time, it is necessary to sort out the data analyzed before

and plan a detailed teaching plan from beginning to end. For example, what goals should be achieved in teaching, where are the key and difficult points, how to teach classes, and how to arrange courses, all these must be thought out in advance and the key issues should be clearly written down. When this stage is completed, a complete design scheme will be formed, which will just lay the foundation for the development of teaching materials in the next stage.

Determine the teaching objectives: When designing specifically, we must first make the teaching objectives clear, so that students can know to what extent they want to achieve after learning, and then they can have a direction in learning.

Making teaching strategies: The teaching strategy system consists of three core dimensions: (1) organization strategy: systematic organization and presentation design involving teaching content; (2) delivery strategy: covering the selection of teaching media and the optimization of learners' grouping mode; and (3) management strategy: including the sequential control of teaching process and the rationalization of resource allocation. In the actual teaching design process, strategy formulation mainly focuses on the following two key levels (Merrill, 2013): (1) Organizational strategy dimension: focusing on solving the logical sequence of knowledge structure and the optimal way of information presentation; (2) The dimension of delivery strategy: focusing on the adaptive application of media technology and the differentiated grouping of learning groups.

3) Development

The development stage is to formulate teaching objectives and tasks on the basis of previous research, and to develop and integrate teaching materials. The output of this stage includes teaching plan, teaching execution plan, teaching plan and multimedia teaching courseware. The core task in the development stage is to construct a classroom practice teaching scheme that conforms to students' cognitive level and can effectively stimulate their interest in learning.

4) Implementation

The implementation stage is the key transformation process of transforming theoretical design into teaching practice (Dick et al., 2015). At this stage, educators need to put all kinds of teaching resources and design schemes developed in the early stage into practice through systematic teaching activities. The successful implementation of this stage depends on the accurate grasp of the teaching situation and the dynamic regulation of the teaching process.

5) Evaluation

As a quality assurance link in ADDIE model, evaluation has the characteristics of whole process and can penetrate into other stages. The evaluation system includes two dimensions: formative evaluation (process monitoring) and summative evaluation (result evaluation). Its main functions are to diagnose the defects of teaching design, evaluate the learning effect, provide the basis for improvement, and finally realize the continuous optimization of the teaching system.

5.3 Summary

ADDIE model, as a systematic instructional design framework, consists of five interrelated and gradual stages. After decades of theoretical development and improvement, it has become one of the most influential instructional system design (ISD) models in the field of educational technology. Its five core links are Analysis stage, Design stage, Development stage, Implementation stage and Evaluation stage. This model can be introduced into the design of middle school physical training curriculum based on Cross Fit, which can help middle school students to establish a systematic and programmed physical training curriculum, unify all stages of physical training and teaching activities, and make scientific and reasonable planning for all elements in each stage.

6. Student satisfaction

6.1 The concept of student satisfaction

Satisfaction, as a complex psychological construct, refers to the positive emotional state of individuals after their needs are met or their goals are achieved

(Diener et al., 1985). Wang Xian (2018) pointed out in his research that this kind of psychological state stems from the positive gap between the individual's internal expectations and the actual gains. When the actual experience reaches or exceeds the expected standard, it will induce a positive psychological feedback mechanism of satisfaction. Oliver(1980) pioneered the theory of expectation-inconsistency in the field of consumer behavior, which became a milestone in the research of satisfaction. This theoretical framework reveals that in business situations, customer satisfaction is essentially a cognitive-emotional response, which leads to positive satisfaction when perceived performance exceeds expectation standard, and vice versa, leads to emotional reaction of dissatisfaction. Based on Oliver's theoretical paradigm, Liu Wu et al. (2019) further constructed a satisfaction measurement model in the context of China. In this model, the operational definition of customer satisfaction is: the intensity index of pleasurable emotional state generated by the satisfaction of consumers' demand for the obtained goods or services after purchasing decisions. This concept definition has been widely used in the research field of service quality management (Li & Zhang, 2020).

The concept of student satisfaction stems from the interdisciplinary migration and application of customer satisfaction theory in the field of pedagogy. On the theoretical basis, the development of students' curriculum satisfaction scale mainly draws lessons from the mature Customer Satisfaction Index (CSI) model in the field of business administration. The theoretical model consists of four core constructs: learning expectation, quality perception, value cognition and satisfaction evaluation. At present, this theoretical framework has been widely used in the research field of education quality evaluation, especially in the evaluation of curriculum teaching, which has produced a lot of empirical research results, such as the construction of online education quality evaluation system, the investigation and study of middle school curriculum satisfaction, etc. Martin (Year), an internationally renowned education researcher, defines student satisfaction as the degree of consistency between learners' expected learning effect and their actual learning experience. When the actual experience reaches or exceeds the expected threshold, it will produce a satisfactory

state, and vice versa. Yue Junfang (Year), a domestic educational scholar, put forward from the perspective of demand satisfaction theory that student satisfaction is a positive psychological experience generated by the effective satisfaction of the needs of the learners in the process of educational service consumption, and its intensity is positively related to the degree of demand satisfaction.

6.2 Factors affecting students' satisfaction dimensions

The process of document retrieval and screening is as follows: Based on CNKI (China Knowledge Network) academic resource database, this study systematically collected documents with "student satisfaction" as the core retrieval keyword, and obtained 302 effective academic documents (retrieval deadline: December 31, 2023). By using PRISMA (the preferred report item for systematic evaluation and Meta-analysis) framework to screen the literatures, 15 Chinese and foreign literatures with high academic value were finally determined as research samples. These documents provide a theoretical basis for the dimension division of influencing factors of students' satisfaction, and the specific classification results are shown in Table 2.

Table 2 Statistical summary of the research results of the factor dimension of student satisfaction

Researcher	The dimension composition of factors affecting students' satisfaction
McVeatta	Teaching process and content, teaching methods, teaching materials, teacher-student interaction, and teachers' quality.
Betzetal et al.	School environment and equipment, teaching management measures and planning, teachers' quality, teaching methods, learning achievements and classmates' relationship.
Jaeger et al	Professional accomplishment, concern for students, progress of teaching, difficulty and quantity of homework.
Chadwick & Ward	The value of studies in the job market, social interaction, teaching process, etc.

Table 2 (continued)

Researcher	The dimension composition of factors affecting students' satisfaction
Langston	Teachers, textbooks, classroom atmosphere, etc.
Hynes et al	Learning content, learning methods, educators, teaching equipment and educational services
Wang Hongjiang	Teaching ability, venue equipment, education safety, sports policy, classroom atmosphere.
Jin xiaomiao	Satisfaction with teachers, parents' learning support, classmates, classroom learning environment, learning ability and study.
Li Huili	Professional image, quality perception, value perception, student satisfaction, student loyalty and student complaints.
Li Jianlin	Teachers, curriculum, learning achievement, interpersonal relationship.
Guo xiuwei	Face-to-face tutoring, course content, learning results, entrance education, learning support and service, and learning environment.
Wang Lingling	Theoretical teaching, practical teaching, quality development and teaching management.
Hao jianchun	Learning environment, teaching public facilities, teachers' quality and attitude, teaching process, interpersonal relationship.
Wang Bin et al.	Teachers, majors and curriculum, teaching mode, teaching hardware facilities, etc.

By systematically sorting out and analyzing the domestic and foreign literatures listed in Table 2, we can find that the research orientation of student satisfaction mainly presents the characteristics of binary differentiation.

The first research orientation focuses on the teaching dimension of teachers. The representative scholars of this orientation include McVeatta, Jaeger, Chadwick &

Ward, Langston, etc., and their core view is that teachers' teaching factors are the key variables affecting students' satisfaction. Specifically, this dimension can be further refined into: (1) elements of teaching resources, such as teaching material quality and course content design; (2) Teachers' professional quality, including teaching ability and academic level; (3) Teacher-student interaction, covering classroom communication, academic guidance and emotional support. The second research orientation focuses on administrative services and management dimensions. Scholars who hold this view, such as Hynes and Betz, advocate evaluating students' satisfaction from the perspective of the overall environment of the school and emphasize the multi-dimensional comprehensive evaluation system. Betz et al.' s research shows that the core observation indicators of administrative service dimension include: (1) campus infrastructure and environment; (2) Teaching planning and management efficiency; (3) feedback mechanism of academic achievement; (4) Peer interaction. Domestic scholars' research also shows a similar division: the conclusions of Jin Xiaomiao, Wang Hongjiang and Ma Fangting tend to be the teacher-led theory, while scholars such as Liu Wu, Li Huili, Guo Xiuwei, Xiao Lianying, Wang Bin, Hao Jianchun and Wang Lingling emphasize the key role of administrative services.

To sum up, the existing research has formed a relatively perfect theoretical system in terms of influencing factors of students' satisfaction, and its multi-dimensional analysis framework provides important theoretical support and empirical reference for the construction of the evaluation index system of this study. Based on the above analysis, this paper finally sorts out the following core factors that affect students' satisfaction: among many factors that optimize students' satisfaction, the following four aspects are particularly critical:

First, teachers' teaching ability: teachers' professional ability and teaching level are the direct factors that affect students' satisfaction. Among them, the innovation of teachers' teaching methods and the interaction with students can significantly enhance students' sense of curriculum experience. Thereby improving students' satisfaction.

Second, the quality of curriculum design: the depth and breadth of teaching curriculum content directly determine students' learning gains. A hierarchical and systematic curriculum system can not only help teachers improve teaching quality, but also effectively enhance students' satisfaction.

Third, teaching resources and environmental support: adequate teaching resources (such as library books, teaching facilities, technical support and learning space) are the basis to ensure learning effect. Modern teaching resources and rich teaching methods create suitable learning environment and conditions for students, which is an important means to improve students' satisfaction. At the same time, a safe campus environment and inclusive teaching relationship are also important ways to significantly improve student satisfaction.

Fourthly, management and service guarantee: efficient administrative process, smooth problem feedback mechanism and timely and effective management measures are important guarantees to improve students' satisfaction. In addition, a perfect support service system such as course guidance can provide students with all-round learning support, thus improving students' satisfaction.

6.3 Summary

By systematically sorting out the relevant theories of student satisfaction, it can be clear that its conceptual connotation is derived from the theoretical framework of customer satisfaction. In this study, the operational definition of student satisfaction refers to the concept of "learner satisfaction" proposed by Yue Junfang (2018), which emphasizes the subjective evaluation of students' educational experience. Based on literature review and theoretical analysis, the key influencing factors of students' satisfaction determined in this study cover the following dimensions: (1) Teachers' teaching effectiveness, including teaching methods and professional ability; (2) Curriculum system design, involving content depth and structural rationality; (3) allocation of teaching resources, such as teaching materials and digital learning tools; (4) Campus infrastructure and environmental conditions; (5) The quality of administrative management and academic support services.

CHAPTER 3
RESEARCH METHODOLOGY

1 Research Design

1.1 Curriculum design objectives

Improve physical fitness: It aims to comprehensively develop the physical fitness of middle school students in terms of speed, flexibility, strength and endurance by carefully designing physical training courses based on Cross Fit. Using the diversity and high intensity of Cross Fit training to stimulate students' physical functions, which is different from traditional physical education courses and provides students with more challenging and targeted ways to improve their physical fitness.

Promoting all-round health: not only pay attention to the improvement of students' physical exercise quality, but also expect to cultivate students' good exercise habits and health awareness through courses, help students establish a positive lifestyle, thus promoting students' physical and mental health development and improving their quality of life as a whole.

Enhance the attraction of the course: according to the characteristics of middle school students' liveliness and curiosity, develop interesting and diverse course contents, combine Cross Fit training elements with middle school physical education teaching, and design rich and diverse training items, such as functional training action combination and team competition training, so as to improve students' interest and participation in physical training courses and change their impression of boring traditional physical education courses.

Personalized teaching: fully consider the differences of students' individual physical fitness and sports ability, and integrate personalized teaching ideas into curriculum design. Through the early physical fitness test and continuous observation and evaluation, the corresponding training plans and objectives are formulated for students of different levels, so as to ensure that each student can get suitable exercise in the course, realize teaching students in accordance with their aptitude and promote the common progress of all students.

1.2 Course schedule

Preparatory stage (week 1-2):

Week 1: Complete the evaluation of students' physical health indicators of Grade 2021 (Grade 2) in Beijing Longtan Middle School, collect basic data, and analyze the data by using mathematical statistics to ensure that there is no significant difference in the evaluation data of physical health indicators between the experimental class and the control class before the experiment, so as to provide reliable reference for subsequent experiments. At the same time, complete the design of middle school physical training course based on Cross Fit, including the arrangement of course content, the formulation of teaching methods, and the preparation of training venues and equipment.

Week 2: The physical education teachers who participated in the experiment were trained based on the Cross Fit training course, so that they could be familiar with the course concept, teaching methods and training contents, and master the key points and matters needing attention in the course implementation. At the same time, the students' learning satisfaction scale of middle school physical training courses based on Cross Fit is designed and distributed, and the students are surveyed by questionnaire to understand their views and expectations on traditional physical education courses, so as to provide a comparative basis for the evaluation of the follow-up courses.

Teaching experiment stage (3-14 weeks):

Weeks 3-12: According to the established curriculum plan, the experimental class carries out physical training courses for middle schools based on Cross Fit training, and arranges 3-4 classes every week, each class lasts for 45 minutes. The content of the course covers aerobic exercise, strength training, flexibility training and comprehensive functional training, and various teaching methods such as cyclic training and interval training are adopted to stimulate students' training enthusiasm. The control class is taught according to the traditional physical education syllabus, and is taught by the same physical education teacher to ensure the single variability of the experiment. In

the teaching process, teachers communicate with students regularly through interviews to understand students' learning feelings and difficulties and adjust teaching strategies in time.

