Journal of Human Movement Science (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/jhms.2024.050114
ISSN 2523-5850 Vol. 5 Num. 1

Innovative Construction and Effect Study of Preschool Physical Fitness Curriculum System

Sisi Ding

Shaanxi Xueqian Normal University, Xi'an, Shaanxi Province, 710000, China

Keywords: Physical Fitness of Young Children, Innovative Construction of Curriculum System, Feedback Regulation, Coordination Ability

Abstract: In today's increasingly serious issue of early childhood health, the role of physical education in early childhood education is becoming increasingly evident. In response to the current situation of insufficient targeting and scientificity in physical education for young children, this article aims to improve their physical fitness, coordination ability, and flexibility, and adopts a physical education teaching method aimed at improving their physical fitness, coordination ability, and physical fitness. This course adopts a modular teaching approach, fully considering the physical and mental development characteristics of young children. It adopts on-site testing, teacher training, feedback regulation, and other methods to evaluate its implementation effect. For children aged 4-5, their physical progress is more significant, with an average improvement of 20 points, soaring from 66.4 points to 86.4 points. This leapfrog improvement not only demonstrates the potential for rapid physical development among school-age children, but also signifies their readiness to move towards higher challenges. The research results of this article will provide innovative design concepts and practical models for the development of physical education in kindergartens.

1. Introduction

With the rapid development of social economy and science and technology, the living habits of contemporary young children have changed greatly. One of the most significant changes is the decline in activity level. In this context, the improvement of young children's physical fitness is of great significance to the physical and mental health of young children and the development of lifelong sports habits. However, the traditional physical fitness education for young children has problems such as unscientific and unsystematic, and it is difficult to meet the needs of contemporary young children's development. For this reason, the reform of early childhood physical fitness education has been explored in a useful way. The purpose of this paper is to design a new kindergarten physical fitness program and evaluate it systematically, which has important theoretical and practical significance for promoting the healthy development of young children and improving their overall quality.

In this paper, the current situation and problems of early childhood physical education in China are analyzed in some detail by using the literature method and fieldwork method. Based on the above analysis, this paper team develops a complete physical training program for young children,

which includes motor skills, physical development and sports games. The program is modular and progressive, and focuses on the development of children's interest and continuous commitment. In addition, the effectiveness of health education is measured quantitatively and qualitatively through tests and behavioral observations.

The structural design of this paper is well planned, firstly, the importance of early childhood physical fitness and the theoretical basis of its study are elaborated to construct the theoretical structure and practical significance of this paper. Then, the design principle, implementation process, data collection and analysis of the course are discussed in some detail. Finally, empirical research is conducted to reveal the impact of the curriculum on the various dimensions of young children's physical fitness, and relevant data are analyzed in depth to explore its success factors and possible future development directions, with a view to providing innovative ideas and practical support for the development of physical fitness education for young children.

2. Related Work

Physical education for young children is an important part of promoting their physical and mental development. Carrying out scientific physical exercise can not only improve the physical fitness of young children and enhance their immunity, but also greatly help their social interaction and emotional development. Chen Hao conducted a study on physical fitness exercises for young children aged 3-5 years old [1]. Pu Lijuan explored the methods of physical fitness training for young children [2]. Wang Bei studied the educational strategies in terms of physical fitness macrocycle in young children [3]. Han Chunyuan studied the research on the ideas and methods of physical fitness training for young children [4]. Gao Lei studied the strategy of cooperative inquiry in physical fitness exercise for young children [5]. At present, although there have been many studies on physical fitness education for young children, most of them have focused on traditional sports programs and methods, ignoring the innovative education model that combines the characteristics of young children, especially in the personalized adaptation of the curriculum content and methods are still largely lacking.

