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Construction and Practice of Project-Based Teaching Model of Primary School Physical Education from the Perspective of STEAM

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Abstract: *This study is grounded in the interdisciplinary, project-based, and practical characteristics of STEAM education. In response to issues such as monotonous skill-training methods, limited interdisciplinary integration, and lack of engagement in primary school badminton instruction, the implementation of a STEAM-oriented approach to teaching badminton in physical education at the primary level holds significant value. Guided by the framework of "Perception–Experience– Creation," this research constructs a project-based teaching model for badminton in primary schools. The core content of this project, titled "Fun Badminton: A Young Athlete's Growth Journey," integrates elements of science, technology, engineering, arts, and mathematics throughout the instructional process. Furthermore, a "hierarchical progression" structure is applied across three tiers of project-based tasks: "First Touch with Badminton" allows students to observe, touch, and lightly hit the shuttlecock to develop basic coordination and spatial awareness; "Skills Exploration Workshop" uses simple equipment and collaborative group activities to practice basic hitting techniques through gamified exercises; and "Sports Demonstration Show" encourages students to creatively design and present badminton-themed games or group drills, incorporating rhythm and basic tactical thinking to highlight expressiveness and teamwork. After a semester-long trial, results indicate that this teaching model effectively enhances students' interest and enthusiasm for the sport, facilitates the development of fundamental dribbling skills, and provides an authentic learning context that supports physical development, interdisciplinary thinking, and creative inspiration. Ultimately, it embodies the integration of STEAM principles within primary physical education.*

Keywords: *STEAM Education; Project-Based Learning; Badminton Teaching; Primary School Physical Education*

1. Introduction

With the ongoing reform of basic education in China, teaching philosophies and methods across subjects continue to evolve. However, compared to the vigorous innovation seen in other academic disciplines, physical education in primary schools has lagged behind. Current teaching practices largely remain traditional, relying on instructor-led skill transmission, which lacks variety and fails to sufficiently stimulate students' interest in sports or adequately develop their physical, psychological, and ethical qualities [1]. In this context, integrating STEAM education into project-based physical education offers a promising pathway for pedagogical innovation in the new era. STEAM education emphasizes interdisciplinary integration, problem-based scenarios, and practical creative thinking [2]. Its incorporation into primary physical education can diversify classroom formats and enhance students' scientific cognition, technical application, and collaborative abilities [3]. Accordingly, this study, based on the principles of STEAM education, employs diversified activities and multi-dimensional task-driven designs to engage students in game-based inquiry [4]. This approach aims to actively involve students in sports participation, improve motor efficiency, and enhance learning outcomes in physical education classes.

2. Research Results and Analysis

2.1 Analysis of Teaching Theme Content and Current Teaching Situation

Because of its simple equipment, easy to develop, and strong interest, badminton has become a

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popular item in primary school physical education. It has unique value for developing students' sensitive quality, hand-eye coordination, displacement speed and reaction ability. At the same time, the mechanical principle, spatial geometric relationship, movement rhythm and team cooperation requirements contained in badminton also provide rich materials for multi-disciplinary integration teaching. However, in the actual teaching process, the traditional badminton class often falls into the pattern of single technical training: teachers repeatedly explain and demonstrate the movement principles such as forehand serve and high stroke, and students practice mechanically, the classroom atmosphere is dull, and students 'interest in learning is difficult to last [5]. Especially for students in lower grades, the badminton racter is too heavy, the ball is too hard, and the court is too large. There is a certain disconnection between the conventional training content and children's physical ability and interest characteristics, which is prone to the problems of "can't learn", "can't practice well" and "don't like to practice". In addition, most of the existing physical education is still based on the teaching of motor skills, failing to consciously combine sports practice with the knowledge of science, mathematics, art and other disciplines. It is difficult for students to experience the fun of interdisciplinary thinking in physical education class, which also restricts the improvement of comprehensive literacy [6]. The attention span of primary school students is short, but they are curious, willing to try, and like games and performances. Therefore, the teaching design should pay special attention to the creation of situation, diversity of activities and instant feedback, and carry out teaching in a way that children are happy to see, as shown in Table 1.