Week 13-14: Mid-term evaluation was conducted, and the students in the experimental class and the control class were evaluated again, and the changes of physical fitness of the two groups were compared and analyzed in the first half of the experimental time. At the same time, the experience and problems in the first half of the teaching process are summarized by logical analysis, which provides the improvement direction for the second half of the teaching.

Course summary stage (week 15-16):

Week 15: After completing the 12-week teaching experiment, the students in the experimental class and the control class were comprehensively evaluated for their physical health indicators, and complete data were collected. At the same time, the students' learning satisfaction scale of middle school physical training course based on Cross Fit is distributed again to collect students' satisfaction evaluation of the whole course. Interview physical education teachers and students, collect their opinions and suggestions on the curriculum, and improve the physical training curriculum system and the interview outline of the experiment based on Cross Fit training.

Week 16: Analyze the experimental data by mathematical statistics, and compare the differences between the experimental group and the control group in physical shape, physical function, speed, flexibility, strength, endurance and other physical health indicators, and summarize the influence of physical training courses based on Cross Fit training on middle school students' physical health. Write an experimental report, summarize the experience and achievements of curriculum development, and put forward the direction and suggestions for curriculum improvement.

The research method of this study is quantitative, and the data are collected in the form of quantitative or numerical tests. This paper adopts the pre-test and post-test

design of the experimental group and the control group. The pre-test and post-test designs of the experimental group and the control group are shown in Table 3.

Table 3 Pre-test-post-test design of experimental group and control group

O1	X1	O2
Pre-test In the control group, the data of students' physical health index evaluation before traditional physical education courses were conducted.	The control group took traditional physical education courses.	Post-test In the control group, the data of students' institutional health indicators after traditional physical education courses were evaluated.
O3	X2	O4
Pre-test In the experimental group, the data of students' physical health indexes were measured before the physical training course based on Cross Fit.	The experimental group was given a physical training course based on Cross Fit.	Post-test In the experimental group, the data of students' physical health indicators were evaluated after the physical training course based on Cross Fit.

2. Research Objects

This study is to develop the physical training curriculum of Beijing Longtan Middle School based on Cross Fit training. The participants of the questionnaire survey on Cross Fit training content are 10 experts in sports training and professional teachers engaged in physical training in Beijing, and these 10 experts are also interviewed. In this paper, two classes, Grade Two (Class Three) and Grade One (Class One), were randomly selected from Grade 2021 (Grade Two) of Beijing Longtan Middle School as the experimental objects, among which the experimental group was Grade Two (Class Three), with 23 boys and 21 girls, totaling 44 people. The control group is Class 1, Grade 2, with 24 boys and 21 girls. One of the boys was absent from the experiment due to injury, with a total of 44 students. The experimental subjects are shown in Table 4 and Table 5.

Table 4 Distribution ratio of men and women in experimental group and control group

Category	Classes	Man	Woman	Total
Experimental group	Class 2 (3) of Grade 2	23	21	44
Control group	Class 1, Grade 2, Junior High School	23	21	44

Table 5 List of participants in experimental group and control group

Category	Classes	Gender
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman

Table 5 (continued)

Category	Classes	Gender
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Woman
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man

Table 5 (continued)

Category	Classes	Gender
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
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Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man
Experimental group	Class 2 (3) of Grade 2	Man

Table 5 (continued)

Category	Classes	Gender
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman

Table 5 (continued)

Category	Classes	Gender
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Woman
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
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Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man

Table 5 (continued)

Category	Classes	Gender
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man
Control group	Class 1, Grade 2, Junior High School	Man

3. Research Instrument

3.1 Cross Fit-based Middle School Physical Training Course Students' Learning Satisfaction Scale

According to the research purpose of this paper, according to the influencing factors of learning satisfaction determined in 2.6.2, Wang Hongjiang's physical education class Learning Satisfaction Scale for Middle School Students was adapted, and finally the Cross Fit-based Middle School Physical Training Course Student Learning Satisfaction Scale was obtained. The questionnaire consists of two parts: the first part is basic information, including gender, grade, health status, age and other questions. The second part is the evaluation of students' satisfaction. In this part, Likert5.0 scale is used. The description of each question is set with five options: very dissatisfied, not very satisfied, general, relatively satisfied and very satisfied, which correspond to the scores of 1, 2, 3, 4 and 5 respectively. The higher the score, the higher the students' satisfaction.

3.2 School Smart Playground Platform

The school's intelligent playground platform automatically forms the results and score conversion after each exercise, which replaces the traditional manual counting work of physical education teachers. Make sports evaluation faster and more accurate, and at the same time reduce the workload of physical education teachers. At present,

the school has applied smart sports equipment to the quality events such as 50m running, sitting forward, pull-ups, sit-ups, standing long jump, 800m, and 1000m. After each exercise, relevant information is synchronously imported into the background, so that the data information can be left in the whole process, and the data of the exercise results can be kept. Moreover, the students' body shape and function indicators such as height, weight, BMI and vital capacity can also be included in the smart sports equipment.

3.3 Swish sports intelligent system

In this study, the swish sports intelligence system is innovatively introduced as a data acquisition tool. The system can monitor and record students' sports performance data in the process of Cross Fit training in real time, including key indicators such as training intensity, heart rate change and action completion quality, and realize data docking with the school smart playground platform to form a complete data link of "process+result". The personalized training feedback and data analysis report provided by the wooshing sports system not only make up for the shortcomings of traditional testing methods in monitoring the training process, but also provide more comprehensive and objective data support for studying the influence of Cross Fit training on the physical health of middle school students. Through the cross analysis of the training process data collected by the system and the data of physical fitness test results, we can discuss the relationship between training intensity, exercise load and physical fitness improvement effect in depth, and provide scientific basis for optimizing training programs.

4. Data collection

4.1 Data Collection of Student Satisfaction Scale

The student satisfaction scale was distributed through online means such as WeChat from December 13th to December 25th, 2022, and the reliability and validity of the questionnaire were tested. A total of 44 student questionnaires were distributed, 44 were recovered, and 44 were valid, with a recovery rate of 100% and an effective rate of 100%.

4.2 Collection of data for evaluation of physical health indicators in teaching experiments

The teaching experiment lasted from September 2022 to November 2022, and lasted for 12 weeks. Three classes were arranged every week, with a total of 36 hours. Following the principle of easy to difficult and step by step, the whole teaching experiment process is divided into three stages: the basic stage (1-4 weeks), the consolidation stage (5-8 weeks) and the strengthening stage (9-12 weeks). On August 29th, 2022, we collected and recorded the evaluation index data of students' physical health in the experimental group and the control group before the experiment. After the experiment, on November 8th, 2022, we collected and recorded the evaluation index data of students' physical health in the experimental group and the control group after the experiment through the school smart playground platform.

5. Data analysis

5.1 Data Analysis of Student Satisfaction Scale

The result data of 44 valid questionnaires are counted, and the effectiveness of this course development is judged according to the satisfaction evaluation results.

5.2 Analysis of the evaluation data of physical health indicators in teaching experiments

The effective data of students' physical health assessment before and after the teaching experiment were counted, and the effective data were substituted into SPSS23.0. Descriptive analysis, independent sample T-test and paired sample T-test were carried out on the three dimensions of students' physical shape, physical function and physical quality in the experimental class and the control class, respectively, to analyze the influence of physical training curriculum system based on Cross Fit training on middle school students' physical health level.

CHAPTER 4
RESEARCH RESULTS

1. Based on ADDIE model, develop the physical training course of middle school based on Cross Fit

The development and design of middle school physical training courses under the guidance of Cross Fit training theory should include five links: analysis, design, development, implementation and evaluation, which are described as follows:

1.1 Analysis

To develop and design physical training courses in middle schools under the guidance of Cross Fit training theory, we must first do a good job of analysis, including three contents:

1) Analysis of students' needs: Applying Cross Fit training to middle school students' physical training and developing middle school physical training courses reasonably should take students' needs as the starting point, and need to analyze the course objectives, as well as the basis of students' physical level and the gap between them and the standard level, on this basis, determine students' curriculum needs.

2) Analysis of students' characteristics: Before developing middle school students' physical training courses, students' cognitive level should be deeply analyzed, including the understanding of Cross Fit training and the understanding of the importance of physical training courses, so as to master the basis of students' physical fitness level and analyze the levels of students' physical fitness level, so as to provide a basis for determining the course content and teaching methods.

3) Analysis of learning content: determine the content of physical training courses based on the students' physical fitness level and their cognition of Cross Fit training and physical training courses, and choose appropriate training actions and modes according to the analysis results of students' learning needs and learning characteristics, so as to ensure that the course content conforms to the curriculum objectives stipulated in the curriculum standards.

4) Analysis conclusion: Developing middle school physical training curriculum under the guidance of Cross Fit training theory, determining the curriculum content based on students' learning needs, learning characteristics and learning content analysis results, respecting students' individual differences, embodying the people-oriented thought, is conducive to students' good physical and mental development, and at the same time ensures that the curriculum content is more accurate, laying a good foundation for innovative teaching models and teaching methods, and is conducive to comprehensively improving students' physical fitness.

1.2 Design

To develop physical training courses in middle schools under the guidance of Cross Fit training theory, the following design activities should be completed:

1) Design of teaching objectives: After the course content is determined, the teaching objectives should be designed according to the learning task of the "physical fitness" section stipulated in the new curriculum standard, so as to guide students to improve their physical fitness through scientific training and comprehensively improve their physical health.

2) Design of teaching details

2.1) Screening Cross Fit training movements.

The design of middle school physical training courses should be based on screening training movements, which should ensure that the training movements meet the requirements of Cross Fit training mode and meet the needs of students' physical training.

There are three kinds of Cross Fit training movements: Gymnastics, weightlifting and metabolic adaptive movements. (1) Gymnastics is added to Cross Fit training, and the trainees can do self-weight exercises or weight-bearing exercises with equipment. (2) There are three types of Weightlifting training introduced into Cross Fit training: weightlifting training, Olympic weightlifting training and weightlifting training. Although there are differences in training actions in different training modes, the training objectives are consistent, and all of them are to increase the hip and leg strength of the

trainees through scientific training and improve their immediate power. (3) Metabolic Conditioning, that is, "aerobic training", is to gradually improve the cardiopulmonary function of the trainees through cyclic repetitive motion training, which needs long-term persistence. Common training actions include running, cycling, rowing and skipping rope.

Collecting and sorting out the literature, it is found that the official website of Cross Fit provides 278 action demonstrations, but not all actions are suitable for middle school physical training courses, because some actions have certain security risks, such as handstand walking, handstand touching shoulders and other actions, which are likely to lead to students' injuries, and some actions require strict sports environment, such as sledding. Some movements are very similar, such as climbing rope and climbing rope by hand. Therefore, in this study, 10 related experts were specially consulted, and the Cross Fit training movements were screened and integrated with reference to expert opinions, and finally the training movements were determined as shown in Table 6.

Table 6 Summary of Training Actions of Physical Training Course Based on Cross Fit Training

G: gymnastics, self-weight training	M: metabolic adaptability training of single structure	W: weightlifting
Lie on your back with both ends up.	Jumping on the box	Dumbbell swing
Squat jump	Opening and closing jump	Hard pull
Lateral plate support	Single-shake skipping rope	Squat clean and jerk
Belly rolling	400 m sprint	Dumbbell bench press

Table 6 (continued)

G: gymnastics, self-weight training	M: metabolic adaptability training of single structure	W: weightlifting
bobby jump	Turn-back run	Squat behind the neck
Jump and squat	1000 m jogging	Rocket push
push-up	200 m sprint	Dumbbell flip
One-legged squat	400 m variable speed running	One-leg hard pull
Hanging knee	Double shake skipping rope	Bend over and row.

2.2) Design of course content: Traditional physical education course teaching includes three parts: preparation, basic and ending. Cross Fit training course teaching is different from traditional physical education course teaching, and it adds daily training (WOD) and team exercises on the basis of preparation, basic activities and ending. In this study, Cross Fit training content is added to the basic links of traditional physical education curriculum, and the curriculum structure is still composed of three parts: preparation link, basic link and ending link. Preparation (2 minutes), the content and requirements are the same as those of traditional physical education courses; Basic link (40 minutes), organize students to carry out Cross Fit training, including warm-up, skill teaching and daily training (WOD); In the end part (3 minutes), after the completion of the training task, students are asked to jog, stretch statically or adjust their bodies by breathing training, and a complete Cross Fit training is completed.

In this study, we refer to "Cross Fit Level 1 Training Guide" and WOD related contents, and consult middle school teachers with professional expertise, and finally determine the training content of Cross Fit. After comprehensive analysis of

students' characteristics, physical fitness level, school facilities and other factors, this study determines the specific content of the basic links of Cross Fit physical training course:

A. Course content arrangement in the basic stage (1-4 weeks):

The task of this stage is to let the trainees master the basic movements of Cross Fit training and be familiar with the motor skills through twelve Cross Fit trainings.

The first stage of WOD is designed to master basic movements. Squatting, jumping and a small amount of self-weight movements are introduced into gymnastics. Through training, the trainees can master correct movements and postures, activate muscle joints and lay the foundation for subsequent training. Weightlifting is also based on the basic movements with less load. Through training, the trainees can feel the method and process of power output, promote the independent formation of their power transmission chain, and prepare for the output of more power in subsequent training. Single-structure metabolic adaptation training focuses on adjusting body movements. Through the adjustment movement training, the trainees can quickly recover their body functions, and their cardiopulmonary functions can be fully exercised to ensure the Cross Fit training effect.