Innovative research on the content of kindergarten physical education teaching is also an effective way to realize its comprehensiveness and systematization. By carrying out effective physical activities, it can stimulate young children's interest in physical education, develop good physical habits, and lay a good foundation for a healthy life in the future. Liu Jiqin studied a physical fitness practice program for 3-6 year olds [6]. Cupeiro R studied the effect of relative age on physical fitness in preschoolers [7]. Haugland E S studied a multivariate physical activity association model of basic motor skills and physical fitness in preschoolers aged 3-5 years old [8]. Cai K L investigated a mini-basketball training program to improve the physical fitness and social abilities of preschool children with autism spectrum disorder [9]. Stafeeva A V used recreational aerobics to improve physical fitness in preschool children with psychiatric disorders [10]. However, most of the existing studies are based on the physical and mental developmental needs of young children and have explored the curriculum design in depth, but there is a lack of research on the sustainable development of the curriculum and the mechanism of dynamic adaptation.

3. Method

3.1 Curriculum Design Concept and Framework

In the process of constructing the curriculum system, the group first defined the core idea of curriculum design: centering on the needs of young children's physical and mental development, and combining the latest research results in the fields of sports science and early childhood

psychology, the group established a physical development curriculum for students of all ages. The intersection of disciplines and the use of pedagogical tools are the basis for its realization.

The mean formula (used to calculate the average of physical fitness test results) is as follows.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{1}$$

Among them, $\bar{x}$ is the sample mean, x_i is the individual child's test score, and n is the total number of children.

3.2 Development and Implementation of Curriculum Content

According to the physiological characteristics of young children and the different stages of motor development, different curriculum contents are designed. The main contents are: training of basic physical skills, training of flexibility and coordination, and game-based teaching. Each unit is set at an appropriate level of difficulty to ensure that each lesson deepens gradually with the growth of the children. In the implementation process, modern educational technologies such as interactive video and virtual reality are combined to enhance the interactivity of the course, increase student participation, and improve student learning [11].

The standard deviation formula (used to calculate the standard deviation of the physical fitness test results, which measures the degree of dispersion of the data) is as follows.

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \tag{2}$$

Among them, s is the sample standard deviation and $\bar{x}$ is the mean.

3.3 Innovation and Application of Teaching Methods

The focus of the teaching reform is to organically combine the learning psychology and physiological characteristics of young children. In the process of implementation, a variety of teaching methods such as storytelling, role-playing, and group cooperation are utilized in an effort to cultivate young children's all-round abilities in a diversified and interactive form. In addition, this paper also explores how to utilize the feedback and reward mechanism to enhance young children's learning motivation and self-efficacy.

The improvement rate formula (used to calculate the rate of physical improvement before and after the program) is:

$$R = \frac{X_{\mathrm{h}} - X_{\mathrm{q}}}{X_{\mathrm{q}}} \times 100\% \tag{3}$$

Among them, R is the improvement rate and X_{q},$X_{\mathrm{h}}$are the test scores before and after the implementation of the course, respectively.

3.4 Evaluation and Optimization of Course Effectiveness

In the evaluation process, we adopted both qualitative and quantitative methods. Quantitative analysis methods include physical tests, psychological development assessment, etc.; qualitative research uses observation transcripts, interviews with parents and teachers, etc. On this basis, the curriculum system was dynamically adjusted according to the evaluation results to optimize the teaching and learning activities. In addition, this paper also focuses on the long-term effects of the program and plans to track the physical and mental growth of the children.

Through systematic research and practice, an innovative teaching model for young children's

physical fitness was adopted to lay a good foundation for promoting healthy growth.

The effect size formula is:

$$d = \frac{\bar{X}_1 - \bar{X}_2}{s_{\text{pooled}}} \tag{4}$$

Among them, $\bar{X}_1$ and $\bar{X}_2$ are the means of two independent samples, respectively, and s_{pooled} is the pooled value of the standard deviation of the two samples:

$$s_{\text{pooled}} = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}} \tag{5}$$

Here, n_1 and n_2 are for both samples; s_1 and s_2 are the respective standard deviations.

4. Results and Discussion

4.1 Experimental Setting

This paper was conducted in three different urban kindergartens, each with its own distinctive socio-economic background and geographical location carefully chosen to ensure the breadth and representativeness of the data. The whole experimental cycle extended for six months and covered a total of 300 children from 3 to 6 years old, aiming to explore the key factors of physical development.

In order to maintain the standardization of the experiment, each participating kindergarten used a consistent curriculum and teaching methodology. Measuring children's engagement and motivation to learn in the curriculum through observation records and careful teacher evaluations is critical to understanding their learning behaviors and curriculum feedback.

