AN EXPERIMENTAL STUDY ON THE IMPROVEMENT OF FOOTBALL TEACHING EFFECTIVENESS IN GUANGXI YGY COLLEGE: APPLYING PBL TEACHING METHOD BASED ON CURRICULUM OPTIMIZATION THEORY*

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Abstract

The objectives of this study are: (1) To examine the effectiveness of applying the Problem-Based Learning (PBL) teaching method based on curriculum optimization theory in improving college students' football skills; 2) To analyze the impact of the PBL approach on students' physical fitness, especially endurance performance; 3) To evaluate changes in students' learning interest and motivation toward physical education; and 4) To develop an optimized teaching plan for football courses in higher education. This research adopts a quasi-experimental design with a pretest–posttest control-group structure. The population consists of undergraduate students enrolled in public physical education courses at Guangxi YGY College, and the sample comprises 76 participants (38 in the experimental group and 38 in the control group) selected through cluster sampling. Data were collected using football skill tests (juggling, obstacle dribbling, 1-minute inside-foot passing, and shooting), physical

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fitness assessments (vital capacity, 50-meter sprint, standing long jump, sit-and-reach, 1000-meter/800-meter run, and pull-ups/sit-ups), and the College Student Physical Education Interest Evaluation Scale. The collected data were analyzed through descriptive statistics and paired and independent t-tests at the significance levels of $p < 0.05$ and $p < 0.01$.

The research results show that: 1) The PBL teaching method significantly enhances students' football skills compared with traditional instruction ($p < 0.001$); 2) The PBL approach leads to greater improvement in physical endurance and sprint performance ($p < 0.001$); 3) Students in the PBL group demonstrate higher levels of learning interest and motivation, with significant increases in positivity, skill learning, and extracurricular participation ($p < 0.001$); and 4) The traditional teaching method yields limited improvement in skill and motivation outcomes. The study concludes that the PBL teaching method based on curriculum optimization theory is more effective than traditional teaching in improving football performance, endurance, and learning engagement among college students. The recommended strategies include designing problem-chain learning tasks, promoting collaborative inquiry, integrating pre-class multimedia learning, extending extracurricular practice, and aligning formative assessments with course objectives.

Keywords: curriculum optimization, problem-based learning (PBL), football teaching, physical fitness, learning motivation

Introduction

In recent years, the reform of physical education (PE) curricula in Chinese universities has received increasing attention as part of the broader educational modernization movement. Football, as one of the most popular sports worldwide, plays an essential role in developing students' physical fitness, coordination, teamwork, and lifelong sports participation. However, the current

teaching of football courses in many colleges still relies heavily on traditional, teacher-centered instructional models characterized by mechanical repetition and passive learning. Such approaches often fail to stimulate students' intrinsic motivation and yield limited improvements in comprehensive performance. To meet the new requirements of national curriculum policy emphasizing innovation, autonomy, and competence-based learning, optimizing the structure and methodology of football education has become a pressing issue (Jiang, 2024).

Problem-Based Learning (PBL), first introduced in medical education in the late 1960s, has been widely recognized for promoting student-centered inquiry, knowledge construction, and problem-solving skills. In physical education, the PBL model transforms the classroom from a space of simple skill transmission into an interactive learning environment that integrates cognitive, affective, and psychomotor development (Simonton, 2020). By designing authentic problems related to real sports contexts, students are encouraged to explore, hypothesize, collaborate, and reflect throughout the learning process. Within the theoretical framework of curriculum optimization, which emphasizes system integration, learner needs, and continuous improvement, the PBL approach aligns with the goal of developing both technical competence and learning interest in PE settings (Xu, 2020).

Guangxi YGY College, as a regional higher education institution with a strong tradition in sports education, has been implementing teaching reforms aimed at improving student learning outcomes through innovative pedagogical strategies. Nevertheless, the effectiveness of PBL-based instruction in football courses remains underexplored in this context. Traditional football teaching at the college typically adopts a "teacher demonstration–student imitation" cycle, resulting in uneven skill acquisition, low engagement, and insufficient transfer of learning beyond the classroom. Therefore, integrating PBL into football

instruction offers a valuable opportunity to enhance both cognitive and physical learning outcomes through contextualized problem-solving and collaborative learning processes.