Table 1: Primary school students' badminton learning characteristics and corresponding teaching strategies

Learning characteristics	Presence of problems	Teaching strategies
Short attention span	Easily distracted and difficult to practice consistently	Use gamification teaching and change the content of activities every 15 minutes
I am curious and willing to try	Irregular movements, low success rate	Reduce the difficulty, use light weight equipment, and encourage experimentation more
Love games and performance	Tired of single repetitions of training	Design display links and create performance stages
The development of body coordination is unbalanced	The speed of technical movement mastery varies greatly	Stratified teaching, personalized guidance
Team consciousness has been formed	Limited cooperation ability	Design group cooperation tasks to cultivate a spirit of collaboration

2.2 Design ideas

STEAM education advocates the integration of multidisciplinary knowledge through real problem situations and emphasizes hands-on practice and creative problem solving. Guided by the concept of STEAM, this project adopts the project-based learning method and focuses on the core goal of "let children fall in love with badminton and learn badminton", and designs a series of interesting and challenging task activities close to students' experience, so that students can learn through play and learn through doing.

2.2.1 Develop STEAM project-based teaching objectives

According to the compulsory education physical education and health curriculum standards, combined with the STEAM education concept and the physical and mental characteristics of primary school students, the following teaching objectives are set, as shown in Table 2:

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Table 2: STEAM project-based teaching goal system

Dimension of ability	Specific goals	Corresponding to the STEAM element
Motor skills	Preliminarily master the basic movements of badminton forehand serve, hitting high and long ball, and can apply the skills learned in games	Engineering
Physical development	Develop coordination, dexterity, reflexes, and spatial positioning through multiple forms of movement, hitting, and play	Science
Scientific cognition	To perceive the parabola, speed change and other phenomena in badminton flight, and establish the preliminary relationship between sports and mechanics	Science
Application of technology	Use simple equipment (such as mobile phone slow shooting) to replay the action, with the help of measurement tools (such as tape measure) to sense the drop point change, and establish data awareness	Technology
Artistic expression	Try to create a badminton game or group display, which can cooperate with music and rhythm to enhance the sense of expression and cooperation	Arts
Mathematical thinking	Perceive the distance, Angle and distribution of the drop point in the service and the match, and try to describe the movement phenomenon with simple mathematical language	Mathematics

2.2.2 Design a sequence of project tasks

Around the theme of "Fun badminton", three progressive activity stages are designed to help students build a sense of the ball, learn skills, and comprehensively apply it:

The first stage: Initial Badminton Experience

Through the activities of "understanding badminton", "bouncing ball competition", "playing balloon" and so on, the difficulty of entry will be reduced, so that students can start from touching, bouncing and hitting the ball, and gradually get familiar with the ball and racket sense. Gamification methods, such as "badminton relay" and "sending badminton home", are used to let students develop basic mobile ability in running, stopping and changing direction. In this stage, attention is paid to fun and security, and lightweight rackets and low-speed balls are used to protect students' sports confidence [7].

Stage 2: Skill Exploration Workshop

Additionally, for students with a certain level of shuttlecock control proficiency, fundamental skills such as forehand serving and clearing are incorporated into the training. Instruction is delivered through a cyclical "deconstruction-imitation-attempt-feedback" approach, utilizing tools like target markings, markers, diagrams, and short video demonstrations [8]. Diverse practice scenarios are designed—such as "serving into target circles" and "clearing over a rope"—to enable students to learn through play. Emphasis is placed on mutual assistance within small groups through activities like the "little coach" initiative, encouraging observational learning.

Stage 3: Sports Show

Guide students in completing a group-based design project and presenting a badminton-themed performance (such as "badminton exercise routines," "badminton games," or "mini tournaments") utilizing the techniques they have acquired. Students may select background music, design the format of their performance, and assign roles based on the requirements of their presentation. The instructor provides guidance and recommendations throughout the process. This activity enables students to review and reinforce their learning while experiencing the enjoyment of creative design, collaboration, and expression through performance [9].

2.2.3 Create a supportive learning environment

Venue arrangement involves partitioning dedicated zones for practice, gameplay, and exhibitions, with equipment provided in varied categories (short-handle rackets, lightweight rackets, and shuttlecocks of differing speeds) to accommodate students across proficiency levels. The atmosphere is

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enlivened with colorful marker mats, rope nets, and cartoon illustrations to evoke a playful ambience. Emphasis is placed on fostering safety awareness and motivation among students: all activities are conducted under instructor supervision, with physical distancing maintained between participants. Clearly defined rules of engagement are communicated, and immediate feedback is provided through stamps, stickers, display walls, and other forms of timely evaluation.