4.2 Analysis of Results

(1) Comparison of the effect of age stratification

Toddler number 1-5 indicates age 3-4 years old, Toddler number 6-10 indicates age 4-5 years old, and Toddler number 11-15 indicates age 5-6 years old. The results of the age stratification effect comparison are shown in Figure 1.

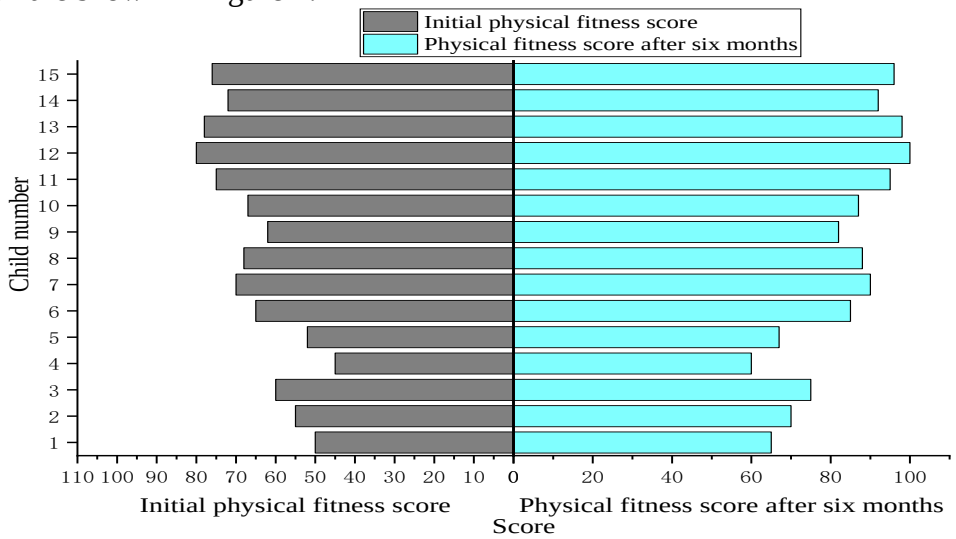

Figure 1: Comparative results of age-stratification effects

The analysis of the initial physical fitness scores showed that 3-4 year olds exhibited relatively low levels of physical fitness, with scores fluctuating from 45 to 60 and an average score of 52.4. This result reflects the fact that in this age group, young children's physical fitness is still in the initial stage of growth and shows a clear potential for growth; among 4-5 year olds, the physical fitness scores show a significant improvement, with a range of scores from 62 to 70, and a mean value of 66.4. Young children in this age group reflect that their physical development is steadily improving, with more concentrated scores indicating more consistent physical improvement; as for the 5-6 year olds, they have the highest physical scores, ranging from 72 to 80, with an average of 76.2. This data not only shows a significant improvement in their physical fitness, but also signals that they are well prepared to enter the school stage with an overall more balanced and mature physical performance.

The results of the physical fitness follow-up after six months revealed an encouraging trend. Among the 3-4 year olds, physical fitness scores improved significantly, 60-75, with an average score of 67.4. This significant improvement not only shows the positive development of physical fitness during this critical growth period, but also reflects that with proper guidance and exercise, the potential of young children can be greatly stimulated; for 4-5 year olds, the jump in physical fitness scores was even more dramatic, with a range of scores from 82-90, and an average score of 86.4. This result not only shows the rapid growth in physical fitness of children in this age group, but also proves the importance of sustained physical activity for young children's development.

The physical fitness scores are even more peaked in the age group of 5-6 years old, with a range between 92 and 100 and an average score of 96.2. This stable and excellent performance illustrates that with age, young children's physical ability not only improves but also stabilizes, laying a solid foundation for further learning and development.