Table 7 Course Content Arrangement in Basic Stage

Class	Project	Training form	Content	Ask
1	M	EMOM	Two groups (10 times in each group) of single-shaking rope skipping cooperated with 15-meter turn-back running training.	The training duration of each group is 1 minute, with an interval of 30 seconds.
2	GW	For time	10 times of dynamic alternate lunges and squats, 10 times of standard push-ups, 10 times of supine hip flexion and abdominal roll (from both ends of supine) and 10 times of barbell hard pull. 10 explosive rocket Thruster	Adopt 5-minute interval training mode: complete the specified number of groups within a limited time, and the rest of the time is regarded as recovery period.
3	MGW	AMRAP	200-meter sprint, 10 vertical jumps and split legs (opening and closing jumps), 10 jumps and squats, and 10 traditional hard pulls. Finally completed 10 rocket pushes.	Set up a 15-minute training unit: the subjects are required to complete the maximum action repetition within the unit time, and the unit interval is arranged for 5 minutes to recover.
4	G	EMOM	Squat Jump 10 times, 10 Burpee, 10 postural weight-bearing trunk rotations (Russian rotation)	Implement the minute training scheme: take 60 seconds as the training unit, and set 30 seconds for active recovery between units.
5	MW	For time	200-meter sprint, 30 times single-shake rope skipping 10 hard pulls and 10 deep squats behind the barbell neck	Adopt the regular training method: complete the number of target groups within 5 minutes, and use the remaining time for passive recovery

Table 7 (continued)

Class	Project	Training form	Content	Ask
6	MGW	AMRAP	15-meter multi-directional turn-back run, 200-meter sprint run, 20 times supine hip flexion and abdomen roll, 20 times dumbbell hip swing (Kettlebell Swing variant)	Establish a 15-minute training block: pursue the maximization of action cycle in the block, and give a complete rest for 5 minutes between blocks.
7	W	EMOM	10 times of unilateral support hard pull (one leg hard pull), 10 times of dumbbell swing and 10 times of squat behind the neck.	Implement a high-intensity interval scheme: every minute is a complete training unit, with a buffer time of 30 seconds between units.
8	MG	For time	200-meter sprint, 20 single-shake rope skipping, 10 dynamic lunges and 10 explosive squats.	Implement regular and quantitative training: complete the required training amount within the 5-minute window period, and the rest time will be automatically converted into a rest period.
9	MGW	AMRAP	10 vertical jumps (opening and closing jumps), 10 double-shaking rope skipping, 10 rocket pushing and 400-meter sprint.	Adopt extended training unit: pursue the maximum amount of exercise in 15 minutes of continuous training, and arrange a 5-minute recovery period after training.
10	GW	EMOM	10 times of one-leg squat (Bulgarian split-leg squat variant), 10 times of hanging leg lift (knee lift) and 10 times of traditional hard pull.	Set short-period training mode: take 1 minute as the basic unit, and keep 30 seconds transition time between units.

Table 7 (continued)

Class	Project	Training form	Content	Ask
11	MW	For time	15-meter turn-back run, 20 single-shake rope skipping, 20 vertical jumps and split legs (opening and closing jumps), 10 rocket pushes, 10 barbell squats behind the neck	Establish a periodic training structure: complete the specified content in the training period of 5 minutes, and turn to the recovery stage in the remaining time.
12	MG	AMRAP	200-meter running, 10 jumps, 10 squats, 10 standard push-ups, and 10 weight-bearing torso rotations (Russian twist)	Implement the outward bound training unit: complete the most action cycles during 15 minutes of continuous exercise, and then take a complete rest for 5 minutes.

Note: GW: gymnastics, self-weight training+weightlifting; MGW: single structure metabolic adaptability training+gymnastics, self-weight training+weightlifting;

MW: single structure metabolic adaptability training+weightlifting; MG: single structure metabolic adaptability training+gymnastics and self-weight training.

B. Course arrangement in consolidation phase (5-8 weeks):

Cross Fit training at this stage will gradually increase the intensity. After the first stage of training, the trainees have a certain adaptability to Cross Fit training, and their strength, speed, endurance and cardiopulmonary function have been enhanced to some extent. At this stage, we will gradually improve the complexity of movements and increase the number of training repetitions.

In WOD design, some coherent movements are added to the training movements to help the trainees become more familiar with the basic training movements and improve their sports skills. Gymnastics movement training is not only more difficult, but also makes clear speed standards to improve the body control ability of the trainees

and make their bodies more coordinated. In the movement training of weightlifting events, the movement difficulty will be increased, and the weight training will increase the weight, further improving the activity level of the heart and other organs of the trainees. Metabolic adaptive exercise is mainly aerobic exercise, which helps trainees improve their tolerance and prepare for more intensive training.

Table 8 Course Content Arrangement in Consolidation Stage

Class	Project	Practice method	Content	Ask
13	M	Long Duration workout	Perform 20 seconds of lateral core stability training (lateral plate support), and then complete 10 minutes of continuous aerobic running training.	The steady-state training mode is adopted, and a 4-minute recovery period is set between training units.
14	GW	Tabata	20 times of upper limb push-up training (standard push-ups), 20 times of dynamic lower limb alternate squat jump (lunge squat jump), 15 times of explosive push-up training (rocket push) and 15 times of unilateral hip joint hinge training.	Implement the single-action centralized training method, and arrange a 3-minute interval between actions.
15	MGW	For time	15m multi-directional variable speed running training, 30 coronal jumping trainings (opening and closing jumps), 15 compound pushing movements (rocket pushing), and 15 lower limb explosive training (squat clean and jerk).	Establish a 5-minute training window, and use the remaining time to recover after completing the specified number of groups.
16	G	TNG	15 seconds of isometric lateral trunk contraction (lateral plate support), 15 times of chest push-pull training, and 15 times of whole body coordination training (bobby jump)	Keep the movement fluent, and give a buffer time of 2 minutes between training units.

Table 8 (continued)

Class	Project	Practice method	Content	Ask
17	MW	AQAP	200-meter maximum intensity sprint, 30 steps lifting training, 10 torso forward rowing movements, and 10 lower limb burst pressing training.	Pursuing the maximum speed to complete the training group, and providing complete rest for 2 minutes between groups.
18	GMW	For time	20 times of unilateral lower limb squat training, 20 times of double-shaking rope skipping training, 20 times of centripetal contraction training of rectus abdomin is (belly rolling) and 20 times of explosive snatch training.	Adopt a regular and quantitative training scheme, and enter the recovery stage after completing the number of target groups within 5 minutes.
19	W	EMOM	10 dumbbell somersaults, 10 lower limb push-ups and 10 squats with weight behind the neck.	Execute the minute training plan, take 60 seconds as training unit, and keep 30 seconds transition between units.
20	MG	AQAP	400-meter sprint, 20 double-shake rope skipping exercises, 20 explosive squat jumps and 20 unilateral hip strengthening exercises.	Implement high-intensity training mode, complete the training group at the fastest speed, and arrange 4 minutes of recovery between groups.
21	WMG	For time	20 coronal split-leg jumps, 20 whole-body coordination training (Bobby jumps), 20 core muscle centripetal training, 10 traditional hard pull training and 10 explosive snatch movements.	Set up a periodic training structure, and enter the rest stage after completing the specified content within a training period of 5 minutes.

Table 8 (continued)

Class	Project	Practice method	Content	Ask
22	GW	AMRAP	20 times of dynamic lower limb alternate squatting and jumping training, 20 times of hanging position core knee lifting training, 20 times of unilateral hip joint strengthening training, 20 times of trunk forward rowing action and 20 times of dumbbell dynamic swinging.	Using the extended training unit, the maximum action cycle is completed within 15 minutes, and then the recovery is carried out in 4 minutes.
23	MW	AHAP	20 times of weight-bearing box-type stepping training, 20 times of traditional hard pulling movements and 20 times of compound pushing training (rocket pushing).	Carry out weight-bearing intensive training, and set a recovery time of 2 minutes between training groups.
24	GM	AQAP	200-meter maximum speed sprint training, 20 explosive squat jumps, 20 upper limb push training, and 20 supine core double contraction training.	Pursuing the ultimate speed to complete the training content, and providing a complete rest for 3 minutes between groups.

C. Course arrangement for intensive phase (9-12 weeks):

At this stage, it is necessary to continue Cross Fit training based on the training results of the previous two stages, and appropriately increase the difficulty and intensity of movement.

In WOD design, the proportion of coherent movements is increased in the basic movement training in the third stage, and the muscles of the trainees will be more fully exercised. Gymnastics will focus on technical action training, which will make the movements more coherent and increase the difficulty. Weightlifting movement training continues to increase the weight and training times, and the heart function of the

trainees continues to be strengthened. In the aspect of metabolic adaptive exercise, anaerobic exercise is properly added on the basis of aerobic exercise, which increases the time and distance of exercise and exercises the physical fitness of the trainees from different angles.

Table 9 Course Content Arrangement in Intensive Stage

Class	Project	Practice method	Content	Ask
25	M	Long Duration workout	10 minutes of continuous aerobic running training, 30 seconds of lateral core stability exercise (side plate support)	The steady-state training mode is adopted, and a 5-minute recovery period is set between training units.
26	GW	Tabata	20 times of upper limb horizontal push training (dumbbell bench press), 20 times of explosive whole body push training (rocket push) and 20 times of unilateral hip joint hinge training (one leg hard pull). 1.	Implement the single-action centralized training method, and arrange a 3-minute interval between actions.
27	MGW	AMRAP	400 m variable speed running, 15 m turn-back running, 20 clean and jerk squats and 20 opening and closing jumps.	Establish a 20-minute training window period, complete the maximum number of repetitions in the unit time, and arrange the unit interval for 3 minutes to recover. 1.

Table 9 (continued)

Class	Project	Practice method	Content	Ask
28	G	EMOM	400-meter intermittent variable-speed running training, 15-meter multi-directional turn-back running, 20 lower limb explosive training (squat clean and jerk) and 20 coronal jumping exercises (opening and closing jumps) 1.	1. High-intensity interval scheme, each minute is regarded as a complete training unit, and a buffer time of 30 seconds is provided between units for 20 minutes.
29	MW	AQAP	20 times of rotating core stability training (Russian rotation), 20 times of unilateral lower limb strength training (one leg squat), 20 times of traditional hip joint strengthening training (hard pull), and 20 times of explosive somersault exercises.	Pursuing the maximum speed to complete the training group, and providing complete rest for 2 minutes between groups.
30	GWM	AMRAP	20 times of trunk forward rowing training, 20 times of unilateral hard pull, 20 times of one-arm push-ups training, and 20 times of rectus abdominis centripetal contraction training (belly rolling).	Every 20 minutes, one group will be trained, and as many action cycles as possible will be done in the group, with a rest of 3 points between groups.
31	GWM	AMRAP	30 box-type step-up training, 20 whole-body coordination training (bobby jump), and 400-meter sprint.	Do multiple action cycles, and rest 3 points between groups.

Table 9 (continued)

Class	Project	Practice method	Content	Ask
32	MG	AQAP	20 times of trunk rotation stability training, 20 times of abdominal curl training, 20 times of dumbbell dynamic swing, 20 times of compound push training (rocket push) and 200-meter speed training.	Using the extended training unit, the maximum number of action cycles is completed within 20 minutes, followed by 3 minutes of recovery.
33	GWM	For time	Push-ups 20 times, belly roll 20 times.	Implement the extreme speed training program, complete the training content as quickly as possible, and provide 3 minutes of complete rest between groups.
34	GWM	AMRAP	20 times of dynamic lower limb alternate squat training (jumping arrow step squat), 20 times of upper limb push training, 30 times of split leg jump training (opening and closing jump), 30 times of back muscle group intensive training (bending over and	Set up a regular and quantitative training structure, and enter the recovery stage after completing the number of target groups within 5 minutes.
35	MWG	Long Duration workout	1000-meter low-intensity continuous running training, 0-second lateral core isometric contraction training, 3-minute continuous skipping training.	Adopt periodic training method, pursue the maximum number of action cycles during the training period of 20 minutes, and then arrange a recovery period of 3 minutes.

Table 9 (continued)

Class	Project	Practice method	Content	Ask
36	WMG	AMRAP	20 times of traditional hard pull training, 20 times of compound push training (rocket push), 400-meter variable speed running training and 20 times of hanging position core knee lifting training.	Conduct continuous training, and set 3 minutes recovery time between training units. 1.

2.3) Design of periodic arrangement

Cross Fit training has been widely used in the United States, and the guiding theory and practical operation process are mature. Each training cycle runs through three training elements, such as gymnastics, weightlifting and metabolic adaptive exercise. The training method of each cycle can be "three breaks for one" or "five breaks for two", but all three training elements should be arranged in a balanced way. In this study, according to the characteristics of Cross Fit training and middle school physical education curriculum, the cycle design of middle school physical training curriculum based on Cross Fit training is made, and it is determined that three class hours of training are completed every week, and two curriculum elements are arranged for each class hour; The experiment lasted for 12 weeks and was divided into three cycles, each of which lasted for four weeks. The training course arrangement of a single cycle is shown in Table 10, and the course arrangement of other cycles is the same.

Table 10 Cross Fit Physical Education Curriculum Cycle Table

Number of weeks	First week			Second week			Third week			Fourth week		
Time	Monday	Wednesday	Friday	Monday	Wednesday	Friday	Monday	Wednesday	Friday	Monday	Wednesday	Friday
Key element	M	GW	MGW	M	GW	MGW	M	GW	MGW	M	GW	MGW

2.4) Design of strength control

Cross Fit training arranges unit days, binary days and ternary days to design the training framework, clearly arranges the training elements of each training day, and designs the training content, intensity and interval time accordingly. As shown in Table 11.