2.3 Teaching process

There are 8 classes in this project, each of which is 40 minutes, as shown in Table 3:

Table 3: Badminton project-based teaching process schedule

Class hours	Teaching phase	Main content	Event format	STEAM element fusion point
1	Project launch	Get to know badminton and build expectations	Video import, touch experience	Scientific cognition, artistic feeling
2	First experience of badminton	Move with ball sense practice	Gamification Activity: "Chasing badminton"	Physical development, math spatial perception
3	Skill Discovery Workshop	Learn the forehand serve	Break down the imitation, serve into the zone game	Technical application, engineering thinking
4	Skill exploration workshop	Review the serve and introduce the high ball	High ball over the rope challenge, group help	Scientific principles, teamwork
5	Skill exploration workshop	Integrated exercises with games	Multi-site cyclic experience	Technology integration, mathematical measurement
6	Sports show	Group creative discussion	Program design, role assignment	Artistic creation, engineering design
7	Sports show show	Show rehearsal	Group practice, teacher guidance	Art and technology to improve performance
8	Sports show	Results show and share	Performance display and collective review	Comprehensive display and multiple evaluation

2.4 Teaching records

The teacher came into class with a mysterious box containing a badminton ball: "Today we are going to meet a new friend -- badminton ball!" The children gathered round, the teacher opened the box, let the children touch the badminton, tell me about it the look and feel. "It's soft! 'There are sixteen feathers! Conveniently introduced the origin of the badminton teacher, children listen to with relish.

At the beginning of the first stage: badminton experience

The teacher organized a "bouncing game", and the children tried to bounce the ball with their hands and rackets. At the beginning, the ball was always not obedient and ran everywhere, and the laughter in the classroom was constant. Slowly, some children find the feeling, can bounce two or three times in a row. "Teacher, I can top five!" "Shouted a little boy excitedly. The teacher promptly gave praise and encouraged the other children to keep trying [10].

Phase 2: Skill Exploration Workshop

Learning to serve, teachers use "swinging" ready - turned - password isolations, the children with imitation. "Teacher, I can't hit the ball high enough," one girl said anxiously. The teacher went over and helped her to adjust her grip and Angle of her arm. "Try to pick it up, yes! That's it!" After several attempts, the ball forward finally flying upwards, girl smile on his face.

In the ring toss game, various colored rings are positioned on the ground, and players earn distinct scores by successfully tossing the ball into different rings. The children are very involved, reminding each other of the essentials of the action and applauding the success of their peers.

The third stage: sports shows

Each group discussed the exhibition plan enthusiastically. Some groups wanted to make up a set of

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"badminton exercises", which combined hitting movements and formation changes; Some groups want to design a "badminton pass" game and invite other groups of students to challenge. The teacher provided suggestions to help each group improve the plan.

In the demonstration class, the children played badminton in a way designed by themselves, some with music rhythm, and some told a short story, full of childlike interest and creativity. After the demonstration, the teacher guided the students to share their feelings: "Today we not only learned to play badminton, but also created our own game together with our friends!"

2.5 Teaching Reflection

This project attempted to integrate the STEAM concept into badminton teaching in primary schools and achieved the following results:

Firstly, students' interest in learning badminton was significantly improved. Through the gamified and contextualized activity design, the boring technical practice was turned into a playful challenge, and the children unconsciously mastered the sports skills in "playing".

Secondly, students' successful experience in sports is enhanced. The program starts from reducing the difficulty and building up the sense of the ball, and gradually makes every child make progress on the original basis, and establishes the confidence of "I can".

Third, it preliminarily reflected the interdisciplinary integration. Students perceived force, direction, rhythm and other elements in the movement, tried to describe the distribution of the landing points with mathematical language, and expressed the beauty of the movement with art forms. Although it was simple, it laid a foundation for subsequent in-depth learning.

Some problems were also found in practice. First, there were great differences in the movement foundation of different students, and how to better realize stratified teaching in the project still needed to be explored. Second, the time schedule of the project is still tight, and some technical movements are not well grasped by students. Three is STEAM elements into sometimes slightly hard, need more naturally and combining exercise teaching.

3. Conclusion

It is the responsibility of PE teachers to make pupils fall in love with badminton and learn how to play it. Through the practice of this project, we realize that the project-based teaching based on the STEAM concept can inject new vitality into the primary school physical education classroom. It reminds us that physical education is not only a skill teaching, but also a process of stimulating interest, cultivating ability and developing literacy. In the future, we will continue to explore ways to deeply integrate STEAM education and physical education, so that more children can gain health, happiness and growth in sports.

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