Over the past six months, we have observed significant differences in the physical progress of our children across age groups. the 3-4 year olds, while making slower progress, have improved by an average of 15 points, from 52.4 to 67.4, a solid increase that reflects positive change during this sensitive formative period; for the 4-5 year olds, their physical progress has been even more dramatic, with an average improvement of 20 points that soared from 66.4 to 86.4 points. This jump in improvement not only demonstrates the potential for rapid physical fitness development among school-age children, but also signals their readiness to move on to higher challenges; meanwhile, 5- to 6-year-olds showed similarly rapid progress, with a similar average increase of 20 points, from 76.2 to 96.2. The sustained physical activity and systematic training of children in this age group not only enhances their physical fitness, but also provides them with a solid foundation for their upcoming school life.

(2) Variability in course content affects data tables

Young children's initial physical fitness scores ranged from 52 to 65 before the physical fitness program began, and this data demonstrates the diversity of their physical fitness levels prior to attending the program. Children achieved a significant increase in their physical fitness scores, this result is not just a numerical improvement; it represents an overall improvement in the young children's flexibility, balance, and overall coordination, providing them with a solid foundation for future sports and daily activities. The results of the differential impact of program content are shown in Figure 2.

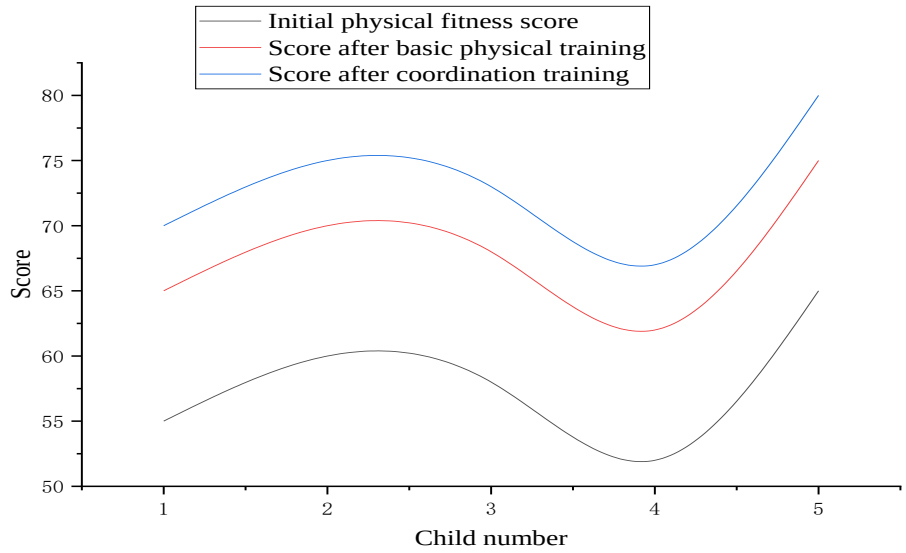

Figure 2: Differences in course content impact results

(3) The influence of teaching methods on teachers

The teaching methods of 1, 2, 3, 4, 5, 6, and 7, 8 are interactive, demonstration, game, and self-directed. The impact of teacher teaching methods is shown in Figure 3.