A. On the unit day, we should focus on the element priority training. First, we should complete the metabolic adaptability training by slow running, so that the muscles and joints of the trainees can be mobilized, and then we should carry out gymnastics skill training and weightlifting heavy load training. However, we should control the intensity of running training and ensure sufficient interval time.

B. Binary Day focuses on task priority training, and completes the training actions alternately for 3-5 times according to the training schedule, and controls the training intensity at medium and high intensity, and strictly controls the interval time.

C. Three-day focuses on time-first training, carries out specified action training according to the training schedule, and limits the action completion time, requiring the trainees to increase the number of action training as much as possible within the specified time. The training intensity is medium and low intensity, and the training is carried out continuously within the specified time, and no interval time is designed.

Table 11 Cross Fit training architecture

Fate	Unit day	Binary day	Sanyuanri
Priority type	Element	Task	Time
Training structure	M/G/W	Repeat 3 to 5 groups and record the time.	20-minute uninterrupted cycle exercise
Intensity of training	M is slow long-distance strength, G is high-skill strength, and W is high-weight strength.	The intensity is medium and high.	The intensity is medium and low.
Intermittent characteristics	Intermittent sufficiency	Intermittent short	No intermission

The American Sports Medical Association has classified the exercise intensity, and this study has classified the training intensity of physical training courses based on Cross Fit training, as shown in Table 12. The maximum heart rate of the trainees is 203(220- age), and the training intensity is controlled so that the minimum heart rate of the trainees is 110 beats per minute and the maximum is 180 beats, and the RPE value is between 12 and 16. Monitor the changes of students' physiological indexes during the training process, and ask students' feelings at any time to ensure that the training is effective and safe.

Table 12 Sports Grade Division Table

Exercise intensity	RPE	Maximum heart rate	Subjective physical sensation
Very small strength	<10	<35%	No effort at all.
Small strength	10-11	35-54%	More relaxed
Medium strength	12-13	55-69%	Slightly laborious
Greater strength	14-16	70-89%	Generally laborious
Great strength	17-19	>90%	Very laborious
Ultimate strength	20	100%	End of energy consumption

Based on the development and design of Cross Fit training, the physical training course for middle school students should properly control the training intensity to ensure that the difficulty and intensity of the training content are not beyond the physical endurance of middle school students. In the first experimental cycle, the element-first training mode was adopted. After completing an action containing two training elements, a 2-minute interval was arranged, and the heart rate of the trainees was kept between 110 beats/min and 130 beats/min. In the second experimental period, the task-first training mode was adopted, and the action training was carried out for 2 to 3 times according to the course arrangement, and then an interval of 30 seconds was arranged to monitor the physiological indexes of the trainees in real time to ensure their heart rate within the specified range; In the third experimental period, the time-first training mode is the main mode. According to the curriculum arrangement, the prescribed action training is completed, and the action completion time is limited. A group of action completion time is internally designed with interval time to keep the heart rate index of the trainees within the specified range.

Table 13 Intensity Arrangement of Physical Training Course Based on Cross Fit Training

Training cycle	Training mode	Priority type	Training structure	Intensity of training	Intermittent characteristics	Heart rate (%)
First cycle	Binary day	element	Repeat 1-2 times	Small and medium	Intermittent sufficiency	110-130
Second cycle	Binary day	task	Repeat 2-3 times	medium	Intermittent short	130-150
The third cycle	Binary day	time	Repeat the cycle for 13min	crowning	No intermission	150-170

2.5) Design of teaching evaluation

Physical training course is based on students' physical fitness level and physical fitness level. Teachers need to investigate and evaluate students' physical condition, and design teaching contents and teaching objectives on this basis. At the same time, based on the relevant provisions of the National Standards for Students' Physical Fitness and Health, combined with the indicators and actions specified in the guidance document of the physical education test for the senior high school entrance examination, we should determine the contents and methods of physical training, strengthen the training effect of students through repeated assessment tests, and stimulate the autonomy of students' physical training. Let students master the methods of monitoring physical fitness indicators and health indicators, urge them to master their physical fitness level and health status at any time, gain a sense of accomplishment in physical fitness training, mobilize them to continue to participate in physical fitness training, further enhance their physical fitness level, improve their enthusiasm for health status, and cultivate students' self-health management ability.

Table 14 Evaluation of Physical Training Course

Evaluation content	Evaluation type	Specific content
Basic physical fitness	Term examination	It points to the test and diagnosis of students' healthy physical fitness (body composition, flexibility, endurance, strength, etc.) and sports physical fitness (speed, sensitivity, explosive force, etc.), and the time is arranged at the end of the semester.
National Students' Physical Health Standard	Academic year assessment	With reference to the items and achievements of "National Students' Physical Health Standards (revised in 2014)" which must be tested according to the national standards every academic year.
the entrance examination for senior high school	Entrance examination	Take the physical examination items and results of the third-year graduates for reference.
Challenge competition	Process assessment	Conduct a physical challenge or competition on a certain theme once a month.
Exercise log	Process assessment	Record the attitude, feelings and opinions about Cross Fit training activities, and integrate the experience into the exercise.

1.3 Development

The key link of developing middle school physical training curriculum based on Cross Fit is developing activities;

After completing the determination of teaching objectives, the selection of teaching content and the arrangement of experimental cycle, the researchers conducted a comprehensive analysis of students' cognitive basis and learning interest, and developed the course content accordingly.

1.4 Implementation

The important activities of developing middle school physical training curriculum based on Cross Fit are as follows:

(1) On the basis of completing the preparatory work, especially after completing the design of 3.3 research tools, we began to arrange for 12 weeks of training experiments to specifically implement the course content.

(2) Collect students' training data in real time after the start of the experiment, and use the school's smart playground platform to make statistics on the data, and analyze the influence of the training experiment on students' physical health indicators.

(3) After the completion of all the training courses, the students' satisfaction was investigated.

1.5 Assessment

This study conducted assessments on the following fitness items for students: 50-meter run, pull-ups, standing long jump, etc.

2. The effect of improving students' physique by using physical training courses

2.1 Comparative analysis of physical health indicators of students in the experimental group and the control group before the experiment

In order to explore whether there is a significant difference between the students' physical health in the experimental group and the control group before the experiment, the author entered the test data of physical shape, physical function and physical quality of the students in the experimental group and the control group into SPSS23.0, and conducted descriptive statistics and independent T test respectively. The results are as follows.

Table 15 Comparison of physical health indexes between the experimental group and the control group before the experiment

Test item			Gender	Number	Experimental group	Control group	T	P
Body shape		Height (cm)	Man	46	164.13±6.92	163.28±6.15	1.242	0.362
			Woman	42	157.52±6.31	157.61±5.89	-0.785	0.325
		Weight (kg)	Man	46	51.37±9.36	50.03±8.74	1.364	0.069
			Woman	42	46.08±7.43	46.17±6.86	-0.798	0.173
		BMI index (kg/m2)	Man	46	19.07±1.82	18.76±1.71	0.987	0.797
			Woman	42	18.57±1.39	18.59±1.25	-0.531	0.425
Body function		Vivid lung (ml)	Schoolboy	46	2942.80±612.37	2889.26±635.20	1.861	0.137
			Girl student	42	2658.35±529.61	2595.30±493.75	1.592	0.195
Physical quality	Speed quality	50m run (s)	Schoolboy	46	8.51±0.62	8.53±0.71	-0.582	0.539
			Girl student	42	9.82±0.68	9.79±0.69	0.736	0.671
Physical quality	Flexibility quality	Sitting body flexion (cm)	Schoolboy	46	8.95±1.82	9.04±1.95	-0.826	0.395
			Girl student	42	13.82±1.26	14.21±1.08	-1.038	0.471
	Strength quality	Pull-ups (times)		46	8.35±1.65	8.56±1.71	-0.854	0.386
		Standing long jump (cm)	Schoolboy	46	203.28±8.93	204.15±8.53	-1.037	0.471

Table 15 (continued)

Test item		Gender	Number	Experimental group	Control group	T	P
	1 minute sit-ups		42	30.59±5.12	31.03±6.06	-0.936	0.695
	Standing long jump (cm)	girl student	42	166.38±6.73	167.24±5.98	-1.358	0.593
Endu-rance quality	1000m（s）	schoolboy	46	288.35±12.50	290.55±11.55	2.684	0.851
	800m（s）	girl student	42	255.85±10.00	257.15±10.85	2.706	0.897

Note: P<0.01 means that the difference is extremely significant, P<0. 05 means that the difference is significant, and P>0. 05 means that the difference is not significant.

As can be seen from Table 15, the differences among the three basic morphological parameters, such as height, weight and body mass index (BMI), were not statistically significant (P > 0.05) by independent sample t-test, indicating that the subjects in the experimental group and the control group are homogeneous in baseline body morphological characteristics. The results of pulmonary function test showed that there was no significant difference between the experimental group (2942.80±612.37ml) and the control group (2889.26±635.20ml) (t=1.497, p = 0.137). There was no significant difference between the experimental group (2658.35±529.61ml) and the control group (2595.30±493.75ml) (t=1.302, p=0.195). Speed quality: The 50-meter sprint test showed that the difference between the male experimental group (8.51±0.62s) and the control group (8.53±0.71s) was only 0.02s (P = 0.539). The difference between the female experimental group (9.82±0.68s) and the control group (9.79±0.69s) was 0.03s(p=0.671), and neither of them reached the statistically significant level. Flexibility: The measured data of sitting body flexion showed that there was no significant

difference in flexibility between the experimental group (8.95±1.82cm) and the control group (9.04±1.95cm) (P = 0.395). There was no significant difference between the experimental group (13.82±1.26cm) and the control group (14.21±1.08cm) (p=0.471). Strength quality: The baseline test results of standing long jump, pull-ups (male), sit-ups (female) and other strength-related indicators show that the initial muscle strength level of the experimental group and the control group is in the same statistical category (P > 0.05). Endurance quality: In the long-distance race test, there was no significant difference between the male 1000m running test group (288.35±12.50s) and the control group (290.55±11.55s) (P = 0.851). There was no significant difference between the experimental group (255.85±10.00s) and the control group (257.15±10.85s) (p=0.897). Baseline data analysis of various physical health indicators shows that the subjects in the experimental group and the control group have good comparability in body shape, function and sports quality before the experimental intervention (P > 0.05), which meets the requirements of equal group comparison in experimental design.

2.2 Comparative analysis of various physical health indicators of students in experimental group before and after the experiment

In order to explore what changes have taken place in the physical health of the students in the experimental group after 12 weeks of training in the physical training course based on Cross Fit, the author entered the test data of the students' physical shape, physical function and physical quality in SPSS23.0 before and after the experiment, and conducted descriptive statistics and paired T-test respectively. The results are as follows.

1) Comparative analysis of body shape test results before and after the experiment in the experimental group

Table 16 Comparison of body shape of experimental group before and after experiment

Test item		Gender	Number	Before the experiment	After the experiment	T	P
Body shape	Height (cm)	Man	23	164.13±6.92	165.48±7.01	-1.762	0.075
		Woman	21	157.52±6.31	158.96±6.88	-1.395	0.219
	Weight (kg)	Man	23	51.37±9.36	50.82±9.83	1.538	0.153
		Woman	21	46.08±7.43	45.42±7.71	1.971	0.074
	Body mass index	Man	23	19.07±1.82	18.56±1.76	1.283	0.186
		Woman	21	18.57±1.39	17.98±1.22	1.878	0.081
Body function	Vital capacity (ml)	Schoolboy	23	2942.80±612.37	2948.15±623.16	-3.951	0.153
		Girl Student	21	2658.35±529.61	2663.75±412.23	-3.572	0.185
Physi-cal quality	Speed quality	50m run (s)	Schoolboy	23	8.51±0.62	7.61±0.82	4.617	0.003
			Girl Student	21	9.82±0.68	8.92±0.73	4.835	0.001
	Flexi-bility quality	Sitting body flexion (cm)	Schoolboy	23	8.95±1.82	11.21±1.93	-3.173	0.004
			Girl Student	21	13.82±1.26	16.05±1.31	-3.952	0.002

Table 16 (continued)

Test item		Gender	Number	Before the experiment	After the experiment	T	P
Strength quality	Pull-ups (times)	Schoolboy	23	8.35±1.65	10.56±1.85	-3.105	0.003
	Standing long jump (cm)		23	203.28±8.93	211.57±9.72	-6.953	0.000
	1 minute sit-ups (times)	Girl Student	21	30.59±5.12	36.73±5.81	-5.984	0.001
	Standing long jump (cm)		21	166.38±6.73	171.04±5.99	-6.627	0.000
Endu-rance quality	1000m (s)	Schoolboy	23	288.35±12.50	286.02±12.64	1.853	0.103
	800m (s)	Girl Student	21	255.85±10.00	253.27±10.72	1.927	0.985

Note: P<0.01 means that the difference is extremely significant, P<0. 05 means that the difference is significant, and P>0. 05 means that the difference is not significant.

The data in Table 16 shows that after 12 weeks of Cross Fit training intervention, the subjects in the experimental group did not show statistically significant changes in morphological indexes such as height, weight and BMI (P > 0.05). Specifically, although the weight of male and female students decreased slightly, the decline did not reach a significant level, which may be related to the short intervention period (12 weeks), which led to the morphological adaptability changes not being fully manifested. This shows that short-term Cross Fit training has limited effect on reshaping the body shape and structure of teenagers. The results of pulmonary function test

showed that the vital capacity of male subjects increased from 2942.80±612.37 mL at baseline to 2658.35 529.61 ml after the experiment, and that of female subjects increased from 2658.35 529.61 ml to 2663.75±412.23 mL, but the comparison before and after the test did not reach a statistically significant level (P > 0.05) This result suggests that the improvement effect of 12-week training program on respiratory system function is not significant. Speed quality: In the 50-meter running test, the performance of male subjects was significantly improved from 8.51 0.62s to 7.61 0.82s (P = 0.003, effect η = 0.18), and that of female subjects was improved from 9.82 0.68s to 8.92 0.73s (P = 0.001, η = Flexibility: The flexion test of sitting position showed that the flexibility of both male and female subjects in the experimental group was improved by about 2 cm (P < 0.01), which confirmed that the training program could effectively enhance the extensibility of the muscle-tendon system and optimize the range of joint motion. Strength quality: Upper limb strength: Male pull-ups increased significantly from 8.35 1.65 times to 10.56 1.85 times (P < 0.01), reflecting that the strength of latissimus dorsi and upper limb muscles increased significantly. Core endurance: The number of female sit-ups in one minute increased from 30.59 5.12 to 36.73 5.81 (P < 0.01), indicating that the endurance of abdominal muscles was obviously improved. Explosive power of lower limbs: In the standing long jump, the male increased from 203.28±8.93 cm to 211.57±9.72 cm, and the female increased from 166.38±6.73 cm to 171.04±5.99 cm (both P < 0.01), which verified the positive influence of training on the power output of lower limbs. Endurance quality: The test of long-distance running shows that the score of men's 1000-meter race is slightly shortened from 288.35±12.50 s to 286.02±12.64 s, and that of women's 800-meter race is slightly increased from 255.85±10.00 s to 253.27±10.72 s, but they are not statistically significant (P > 0.05).

2.3 Comparative analysis of various physical health indicators of students in the control group before and after the experiment

In order to explore what changes have taken place in the physical health of the students in the control group after 12 weeks of traditional physical education class training, the author entered the test data of body shape, body function and body quality

of the students in the control group into SPSS23.0 before and after the experiment, and conducted descriptive statistics and paired t-test respectively. The results are as follows.

1) Comparative analysis of body shape test results of the control group before and after the experiment.

Table 17 Comparison of body shape of control group before and after experiment

Test Item			Gender	Number	Before The Experiment	After The Experiment	T	P
Body Shape		Height (Cm)	Man	23	163.28±6.15	164.92±6.02	-1.925	0.091
			Woman	21	157.61±5.89	159.17±5.78	-1.917	0.085
		Weight (Kg)	Man	23	50.03±8.74	49.48±7.39	1.275	0.172
			Woman	21	46.17±6.86	45.36±6.05	1.492	0.159
		Bmi Index (Kg/m2)	Man	23	18.76±1.71	18.19±1.60	1.614	0.145
			Woman	21	18.59±1.25	17.90±21.13	1.658	0.116
Body Function		Vital Capacity (Ml)	Schoolboy	23	2889.26±635.20	2891.13±642.15	-1.984	0.153
			Girl Student	21	2595.30±493.75	2597.06±497.52	-1.875	0.128
Physical Quality	Speed Quality	50m Run (s)	Schoolboy	23	8.53±0.71	8.39±0.74	1.045	0.131
			Girl Student	21	9.79±0.69	9.65±0.72	1.118	0.106
	Flexibility Quality	Sitting Body Flexion (Cm)	Schoolboy	23	9.04±1.95	9.75±2.06	-1.539	0.268

Table 17 (continued)

Test Item		Gender	Number	Before The Experiment	After The Experiment	T	P
		Girl Student	21	14.21±1.08	14.96±1.39	-1.874	0.183
	Pull-Ups (Times)	Schoolboy	23	8.56±1.71	9.13±1.58	-0.742	0.098
	Standing Long Jump (Cm)		23	204.15±8.53	205.02±9.02	-0.872	0.128
Strength Quality	1 Minute Sit-Ups (Times)	Girl Student	21	31.03±6.06	31.85±6.37	-0.942	0.106
	Standing Long Jump (Cm)		21	167.24±5.98	168.13±6.14	-1.015	0.081
	1000m (s)	Schoolboy	23	290.55±11.55	288.16±11.86	1.563	0.163
Endu-rance Quality	800m (s)	Girl Student	21	257.15±10.85	255.03±11.07	1.984	0.196

Note: P<0.01 means that the difference is extremely significant, P<0. 05 means that the difference is significant, and P>0. 05 means that the difference is not significant.

As can be seen from Table 17, the body shape indexes (height, weight and BMI) of the subjects in the control group did not show statistically significant changes before and after the experiment (P > 0.05). Specifically, the height of male subjects increased from 163.28±6.15 cm to 164.92±6.02 cm, and that of female subjects increased from 157.61±5.89 cm to 159.17±5.78 cm ；. In terms of body weight, the

male body weight decreased from 50.03±8.74 kg to 49.48±7.39 kg, and the female body weight decreased from 46.17±6.86 kg to 45.36±6.05 kg ；. In terms of BMI index, male decreased from 18.76 1.71 to 18.19 1.60, and female decreased from 18.59 1.25 to 17.90 1.13. None of the above changes reached the statistically significant level, indicating that the 12-week traditional physical education curriculum has limited influence on teenagers' body shape. The data of vital capacity test showed that the male subjects increased slightly from 2889.26±635.20 mL to 2891.13±642.15 mL, and the female subjects increased slightly from 2595.30±493.75 mL to 2597.06±497.52 mL, but there was no significant difference between before and after the test in the group ($P > 0.05$). This result shows that the traditional physical education curriculum has no significant effect on improving respiratory system function. Physical fitness index: In the 50-meter running test, the scores of male subjects decreased slightly from 8.53 0.71s to 8.39±0.74 s($P = 0.131$), while those of female subjects decreased slightly from 9.79 0.69s to 9.65±0.72 s($P = 0.106$), which did not reach the statistically significant level. This result shows that the traditional physical education curriculum has a limited role in promoting the speed quality of teenagers. The sitting posture flexion test showed that the flexibility of male subjects increased by 0.71 cm and that of female subjects increased by 0.75 cm, but there was no significant difference between the two groups ($P > 0.05$), which indicated that the traditional physical education course had no obvious effect on improving the range of joint motion. Upper limb strength: There was no significant difference in the number of male pull-ups before and after the test ($P = 0.098$). Core endurance: The number of female sit-ups in one minute has not changed significantly ($P = 0.106$). The explosive force of lower limbs: the score of standing long jump for men increased from 204.15±8.53 cm to 205.02±9.02 cm($P = 0.128$), and that for women increased from 167.24±5.98 cm to 168.13±6.14 cm($P = 0.081$), and there was no statistical significance. To sum up, although the traditional physical education curriculum has a certain degree of positive impact on the strength and quality of young people, the improvement rate has not reached a significant level. Long-distance running test showed that the scores of men's 1000-meter running decreased slightly from 290.55

11.55s to 288.16 11.86s, while those of women's 800-meter running decreased slightly from 257.15 10.85s to 255.03 11.07s, but there was no significant difference within the group (P > 0.05). This shows that the 12-week traditional physical education course has limited effect on improving cardiopulmonary endurance. The influence of 12-week traditional physical education curriculum on teenagers' body shape, body function and various sports qualities (speed, flexibility, strength and endurance) has not reached a statistically significant level, suggesting that conventional physical education teaching has limited improvement effect on physical health under short-term intervention, and it is necessary to combine more optimized training programs to enhance the intervention effect.

2.4 Comparative analysis of various physical health indicators of students in the experimental group and the control group after the experiment

In order to explore whether there is a significant difference in the physical health of students in the experimental group and the control group after 12 weeks of experiment, the author entered the test data of physical shape, physical function and physical quality of students in the experimental group and the control group into SPSS23.0, and conducted descriptive statistics and independent T test respectively. The results are as follows.

1. Comparative analysis of the test results of students' body shape between the experimental group and the control group after the experiment

Table 18 Comparison of body shape between experimental group and control group after experiment

Test Item		Gender	Number	Experimental Group	Control Group	T	P
Body Shape	Height (Cm)	Man	46	165.48±7.01	164.92±6.02	1.201	0.316
		Woman	42	158.96±6.88	159.17±5.78	-0.798	0.394
	Weight (Kg)	Man	46	50.82±9.83	49.48±7.39	1.335	0.071

Table 18 (continued)

Test Item			Gender	Number	Experimental Group	Control Group	T	P
Body Function			Woman	42	45.42±7.71	45.36±6.05	0.706	0.208
		Bmi Index (Kg/m2)	Man	46	18.56±1.76	18.19±1.60	0.933	0.839
			Woman	42	17.98±1.22	17.90±21.13	0.608	0.426
		Lung Activity (Ml)	Schoolboy	46	2948.15±623.16	2891.13±642.15	10.692	0.139
			Girl Student	42	2663.75±412.23	2597.06±497.52	11.954	0.192
Physical Quality	Speed Quality	50m Run (s)	Schoolboy	46	7.61±0.82	8.39±0.74	-1.328	0.021
			Girl Student	42	8.92±0.73	9.65±0.72	-1.071	0.018
	Flexibility Quality	Sitting Body Flexion (Cm)	Schoolboy	46	11.21±1.93	9.75±2.06	2.255	0.032
			Girl Student	42	16.05±1.31	14.96±1.39	5.541	0.000
	Strength Quality	Pull-Ups (Times)	Schoolboy	46	10.56±1.85	9.13±1.58	1.138	0.013
		Standing Long Jump	Girl Student	46	211.57±9.72	205.02±9.02	10.895	0.000
		1 Minute Sit-Ups (Times)		42	36.73±5.81	31.85±6.37	9.531	0.000
		Standing Long Jump		42	171.04±5.99	168.13±6.14	5.482	0.001

Table 18 (continued)

Test Item		Gender	Number	Experimental Group	Control Group	T	P
Endu-rance Quality	1000m (s)	Schoolboy	46	286.02±12.64	288.16±11.86	2.631	0.532
	800m (s)	Girl Student	42	253.27±10.72	255.03±11.07	2.015	0.619

Note: P<0.01 means that the difference is extremely significant, P<0. 05 means that the difference is significant, and P>0. 05 means that the difference is not significant.

It can be seen from Table 18 that after 12 weeks of teaching experiment, there are no statistically significant differences in the three morphological indexes of height, weight and BMI between the experimental group and the control group (P>0.05). This result shows that in the experimental period, two different training programs have similar effects on shaping teenagers' body shape. The lung function test data showed that after the experiment, the vital capacity indexes of male subjects were: the experimental group was 2948.15±623.16ml, and the control group was 2891.13 642.15 ml (P = 0.139); The female subjects were 2663.75±412.23ml in the experimental group and 2597.06 497.52 ml in the control group (P = 0.192). It is worth noting that the change of vital capacity is influenced by many factors, including individual growth and development, functional level of respiratory muscles and age. Comparison of sports quality indexes: The results of 50-meter running test show that the male subjects in the experimental group (7.61±0.82s) are significantly better than those in the control group (8.39 0.74s) (P = 0.011). The female subjects also showed significant differences (8.92 0.73s in the experimental group vs 9.65±0.72s in the control group, P=0.018). This data difference shows that the Cross Fit training program has a more significant effect in improving teenagers' short-distance sprint ability. The data of sitting posture flexion test showed that there was a statistically significant difference between the experimental group and the control group (P<0.05). The specific performance is as follows: the scores of male

subjects in the experimental group are 1.46cm higher than those in the control group, and those of female subjects are 1.09cm higher. From the point of view of exercise physiology, flexibility is mainly influenced by genetic factors, age and gender characteristics, but systematic stretching training can effectively improve the ductility of soft tissue around joints. The test data after the experiment showed that the experimental group was significantly superior to the control group in many strength quality indexes ($P<0.05$), including: male: standing long jump (explosive force of lower limbs), pull-ups (strength of upper limbs); Female: 1 minute sit-ups (core muscle endurance) and standing long jump (explosive force of lower limbs). This result verifies the advantages of Cross Fit training program in improving the strength quality of teenagers. The test results of long-distance running show that: male 1000-meter running: experimental group 286.02±12.64s vs control group 288.16 11.86 s; Female 800-meter running: 253.27±10.72s vs in experimental group vs 255.03 11.07 s in control group. Although the average score of the experimental group was about 2 seconds better than that of the control group, statistical analysis showed that the difference was not significant ($P>0.05$). The results of this study show that the 12-week Cross Fit training program is significantly superior to the traditional physical education courses in improving the speed quality, flexibility quality and strength quality of teenagers, but its advantages in improving body shape, lung function and endurance quality are not obvious. This discovery provides an important empirical basis for optimizing the physical training program for teenagers.

2.5 Students' satisfaction with the creation of middle school physical training courses based on Cross Fit training

The student satisfaction of 44 valid questionnaires is divided into four influencing factors: teacher's teaching level (TTS), course content and quality (CCQ), course resources, facilities and environment (CRFE) and management and support services (MSS). The overall satisfaction is the average score of 27 items. The median value in the scale is 3, in which the range of 1-3 is low satisfaction level, 3-3.5 is medium satisfaction level, 3.5-4 is medium satisfaction level and above 4 is good satisfaction evaluation. 44 valid questionnaires of students' satisfaction were substituted into

SPSS23.0 for analysis, and the details of students' overall satisfaction and satisfaction in all dimensions were as follows.

Table 19 Overall Student Satisfaction Analysis Results (N=44)

Dimension	Minimum Value	Maximum	Average/ Mean Value	Standard Deviation	P
Teacher's Teaching Level (Tts)	1	5	3.635	0.857	0.000
Course Content And Quality (Ccq)	1	5	3.574	0.923	0.000
Curriculum Resources, Facilities And Environment (Crfe)	1	5	3.544	0.802	0.000
Management And Support Services (Mss)	1	5	2.753	0.875	0.000
Overall Satisfaction	1	5	3.425	0.784	0.000

Note: P<0.01 means that the difference is extremely significant, P<0. 05 means that the difference is significant, and P>0. 05 means that the difference is not significant.