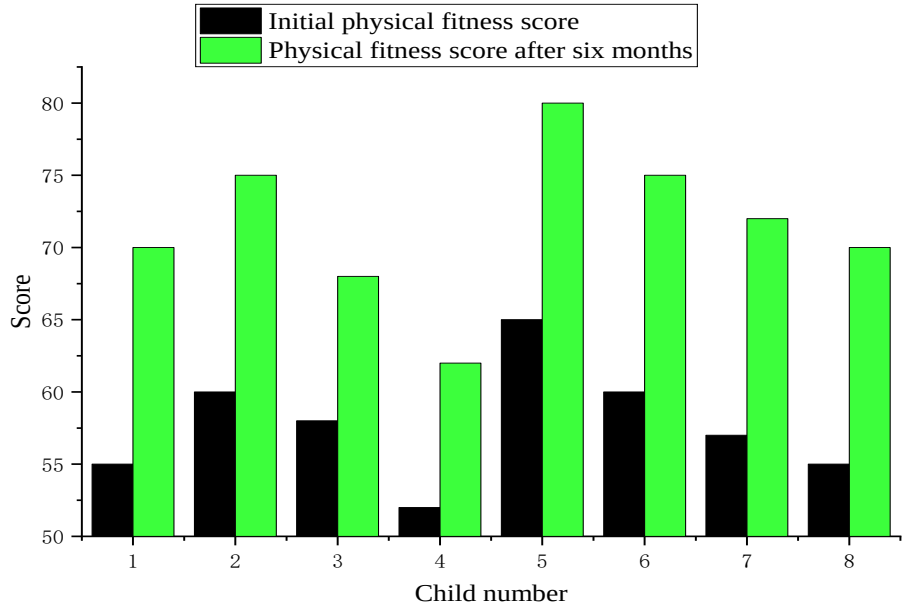

Figure 3: Results of the impact of teacher teaching methods

When exploring the impact of different teaching methods on the physical fitness improvement of young children, we found some significant trends. Interactive teaching, covering children 1 and 2, successfully stimulated their interest and participation by creating an interactive and rich learning environment, resulting in a 15 point increase in average physical fitness score. This method significantly enhances the physical fitness and coordination of young children through active participation and practice.

However, demonstrative teaching, involving toddlers 3 and 4, although it similarly promoted physical performance, with an average improvement of 10 points, the effects of this model appear

to be more modest compared to interactive teaching. This may suggest that, in some respects, demonstrative teaching takes longer to demonstrate its effectiveness, or that it is less dynamic in encouraging active participation by the toddlers.

Play-based teaching, including Toddlers 5 and 6, performed well in capturing the attention of the toddlers and increasing their engagement, with a 15-point improvement in average physical scores. This style of teaching was effective in improving children's physical fitness by making the learning process both enjoyable and educational through the use of games.

Self-directed teaching, involving toddlers 7 and 8, also provided positive results with an average improvement of 15 points. This approach gave the toddlers more freedom to explore and learn.

(4) Correlation data between engagement and physical development

After six months of physical fitness training, we observed that all toddlers improved their physical fitness scores, a phenomenon that confirms the general benefits of consistent exercise and the fact that even toddlers with a low physical fitness starting point can achieve significant progress through hard work. In particular, children with high initial fitness scores, such as numbers 5 and 6, were among the highest post-training scores, reflecting the additive effect of a good fitness base on further improvement.

Analyses in terms of engagement revealed a key trend: toddlers with higher engagement ratings (e.g., numbers 1, 4, and 7, all rated 5) excelled in physical fitness improvement, implying that toddlers with higher engagement were more likely to achieve greater physical fitness progress. In contrast, toddlers with lower engagement ratings (e.g., number 8, rating 2) showed less physical improvement, further emphasizing the importance of engagement in the physical improvement process.

Furthermore, although there was no direct linear relationship between initial fitness scores and engagement, we found that toddlers with lower initial fitness (e.g., numbers 4 and 8) typically required higher levels of engagement in fitness improvement to achieve desired results. This finding challenges conventional wisdom and suggests differentiated training strategies for children with different starting points. The data on the correlation between engagement and physical fitness development are shown in Table 1.

Table 1: Correlation data between participation and physical development

Child number	Initial physical fitness score (out of 100)	Physical fitness score after six months (out of 100)	Participation rating (1-5)
1	55	72	5
2	60	78	4
3	58	70	3
4	52	67	5
5	65	82	4
6	62	77	3
7	57	73	5
8	55	69	2
9	60	75	4
10	58	71	3

(5) Influence data of family background

The influence data of family background is shown in Table 2.

Research has shown that annual household income, while having some influence on young children's physical fitness development, is not a determining factor. For example, although toddlers with family number 5 (annual income of $300,000) had higher physical fitness scores after six

months, their improvement was the same as that of toddlers with family number 1 (annual income of $100,000), suggesting that other factors such as the family environment and personal dispositions may be equally important.

Also, initial physical fitness score is a key factor influencing the subsequent physical fitness development of young children. Young children in Family Number 5 had an initial physical fitness score of 65 and improved to 82 after six months, an improvement of 17, emphasizing the importance of a good starting point in achieving higher levels of physical performance.