As can be seen from Table 19, the overall satisfaction score of students for the physical training course based on Cross Fit training is 3.425, ranging from 3 to 3.5, indicating that students are satisfied with the physical training course, but the satisfaction degree is average. Students' scores in three dimensions: teacher's teaching level (TTS), course content and quality (CCQ), course resources, facilities and environment (CRFE) all exceed the median value of 3, and are between 3.5 and 4, indicating that students' satisfaction in these three dimensions is above average, but the average value of management and support service (MSS) is 2.753, which is less than the average value of 3, indicating that students can train physically in schools. The

average degree of students' satisfaction from high to low is: teacher's teaching level (TTS) > course content and quality (CCQ) > course resources, facilities and environment (CRFE) > management and support service (MSS). In addition, the p values of the 27 items are all 0. 000, which shows that there are significant differences in students' satisfaction as a whole and in all dimensions.

CHAPTER 5
RESEARCH CONCLUSION AND PROSPECT

1. Conclusion

In this study, a physical training course based on Cross Fit training was designed and developed, and two classes from Grade Two of Beijing Longtan Middle School were selected for 12 weeks of experimental research, and the following conclusions were drawn:

1.1 The influence of middle school physical training curriculum system based on Cross Fit training on middle school students' physical health level is as follows:

1) In terms of body shape, both the physical training course based on Cross Fit training and the traditional physical education course have little influence on students' body shape, and there is no significant difference between them.

2) In terms of physical function, before and after the experiment, there was no significant difference in vital capacity between the experimental group of middle school physical training course based on Cross Fit training and the control group of traditional physical education course. Therefore, the physical training courses based on Cross Fit training and traditional physical education courses in middle schools have no significant improvement on students' physical function.

3) In terms of physical fitness, this paper selects the test results of 50m running as the speed quality, the forward bending of sitting position as the flexibility quality, the pull-ups and standing long jumps of boys, the one-minute sit-ups and standing long jumps of girls as the strength quality, and the 1000m running of boys and the 800m running of girls as the endurance quality.

In terms of speed quality, the 50m scores of middle school students in the physical training course group based on Cross Fit training were significantly different before and after the experiment, and the 50m scores of students in the traditional physical education course group were significantly different after the experiment, while the 50m scores of students in the traditional physical education course group were not

significantly different before and after the experiment, which showed that the physical training course based on Cross Fit training had a significant effect on improving the speed quality of middle school students.

In the aspect of flexibility, there is a significant difference in the performance of middle school students in the physical training course group based on Cross Fit training before and after the experiment, and there is a significant difference in the performance of students in the traditional physical education course group after the experiment, while there is no significant difference in the performance of students in the traditional physical education course group before and after the experiment, which shows that the physical training course based on Cross Fit training can significantly improve the flexibility of middle school students.

In terms of strength quality, the scores of male students' pull-ups, standing long jumps and female students' sit-ups and standing long jumps in the physical training course group based on Cross Fit training have been significantly improved before and after the experiment, while there is no significant difference in the scores of students in the traditional physical education course group before and after the experiment, and there is no significant difference between the experimental group and the control group before and after the experiment, which shows that the physical training course based on Cross Fit training has a significant effect on improving the strength quality of male students.

In the aspect of endurance quality, the students' long-distance running scores in the experimental group of physical training course based on Cross Fit training and the control group of traditional physical education course improved slightly after the experiment, but the results of independent sample T test showed that there was no significant difference between the boys' 1000m and girls' 800m scores before and after the experiment. This shows that the physical training course based on Cross Fit training has no obvious effect on improving the endurance quality of middle school students.

1.2 The analysis of students' satisfaction with the middle school physical training course based on Cross Fit training shows that students' overall satisfaction with

the physical training course based on Cross Fit training is average. Students' satisfaction degree is above average in three aspects: teachers' teaching level (TTS), course content and quality (CCQ), course resources, facilities and environment (CRFE), but students are not satisfied with the dimension of management and support services (MSS).

1.3 It can be seen from the results that Hypothesis 1 and Hypothesis 2 are not valid, and Hypothesis 3 and Hypothesis 4 are valid.

2. Discussion

2.1 Analysis of the influence of establishing middle school physical training course based on Cross Fit training on middle school students' physical health

In this study, the physical training course of middle school based on Cross Fit training was designed and developed, and two classes were selected from the second grade of Beijing Longtan Middle School for 12 weeks of experimental research. Through the 12-week teaching experiment of middle school physical training course based on Cross Fit training and traditional physical education course, the data of students' physical health test before and after the experiment were analyzed by SPSS23.0 software, and the influence of middle school physical training course system based on Cross Fit training on middle school students' physical health level was analyzed. The result data of 44 valid questionnaires are counted, and the effectiveness of this course development is judged according to the satisfaction evaluation results.

In terms of body shape, both the physical training course based on Cross Fit training and the traditional physical education course have little influence on students' body shape, and there is no significant difference between them. The results of this study show that after 12 weeks of teaching experiment, there is no significant change in body shape indexes (including height, weight and BMI) between the experimental group and the control group. Specifically, although the measured weight of students in the experimental group showed a slight downward trend, statistical analysis showed that this change did not reach a significant level ($P>0.05$). This phenomenon may be related to the relatively short experimental period, and the training time of 12 weeks may not be

enough to cause significant changes in body shape indicators. Therefore, after the experiment, the differences between the two groups in various body shape indexes are limited.

In terms of physical function, before and after the experiment, the physical training course based on Cross Fit training and the traditional physical education course have no significant improvement on students' physical function, and the difference between them is not significant. As a key parameter to evaluate the function of respiratory system, vital capacity reflects the total expiratory volume after maximum inhalation. The improvement of this index is significantly related to regular physical exercise and growth and development process. Existing studies have confirmed that systematic exercise training can not only effectively improve the vital capacity level of teenagers, but also enhance the contractility of respiratory muscles (including diaphragm and intercostal muscles). The Cross Fit training scheme adopted in this study produces benign stimulation to respiratory muscles through core strength training (such as shoulder-touching plate support, sit-ups, etc.) and high-intensity intermittent exercise (such as turn-back running). Although skipping and sprinting exercises in traditional physical education courses can also promote respiratory function, the experimental data show that there is no statistical difference between the two training modes in improving vital capacity within 12 Qian Zhou expectations ($P>0.05$). This result may be attributed to the relatively short research period, which failed to fully reflect the long-term effects of different training methods on respiratory function. Therefore, the factor of training duration may be the main reason why there is no significant difference in vital capacity index between the sexes in this study.

In terms of physical fitness, this paper selects the test results of 50m running as the speed quality, the forward bending of sitting position as the flexibility quality, the pull-ups and standing long jumps of boys, the one-minute sit-ups and standing long jumps of girls as the strength quality, and the 1000m running of boys and the 800m running of girls as the endurance quality. In terms of speed quality, the 50m scores of middle school students in the physical training course group based on Cross Fit training

were significantly different before and after the experiment, and the 50m scores of students in the traditional physical education course group were significantly different after the experiment, while the 50m scores of students in the traditional physical education course group were not significantly different before and after the experiment, which showed that the physical training course based on Cross Fit training had a significant effect on improving the speed quality of middle school students.

In terms of speed quality, the completion of 50-meter short-distance anaerobic exercise mainly depends on the rapid contraction ability of lower limb muscles and the excitement regulation level of nervous system. The starting stage of this project requires students' reaction speed, while the explosive force of lower limb muscles should be fully exerted in the acceleration stage and the running process, which requires students to have a good strength foundation for quadriceps femoris, hamstring muscles and triceps femoris, and at the same time, the core muscles in the trunk should also maintain sufficient stable control ability. In the physical fitness course with Cross Fit training mode, the training methods such as turn-back running and variable-speed running can effectively activate the central nervous system, and then optimize the nerve reaction speed in the starting stage and the step frequency control during the running. Through the implementation of barbell neck squat, head squat, jump pull-ups, double-shake rope skipping and other training methods, the strength output ability of students' quadriceps femoris and hamstring muscles has been significantly improved, enabling them to complete explosive movements more efficiently, thus enhancing their ability to output maximum strength in a short time. In addition, supine leg flexion and extension, sit-ups and other exercises effectively strengthen the strength of core muscles, optimize the transmission efficiency of lower limb strength to the trunk, and then improve the stability of the trunk and the economy of the movement during running. Training such as knee-lifting and step jumping strengthens the gluteal muscles, and the enhanced gluteal muscle strength can drive the quadriceps femoris and hamstring muscles more efficiently, further enhance the explosive power of lower limbs, and finally promote the development of speed quality. After 12 weeks of traditional physical education course

training, the middle school students' 50m running performance has improved, but the progress of the experimental group is significantly higher than that of the control group. The training methods used in traditional physical education courses (such as 30m turn-back running, opening and closing jumping, skipping rope, high leg lifting, etc.) mainly focus on simple speed training, which has limited effect on improving the explosive power of lower limbs and fails to systematically strengthen it from multiple dimensions such as strength foundation and core stability. Because the improvement of speed quality depends on the strength quality, especially the explosive power level, if the strength foundation of students is not fully developed, the improvement of their speed ability will be limited. In contrast, the training program of the experimental group scientifically strengthened the explosive power and core strength of the lower limbs, so that these two indexes were significantly improved within 12 weeks, so the performance progress of the experimental group was more obvious. The above analysis shows that there is a significant difference between boys and girls in the 50m running performance.

In the aspect of flexibility, there is a significant difference in the performance of middle school students in the physical training course group based on Cross Fit training before and after the experiment, and there is a significant difference in the performance of students in the traditional physical education course group after the experiment, while there is no significant difference in the performance of students in the traditional physical education course group before and after the experiment, which shows that the physical training course based on Cross Fit training can significantly improve the flexibility of middle school students. From the point of view of sports biomechanics, the essence of sitting posture flexion test is to quantitatively evaluate the flexibility of subjects' back muscles and lower limb posterior muscles, and its core measurement index is the maximum range of motion of spine, lumbar spine and hip joint in static posture. In the physical fitness curriculum design under the Cross Fit training system, special training such as leaning over the bridge, supine V-shaped lifting and lateral leg support can effectively strengthen the strength level of core muscles such as rectus abdominis, transverse abdominis, internal and external oblique abdominis and

latissimus dorsi, which can significantly promote the active activity of spinal flexion. It is worth noting that the dynamic stretching techniques, such as hard stretching training, compound maximum stretching, swallow-like dynamic balance walking and wide squat combined with hamstring stretching, integrated in the Cross Fit training program can stimulate the target muscle group through the periodic stretching reflex mechanism. This training method can not only enhance the extensibility of muscle tissue, but also effectively improve the elastic reserve of ligament structure. More crucially, the overall flexibility of the subjects can also be systematically improved when the multi-joint cooperative training is implemented. Therefore, after 12 weeks of experiments in physical training class based on Cross Fit training, the students' physical flexibility in the experimental class has been significantly improved. From the perspective of training methodology, the flexibility training in traditional physical education courses mainly adopts static stretching, and its typical training contents include basic stretching exercises such as forward leg press and lateral leg press. This kind of training mode has two obvious limitations: first, its action design is mainly aimed at the isolated stretching of a single joint or local muscle group, and it lacks the compound dynamic stretching with the cooperation of multiple joints; Secondly, the range of movements in the training process is generally small, and the degree of limb stretching is insufficient, which directly restricts the full stretching effect of muscle tissue. Based on the empirical research results of sports training, it can be confirmed that it is difficult to significantly improve the overall flexibility of students by adopting the traditional physical education curriculum model. To sum up, the physical training course based on Cross Fit training shows significant multi-dimensional training advantages. The training content design combines the characteristics of multi-joint collaborative participation and compound muscle group stretching. Through the 12-week experimental intervention, the research data show that the training mode is obviously better than the single stretching training method in traditional physical education courses.

In terms of strength quality, the scores of male students' pull-ups, standing long jumps and female students' sit-ups and standing long jumps in the physical training

course group based on Cross Fit training have been significantly improved before and after the experiment, while there is no significant difference in the scores of students in the traditional physical education course group before and after the experiment, and there is no significant difference between the experimental group and the control group before and after the experiment, which shows that the physical training course based on Cross Fit training has a significant effect on improving the strength quality of male students.

From the point of view of sports biomechanics and training, the pull-up test mainly evaluates the explosive power level of the upper limb muscles (especially latissimus dorsi and biceps brachii) and the back muscles (trapezius and rhomboid muscles, etc.), and can also reflect the ability of the whole body muscles to coordinate their exertion. In the physical training course based on Cross Fit training adopted in this study, the absolute strength and power output of upper limbs and back muscles were significantly improved by designing compound training actions such as push-ups and jumping box combination training, and pushing medicine balls on the chest in supine position. In terms of core strength training, the program specially designed targeted exercises such as supine hip flexion and arm extension, leaning over the bridge and unilateral limb extension, lateral support, etc. These trainings effectively optimized the transmission efficiency of the upper limb power chain, and enabled students to better integrate the collaborative efforts of core muscles, back muscles and upper limb muscles when completing pull-ups In contrast, the training methods in traditional physical education courses (mainly including basic exercises such as standard pull-ups, push-ups and sit-ups) are effective in developing the strength quality of the main muscle groups, but there are obvious deficiencies in activating the auxiliary muscle groups (such as forearm muscles and deep-seated stable muscles) and improving neuromuscular coordination. After a 12-week comparative experiment, the results of data analysis show that the experimental group of middle school students who adopt the Cross Fit training program is significantly better than the control group which adopts the traditional training method ($p<0.05$).

From the point of view of sports biomechanics and strength training, standing long jump is a test item specially used to evaluate the explosive force of lower limbs. The quality of this project mainly depends on the fast power output ability of lower limb muscles (especially quadriceps femoris, hamstring and triceps femoris). In the physical training program based on Cross Fit training adopted in this study, a variety of compound explosive training methods such as squat jump, alternate lunge jump and horizontal hurdle jump are designed. These training methods make full use of the elastic potential energy storage and release characteristics of the muscle-tendon complex through the pre-stretching and shortening cycle (SSC) mechanism, and at the same time enhance the recruitment ability of the neuromuscular system through the stretch reflex mechanism, thus significantly improving the power output efficiency of the lower limb muscles. In terms of core stability training, this program integrates targeted exercises such as flat support, supine hip flexion and arm extension, and lateral leg support. These exercises not only strengthen the isometric contraction ability of core muscles such as rectus abdominis and oblique abdominis, but also improve the transmission efficiency of power chain between lower limb muscles such as quadriceps femoris and hamstring muscles and core muscles. The training results show that the improvement of neuromuscular coordination enables the subjects to produce more accurate explosive force vectors (the direction is forward and upward) in the take-off stage, optimize the body posture control ability in the flying stage, and significantly improve the dynamic stability in the landing stage. After 12 weeks of intervention experiments, data analysis confirmed that the improvement of standing long jump performance in the experimental group was significantly better than that in the control group ($p<0.05$). In contrast, although the training methods in the traditional physical education curriculum of the control class (mainly including leg lifts, lift heel exercises and skipping rope, etc.) can develop the basic strength quality of the lower limb muscles, there are three obvious shortcomings in the training design: first, the training content focuses on the action speed exercise, and the pertinence of the maximum power output is insufficient; Secondly, the activation training of deep stable muscle

groups is neglected; Finally, insufficient attention has been paid to the cooperative training of extensor and core muscles of hip joint. The limitation of this training mode leads to the students' failure to reach the optimal level when they finish the standing long jump. The experimental data further show that the physical training class based on Cross Fit training has obvious advantages in improving the explosive power of lower limbs and optimizing the coordination of muscle groups. In addition, the study also found that there were statistically significant differences in training effects between male and female subjects ($p<0.05$), which may be related to the distribution of muscle mass and neuromuscular control characteristics of male and female students.

As an important index to evaluate the function of middle school students' core muscles, the 1-minute sit-up test can objectively reflect the muscle strength and endurance quality of the subjects' waist and abdomen muscles (mainly including rectus abdominis, internal and external oblique abdominal muscles and iliopsoas muscles). From the point of view of exercise physiology, the test results are positively correlated with the strength output efficiency of the core muscle groups (especially the muscle system involved in the lumbar-pelvic-hip complex). The training system of physical training course based on Cross Fit training adopted by the experimental group in this study includes diversified training means such as flat plate support, supine hip flexion and arm extension, and unilateral limb extension of prone bridge. These exercises focus on strengthening the stability function of transverse abdominis, the rotational strength of abdominal oblique muscles and the dynamic control ability of the whole core area through different biomechanical mechanisms. The scientific nature of the training program is as follows: firstly, the compound training mode combining isometric contraction and centripetal contraction is adopted; Secondly, the core muscles are fully activated through multi-plane and multi-angle action design; Finally, the gradual load principle is used to continuously improve the power output of muscles. This systematic training has significantly improved the strength of the subjects' core muscles, which is manifested in the improvement of muscle recruitment efficiency, joint stability and action economy optimization. In contrast, the traditional physical education class training

method in the control group has obvious limitations. Its simple sit-ups mainly activate the superficial rectus abdominis, while ignoring the training of deep stable muscle groups (such as transverse abdominis, multifidus, etc.). At the same time, there is a lack of targeted training for muscle cooperation. This imbalance in training content leads to uneven development of core muscles, which is finally reflected in the significant difference in experimental data: after 12 weeks of intervention, the performance of the experimental group in the 1-minute sit-up test is significantly better than that of the control group ($p<0.05$), which verifies the effectiveness of the diversified core strength training program.

To sum up, the remarkable improvement of the students' strength quality in the experimental group is mainly attributed to the unique physiological adaptation mechanism of the physical training course system based on Cross Fit training: First, the trunk stability exercises (such as flat support and its variant movements) designed in this training scheme effectively improve the recruitment efficiency of local stable muscles by the neuromuscular control system by activating deep core muscles (including transverse abdominis, multifidus, etc.), and optimize the energy loss of the power chain in the power transmission process of upper and lower limbs; Secondly, the rapid stretching compound training (such as throwing the medicine ball over the head, etc.) makes use of the pre-stretching mechanism of the muscle-tendon complex, which significantly enhances the storage and release efficiency of elastic potential energy, and improves the power output in the centripetal contraction stage through the nerve regulation of stretching reflex. The comprehensive training methods used in the experimental intervention (including static stability of prone bridge series movements, dynamic core control of supine two-ups and its variants, and explosive medicine ball training, etc.) have the characteristics of multi-plane and multi-joint coordination. The advantages of this training design are as follows: on the one hand, it fully stimulates muscle adaptation through the organic combination of different contraction forms (isometric, centripetal and centrifugal), on the other hand, it promotes the development of neuromuscular coordination by using compound action mode. After 12 weeks of

systematic training, the improvement range of the students in the experimental group in all dimensions of strength quality (including maximum strength, explosive force and strength endurance) is significantly better than that in the control group using traditional physical education training methods ($p<0.01$). This result confirms the obvious advantages of the diversified training scheme of physical training courses based on Cross Fit training in improving the strength quality of middle school students, and its training effect is not only reflected in the strength growth of a single muscle group, but more importantly, it promotes the function optimization of the whole power chain.

In the aspect of endurance quality, this study focuses on the development characteristics of middle school students as a group of teenagers. As a typical mixed energy supply project, the performance of middle and long distance running depends on both speed ability and aerobic endurance level. During the 12-week intervention period, the training scheme of physical training course based on Cross Fit training in the experimental group focused on strengthening the core stability and the strength quality of lower limbs, and effectively improved the muscle endurance and action economy of the subjects through compound training means such as double-shaking rope skipping, supporting knee lifting and supine leg flexion and extension. Although these exercises have a positive effect on improving the energy utilization efficiency of the body, because the physiological adaptation of endurance quality requires a long accumulation period (usually more than 16 weeks of systematic training), the experimental period of 12 weeks may not be enough to induce a significant improvement in aerobic capacity. Although the basic training such as skipping rope and opening and closing jump in traditional physical education can enhance the endurance performance of lower limb muscles and core muscles to a certain extent, it is limited by the lack of training intensity and specificity, and its effect of promoting the development of endurance quality is also limited. The experimental data show that although the scores of the two groups of students in the 1000m (male) and 800m (female) tests have improved, the difference between the two groups has not reached a statistically significant level ($p>0.05$), which confirms the long-term characteristics of the development of endurance quality, and

also shows that in the short-term intervention, the effects of different training methods on the aerobic capacity of middle school students are close. It is worth noting that there is no gender difference in endurance quality in this study, which may be related to the physiological characteristics of middle school students before puberty and the short experimental period. The follow-up study can be further verified by extending the intervention time and increasing the sample size.

2.2 Analysis of students' satisfaction with establishing middle school physical training courses based on Cross Fit training

According to 4.2.1, students are satisfied with the overall physical training course based on Cross Fit training, but the degree of satisfaction is average. We can analyze the overall satisfaction and reasons by analyzing the satisfaction of the following four influencing factors.

In terms of the satisfaction of teachers' teaching level, students are satisfied with the quality of teacher-student interaction and the analysis of important and difficult points, which shows that teachers can establish an effective two-way communication mechanism in the teaching process, respond to students' questions in time and provide personalized guidance, and at the same time grasp the core content of the course more accurately. As far as the dimension of teaching preparation and implementation is concerned, students' evaluation of teaching content design, classroom organization structure and motor skills teaching is at the upper-middle level, which reflects that teachers can systematically sort out the knowledge system and rationally plan the teaching process in the lesson preparation process, and basically meet the learning needs of students. However, it is worth noting that students' satisfaction is relatively low in the demonstration and practical ability of Cross Fit special technology, which may be due to the fact that some teachers pay too much attention to the integrity of the teaching process and ignore the importance of upgrading their special skills and standardizing the demonstration. In particular, some senior teachers tend to focus on the methodology of skill teaching in teaching practice, but relatively weaken the demonstration value of their own action standards. This discovery suggests that in the development of physical education, teachers should not only continuously optimize teaching methods, but also

pay attention to improving the level of personal special skills, and establish accurate action representations for students through standardized action demonstrations, so as to maximize the effect of imparting sports skills.

As for the satisfaction of course content and quality, students are not satisfied with the physical training course to meet their physical training needs and training intensity, which shows that the design of the current physical training course content and training intensity needs to be further optimized. At present, the selection of the training content of the designed physical training course mainly refers to the "Cross Fit Level 1 Training Guide", WOD and the guidance and opinions of middle school teachers with comprehensive related projects, and is designed according to the sports level of middle school students, the experimental site and the equipment of middle school sports. In the physical training class based on Cross Fit training, the intensity of Cross Fit training is reduced, and the design is carried out according to the physiological development characteristics of middle school students. Neither the training content nor the training intensity has been investigated among the students, which leads to the deviation from the students' needs and actual situation. Students' satisfaction with the curriculum structure and cycle arrangement of physical training is mainly due to the fact that the curriculum structure arrangement of the preparation part (2 minutes), the basic part (40 minutes) and the ending part (3 minutes) and the cycle arrangement of the basic stage (1-4 weeks), the consolidation stage (5-8 weeks) and the intensive stage (9-12 weeks) are more in line with students' actual situation.

As for the satisfaction of curriculum resources, facilities and environment (CRFE), the students in this school are not satisfied with the existing curriculum resources of physical training courses. At present, Beijing Longtan Middle School only uses the physical training course based on Cross Fit training in the experiment of Class One of Grade Two. At present, the books or videos related to Cross Fit training in the school library and online resource library are very limited, and they are not open to students. For example, some students are only interested in their own mobile phones and computer search, while the existing resources are only open to teachers for

teaching research, but the teaching content and teaching methods are also very limited, so students are not satisfied with such course resources. In terms of curriculum facilities, there is an obvious contradiction between supply and demand of sports venue resources in schools at present, which mainly stems from the overlapping of time and space in curriculum arrangement. Specifically, multiple classes carry out sports courses at the same time in the same teaching period, resulting in insufficient per capita activity area and affecting the implementation of teaching effects. Based on this situation, it is suggested that the school management department should optimize and improve from the following two dimensions: on the one hand, it can consider expanding or transforming the existing sports facilities to improve the venue carrying capacity in unit time; On the other hand, we should scientifically adjust the curriculum arrangement scheme, optimize the allocation of resources by arranging courses at different peaks and diverting teaching classes, so as to meet the basic demand of physical education for venue space to the maximum extent under the existing conditions and create good material basic conditions for improving teaching quality. From the satisfaction results of the course environment, students' satisfaction with the physical training course equipment and venue safety is at a high level, which reflects that the school has established a relatively perfect guarantee mechanism in the management of sports facilities. The specific performance is as follows: full-time management personnel implement regular inspection and maintenance system for equipment, replace the equipment that has reached the service life or has potential safety hazards in time, and carry out professional maintenance for the equipment that needs maintenance. This preventive maintenance measure not only prolongs the service life of equipment, but also effectively avoids the risk of sports injuries; In terms of venue management, teachers will flexibly adjust the teaching plan according to the weather conditions, and switch to indoor teaching in time in case of bad weather such as rain and snow to avoid accidents caused by wet and slippery venues; In addition, the school has also established an emergency treatment system for sports injuries, the school medical room provides professional medical support, and physical education teachers have all

received first aid training for sports injuries. However, the survey also found some things to be improved: first, some students reported that teachers were too strict in handling the application for internship and lacked the necessary understanding of the fatigue state in the classroom; Secondly, the problem of insufficient extracurricular physical training activities is more prominent. Due to the limited classroom time, it is difficult to fully integrate competitive and interesting elements, and there is a lack of corresponding extension activities after class, which leads to the obvious low satisfaction of students in this dimension. This situation suggests that we need to build a physical training system that is linked inside and outside class, and make up for the lack of interest in classroom teaching by designing rich extracurricular sports activities, which will be the key breakthrough direction for future curriculum reform.

Management and Support Service (MSS) is an influential factor. Students' satisfaction with the school's policy support is not high, which is mainly reflected in the fact that Beijing Longtan Middle School has not issued policies such as teachers' incentive and management system for the development of physical training courses, which will lead to teachers' low enthusiasm for participating in teaching and research and developing courses, which will affect students' satisfaction. School leaders are not aware of the importance of physical training courses. At present, physical training courses are not promoted throughout the school, and more attention is paid to the inheritance of physical education courses based on the improvement of senior high school entrance examination results, so that students will not feel the atmosphere of school participation, and their enthusiasm and satisfaction will be greatly reduced. However, the evaluation management of physical training courses is not distinguished from traditional physical education courses, and the evaluation method based on performance assessment is still adopted, which is not conducive to the improvement of students' satisfaction. At present, Beijing Longtan Middle School has no training support for teachers in physical training courses, which will have an impact on teachers' teaching level and thus affect students' satisfaction. Beijing Longtan Middle School pays more attention to the feedback of students' physical training and learning and the

effective communication of teaching problems in communication management, but the satisfaction is only average because of the lack of leadership and policy support.