Table 2: Impact data of family background

Child number	Annual household income (10000 yuan)	Parental education level (1=junior high school or below, 2=high school, 3=university or above)	Initial physical fitness score	Physical fitness score after six months	Improvement amplitude (score)
1	10	3	55	72	17
2	20	2	60	78	18
3	8	1	58	70	12
4	15	3	52	67	15
5	30	2	65	82	17
6	12	1	62	77	15

5. Conclusion

The main purpose of this paper is to establish a set of curriculum suitable for young children's physical health education and evaluate its effectiveness. This paper integrates the theory of physical development with the psychology of young children, and innovatively designs diversified physical activities and curricula, including basic physical training, flexibility training, and interesting physical games. In the course of the study, the curriculum system was applied to a number of kindergartens, and physical tests, behavioral observations, and psychological evaluations were conducted on the participating children to comprehensively analyze the effectiveness of the implementation of the curriculum. It was found that after receiving the program for six months, the participating children's physical ability, coordination and flexibility were significantly improved. The results showed that muscle strength improved, balance improved and physical coordination improved. In addition, the children's social skills and emotional control have also shown positive improvement. Feedback from parents and teachers indicates that the children's ability to participate and cooperate in groups has improved. Although some achievements have been made, there are still some shortcomings. First, the sample size was small, so the generalizability of the findings was somewhat limited. Second, the study was conducted in a six-month cycle to evaluate its long-term effects in a short period of time. In addition, although various evaluation methods are available, the objectivity and sensitivity of some evaluation methods need to be improved. Future studies should expand the sampling to a wider geographical area to improve the representativeness and generalizability of the findings. In addition, long-term tracking studies are needed to more accurately evaluate the long-term impact of the program on the physical and mental development of young children. Based on this, this study will focus on the efficacy and reliability of the assessment tool in subsequent studies to further explore how to integrate scientific and technological factors, such as wearable smart devices, with physical fitness education in order to enhance students' learning experiences and teaching methods.

Acknowledgement

Project Name: Exploration of Teaching Content of Physical Fitness Training Course in Kindergarten (Project Approval Number: 23JG06JC), Project Leader: Ding Sisi Hu Yuan, Project Category: Basic Education Teaching Reform Special Project.

References

[1] Chen Hao, Huang Gui. Research on Physical Exercise of 3-5 Year Old Children [J]. Neijiang Technology, 2023, 44 (5): 124-126.
[2] Pu Lijuan. Analysis of Methods for Preschool Physical Training [J]. Contemporary Sports Technology, 2022, 12 (2): 34-36.
[3] Wang Bei. Research on Educational Strategies for the Physical Cycle of Preschool Children [J]. Modern Education Progress, 2024, 2 (3): 45-47.
[4] Han Chunyuan, Su Xiaowei, Xu Yi, etc. Research on the ideas and methods of physical fitness training for young children [J.] Physical Science, 2024, 4 (1): 89-93.
[5] Gao Lei. Strategies for cooperative exploration in physical exercise for young children [J]. Contemporary Sports Technology, 2021, 11 (7): 228-230.
[6] Liu Ciqin, Gao Sheng. A study on physical exercise of 3-6 year old children [J]. Frontiers of Modern Education, 2022, 3 (1): 5-8.
[7] Cupeiro R, Rojo-Tirado M A, Cadenas-Sanchez C, et al. The relative age effect on physical fitness in preschool children [J]. Journal of Sports Sciences, 2020, 38(13): 1506-1515.
[8] Haugland E S, Nilsen A K O, Okely A D, et al. Multivariate physical activity association patterns for fundamental motor skills and physical fitness in preschool children aged 3–5 years[J]. Journal of Sports Sciences, 2023, 41(7): 654-667.
[9] Cai K L, Wang J G, Liu Z M, et al. Mini-basketball training program improves physical fitness and social communication in preschool children with autism spectrum disorders[J]. Journal of Human Kinetics, 2020, 73(1): 267-278.
[10] Stafeeva A V, Ivanova S S, Drandrov G L, et al. Improving the Physical Fitness of Preschool Children with Mental Disorders by Means of Recreational Aerobics[J]. Journal of Environmental Treatment Techniques, 2020, 8(4): 1539-1544.
[11] Javaid M, Haleem A. Virtual reality applications toward medical field[J]. Clinical Epidemiology and Global Health, 2020, 8(2): 600-605.