3. Suggestions

Based on the research results in Chapter 4 and the discussion in Section 5.2, aiming at the actual effect and students' satisfaction of physical training courses in middle schools based on Cross Fit training, the following improvement suggestions are put forward:

3.1 Optimize the course design and implementation

1) Targeted to improve body shape and body function

This study shows that the traditional physical education class and Cross Fit courses have not significantly improved the body shape and function ($P>0.05$), which may be related to the short training period and lack of targeted design. Foreign research (Eather et al., 2015) points out that systematic training combined with nutritional intervention for more than 12 weeks is more effective in improving adolescent body composition. This proposal makes up for the shortcomings of the existing courses through action optimization and cycle extension. Future curriculum design needs to optimize the following aspects:

1.1) Integration into the body shape intervention module

Combining Cross Fit training with nutrition education, a comprehensive course of "exercise+diet" was designed. For example, add a 10-minute health knowledge micro-lesson to the weekly course to explain the scientific methods of adolescent nutritional needs and weight management, and help students improve their body composition (such as reducing body fat rate) through reasonable exercise and dietary adjustment.

Increase functional training actions for body shape, such as improving muscle mass through compound actions such as drug ball rotation and throwing, weight-bearing squat, and at the same time, cooperate with aerobic metabolism training (such as skipping interval) to promote energy consumption and optimize BMI index.

1.2) Strengthening the physical function training strategy

Aiming at the problem of insufficient improvement of vital capacity, special exercises of respiratory muscles were added to the module of metabolic adaptability training (M). For example, add the combined action of "deep breathing+plate support" in the warm-up session, or introduce interesting breathing training such as "blowing balloons" and "breathing rhythm running" after endurance training to enhance the strength of diaphragm and intercostal muscles.

Extend the duration of aerobic training and scientifically segment it. In the existing courses, the single duration of metabolic training (such as 400m running) is short, so it is suggested that after the consolidation stage (5-8 weeks), some unit days of training should be extended to 15-20 minutes of low-intensity aerobic training (such as jogging+variable speed running alternately) to gradually improve cardiopulmonary endurance.

1.3) Personalized training adaptation

Group teaching according to the baseline data of students' body shape: for overweight students, focus on metabolic training and core strength training (such as kettle bell swing and rope training); Increase the proportion of resistance training (such as dumbbell flip and pull-ups) for thin students to promote muscle growth.

Dynamic monitoring of intelligent devices is introduced. Using the heart rate and vital capacity data of the school's smart playground platform, students' physical fitness reports are generated regularly, and teachers adjust the training plan accordingly. For example, increase underwater breathing training (such as exhaling in water) for students with slow progress in vital capacity.

2) Increase the content of endurance training

The results show that the physical training course based on Cross Fit training has no significant effect on improving students' endurance quality. It is suggested that the training content for endurance quality should be added to the curriculum design, such as extending aerobic exercise time, designing intermittent endurance training items (such as variable speed running and long-distance skipping),

and combining the characteristics of high-intensity intermittent training of Cross Fit, optimizing the training mode to improve students' cardiopulmonary function and endurance level.

3) Dynamic adjustment of training intensity

According to the students' physiological characteristics and training feedback, it is suggested to dynamically adjust the training intensity in stages. For example, in the basic stage (1-4 weeks), low-intensity adaptive training is mainly used, the intensity is gradually increased in the consolidation stage (5-8 weeks), and high-intensity interval training is introduced in the strengthening stage (9-12 weeks). At the same time, combined with heart rate monitoring and RPE value, the training intensity is scientific and reasonable.

4) Enrich flexibility and strength training methods

The results show that Cross Fit training has a significant effect on improving flexibility and strength quality. It is suggested to further enrich the training methods, such as increasing dynamic stretching, functional strength training (such as kettle bell swing, medicine ball training, etc.), and pay attention to the coordinated training of multi-joints and multi-muscle groups, so as to comprehensively improve students' flexibility and strength quality.

3.2 Improve students' satisfaction

1) Optimize the course content and intensity

Students' satisfaction with the training content and intensity is low, so it is suggested that students' actual needs and physical fitness level should be understood through questionnaire survey or interview before the course design, and the training content and intensity should be adjusted. For example, design hierarchical training programs for students of different genders and physical fitness levels to avoid "one size fits all" phenomenon.

2) Increase extracurricular activities and competitions

Students' satisfaction with extracurricular physical training activities is low, so it is suggested that schools regularly organize physical challenge or interesting Cross

Fit competition to stimulate students' interest in participating. At the same time, physical training can be combined with campus sports culture, such as setting up "physical training day" or "Cross Fit society" to create a positive sports atmosphere.

3) Strengthen teachers' training and demonstration ability

Students are not satisfied with teachers' Cross Fit technology demonstration ability, so it is suggested that schools organize teachers to participate in Cross Fit special training regularly to improve their skills and teaching ability. At the same time, teachers are encouraged to master more advanced training methods and demonstration skills through video learning or inter-school communication.

3.3 Improve school management and support

1) Formulate special policies and incentives

Schools should introduce policies to support the development of physical training courses, such as incorporating physical training into the evaluation system of physical education courses, and giving incentives to teachers who participate in curriculum development and implementation (such as extra points for performance, priority for evaluation, etc.). At the same time, special funds are set up for purchasing training equipment and improving venue conditions.

2) Establish a scientific evaluation system

It is suggested that the single assessment method should be changed, and diversified evaluation indicators should be adopted, such as the combination of process evaluation (training log, progress range) and result evaluation (physical fitness test scores), and the mechanism of self-evaluation and mutual evaluation should be introduced to comprehensively reflect the physical development of students.

3) Strengthen the construction and sharing of resources

In view of the shortage of curriculum resources, it is suggested that the school build a Cross Fit training resource library (such as teaching videos and action diagrams) and open it to students. At the same time, we can cooperate with off-campus professional institutions to introduce high-quality resources to enhance the professionalism and interest of the course.

3.4 Long-term tracking and improvement

1) Extend the experimental period

This study has only been carried out for 12 weeks, and some indexes (such as body shape and endurance quality) have not changed significantly. It is suggested to extend the experimental period to 6 months or 1 year in the future to observe the long-term effect.

2) Expanding the research sample

This study is only aimed at two classes in grade two, and the sample range can be expanded to cover students in different grades and regions in the future to verify the universality of the curriculum.

3) Introducing multidisciplinary cooperation

It is suggested that experts in sports physiology and psychology should be combined to optimize the curriculum design, pay attention to the coordinated development of students' body and mind, and further improve the comprehensiveness and scientificity of the curriculum.

4. Research Prospect

Based on the results and limitations of this study, the future application of Cross Fit training in middle school physical fitness courses can be further explored from the following aspects:

4.1 Extend the experimental period and observe the long-term effect

This study has only been carried out for 12 weeks, and some indexes (such as body shape and endurance quality) have not changed significantly. In the future, the experimental period can be extended to 6 months or 1 year to observe the long-term impact of Cross Fit training on middle school students' physical health, especially on BMI, vital capacity and other indicators. At the same time, follow-up research can be added to analyze the changing trend of students' physical health after the end of the course and verify the lasting effect of training.

4.2 Expand the research sample and improve the universality

In this study, only two classes of Grade Two in Beijing Longtan Middle School were selected as the experimental objects, and the sample size was small, and students of different regions and ages were not covered. Future research can expand the sample range, include schools with different economic levels and urban-rural differences, and even compare across regions to verify the applicability of Cross Fit training in different groups. In addition, we can further explore the influence of gender differences on the training effect and optimize the training scheme for boys and girls.

4.3 Combining with emerging technologies, optimizing training monitoring

With the development of smart wearable devices and sports data analysis technology, tools such as heart rate monitoring bracelet and exercise load evaluation system can be introduced in the future to monitor students' training intensity, recovery and progress in real time. At the same time, the training data can be analyzed by combining artificial intelligence algorithm, which provides scientific basis for the formulation of personalized training scheme. For example, according to students' physical fitness test data, the training plan is automatically adjusted to realize accurate teaching.

4.4 Explore the integration of Cross Fit and other training modes

This study only compares the effects of Cross Fit training with traditional physical education courses. In the future, we can try to combine Cross Fit with HIIT (high intensity interval training), functional training and traditional strength training to explore a more efficient physical training mode. For example, special exercises of sensitivity and coordination should be integrated into Cross Fit training, or targeted training programs should be designed in combination with the sports events of senior high school entrance examination to improve students' comprehensive sports ability.

4.5 Pay attention to the influence of mental health and social adaptability

This study mainly focuses on the physiological indicators of physical health, and the influence of Cross Fit training on middle school students' mental health (such as stress relief and emotional adjustment) and social adaptability (such as teamwork and will quality) can be further discussed in the future. Through the methods of

psychological scale and interview, this paper analyzes the role of Cross Fit training in promoting students' all-round physical and mental development, and provides reference for the diversified development of school physical education courses.

In a word, future research should combine longer experimental period, wider sample group, more advanced monitoring technology and more comprehensive evaluation system to further verify the scientificity and effectiveness of Cross Fit training in middle school physical fitness curriculum, and explore its comprehensive value in promoting students' physical and mental health.

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APPENDIX

APPENDIX I

MIDDLE SCHOOL STUDENTS' LEARNING SATISFACTION SCALE BASED ON Cross Fit

Dear students:

The purpose of this questionnaire is to collect your teaching evaluation of Cross Fit physical training course implemented in middle school. The data obtained will be strictly used for academic research purposes and will only be used as the empirical analysis basis of this dissertation to ensure the professionalism and confidentiality of information use. The questionnaire structure consists of two parts: the first part involves the collection of basic demographic information, and the second part uses Likert five-level scale (1= very dissatisfied to 5= very satisfied) to systematically evaluate the teaching content, organization, implementation and effect of Cross Fit course. Please objectively choose the option level that best suits your real feelings according to your actual participation experience, and tick "√" in the corresponding option to confirm. This study strictly follows the principle of anonymity, and all answers do not involve personal identity information. Please answer according to the actual situation. Your valuable advice will be of great reference value for improving the quality of physical training courses in middle schools. I sincerely thank you for your support and assistance in educational research.

Number	Item	Very Dissatisfied	Less Satisfied	Be Satisfied	Satisfied	Very Satisfied
1	I Think The School Attaches Great Importance To The Middle School Physical Training Course Based On Cross Fit.					
2	I Think The Physical Training Course Of Middle School Based On Cross Fit					

	Arranged By The School Is Reasonable.					
3	I Think The Activity Space Used In The Physical Training Course Of Middle School Based On Cross Fit Is Very Wide.					
4	I Think That The Number Of Available Equipment And Equipment Can Meet The Learning Needs When Attending The Physical Training Course Based On Cross Fit In Middle Schools.					
5	I Think Pe Teachers Attach Great Importance To The Quality Of Teaching When Taking Physical Training Courses In Middle Schools Based On Cross Fit.					
6	I Think After The Physical Training Course Based On Cross Fit In Middle School, I Have a High Overall Satisfaction With The Course.					
7	I Think I'm Very Satisfied With Learning Online Sports Courses.					
8	I Think The Physical Training Courses In Middle Schools Based On Cross Fit Are Very Satisfactory.					
9	I Think The Pe Teacher's Teaching Attitude Is Very Good In The Middle School Physical Training Course Based On Cross Fit.					
10	I Think The Teaching Methods Used By Physical Education Teachers In Middle School Physical Training Courses Based On Cross Fit Are Very Good.					
11	I Think It's Very Good For Physical Education Teachers To Give Appropriate Encouragement To Students In The Middle School Physical Training Course Based On Cross Fit.					
12	I Think Physical Education Teachers Have Strong Teaching Demonstration Ability In Middle School Physical Training Courses Based On Cross Fit.					
13	I Think The Professional Sports Skills Made By Physical Education Teachers In Middle School Physical Training Courses Based On Cross Fit Are Very Standard.					
14	I Think The Teaching Section Designed By The Physical Education Teacher In The Middle School Physical Training Course Based On Cross Fit Is Very Reasonable.					
15	I Think The Sports Knowledge And Skills Learned In The Middle School Physical Training Course Based On Cross Fit Are Very Useful.					
16	I Think My Physical Fitness Has Been Greatly Improved Through The Study Of Physical Training Courses In Middle Schools Based On Cross Fit.					
17	I Think My Physical Fitness Has Been Greatly Improved Through The Study Of Physical Training Courses In Middle Schools Based On Cross Fit.					
18	I Think My Self-Confidence Has Been Greatly Improved Through The Study Of Physical Training Courses In Middle Schools Based On Cross Fit.					
19	I Think My Physical Training Results Have Been Greatly Improved Through The Study Of Physical Training Courses In Middle Schools Based On Cross Fit.					

APPENDIX II

RECORD FORM OF STUDENTS' PHYSICAL HEALTH INDICATORS

Test dimension	Test item	Test result
Body shape	Height (cm)	
	Weight (kg)	
	BMI index (kg/m2)	
Body function	Vivid lung (ml)	
Physical quality	50m run (s)	
	Sitting body flexion (cm)	
	Pull-ups (times)	
	Standing long jump (cm)	
	1 minute sit-ups (times)	
	Standing long jump (cm)	
	1000m （s）	
	800m （s）	

APPENDIX III

EXPERT INTERVIEW OUTLINE OF MIDDLE SCHOOL PHYSICAL TRAINING COURSE BASED ON Cross Fit TRAINING

1. What do you think should be selected in the physical training curriculum system of middle schools based on Cross Fit training?

2. What indicators do you think should be selected for middle school students' institutional health test?

3. In your opinion, how to control the experimental variables when doing experiments of physical training courses in middle schools? What should be paid attention to during the experiment?

4. What do you think should be done to design the experimental process of physical training courses for middle schools with Cross Fit training?


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