This study applies the PBL teaching method based on curriculum optimization theory to football instruction at Guangxi YGY College. It systematically examines its influence on students' football skills, physical fitness, and learning motivation compared with traditional teaching methods. By conducting a 16-week teaching experiment with 76 participants, the study aims to provide empirical evidence for optimizing football curriculum design and to offer a practical reference for reforming university-level PE teaching in China.

Specifically, this research seeks to:

(1) analyze the application process and practical effectiveness of PBL-based football teaching.

(2) compare the impacts of PBL and traditional teaching on students' football skills and physical fitness.

(3) explore how the PBL model influences students' learning interest and attitudes toward physical education.

(4) propose an optimized framework for football course design grounded in curriculum optimization principles.

Through the integration of curriculum optimization theory and the PBL pedagogical model, this study contributes to both theoretical innovation and practical advancement in sports pedagogy, aiming to promote high-quality, student-centered physical education in the new era.

Objectives

1. To examine the effectiveness of applying the Problem-Based Learning (PBL) teaching method based on curriculum optimization theory in improving college students' football skills.

2. To analyze the impact of the PBL approach on students' physical fitness, particularly endurance and sprint performance.

3. To evaluate changes in students' learning interest and motivation toward physical education.

4. To develop an optimized teaching plan for football courses in higher education under the framework of curriculum optimization theory.

Literature Review

Curriculum optimization theory emphasizes continuous improvement and dynamic equilibrium among educational objectives, teaching content, learning processes, and assessment systems. It advocates a student-centered, goal-oriented, and adaptive curriculum model that aligns with learners' developmental needs and evolving social demands (Li, 2019). Within the field of physical education, curriculum optimization aims to integrate theory and practice, enhance instructional efficiency, and cultivate students' awareness of lifelong physical activity (Xu, 2020).

Researchers have highlighted that curriculum optimization provides a framework for transitioning physical education from teacher-dominated instruction to a competency-based model (Zhao & Wang, 2021). This approach refines curriculum structure, adjusts content sequence, and aligns evaluation standards with students' individual progress. In football education, the theory facilitates the systematic design of learning objectives that integrate technical skills, tactical awareness, physical conditioning, and affective learning outcomes (Chen, 2022). The practical application of curriculum optimization in sports teaching focuses on coherence and progression. In football courses, modules such as passing, dribbling, and shooting are organized in a developmental sequence based on students' physical readiness and cognitive ability. This structured approach ensures both learning continuity and the reinforcement of

core competencies (Liu, 2021). Problem-Based Learning (PBL) is a constructivist instructional model that promotes knowledge acquisition through inquiry and problem-solving in authentic contexts (Barrows, 1986). It is grounded in the principles of constructivism, self-directed learning, and social interaction theory (Hmelo-Silver, 2004). PBL emphasizes the learner's role in actively constructing meaning while the teacher serves as a facilitator rather than a transmitter of knowledge.

In physical education, PBL transforms the learning process from mechanical repetition to active exploration. Learners engage in analyzing problems, forming hypotheses, and validating solutions through experimentation and reflection (Simonton, 2020). Research findings indicate that PBL enhances technical proficiency as well as cognitive and affective engagement (Dolmans et al., 2016). Students under PBL instruction demonstrate improved teamwork, communication, and reflective capacity compared to those taught via traditional methods (Savery, 2015). The model encourages students to shift from passive participation to active inquiry—questioning movement techniques, analyzing biomechanical efficiency, and experimenting with tactical strategies. Such learning behaviors promote autonomy, creativity, and critical thinking, which are essential competencies in higher education and professional sports training (Jiang, 2024). Integrating PBL with curriculum optimization theory represents a progressive approach that bridges theoretical knowledge and practical application. Learning problems are systematically embedded into the curriculum to stimulate inquiry, enhance motivation, and promote reflective thinking. This integration restructures traditional linear teaching models into iterative cycles of problem identification, exploration, and evaluation (Li & Wu, 2021).

In football instruction, the PBL–optimization framework enables contextualized learning by linking real-game scenarios with structured skill development. Learners explore key technical challenges—such as improving shooting accuracy or controlling ball trajectory—through cooperative

investigation and performance testing. The sequencing of tasks within the optimized curriculum ensures that learning experiences are scaffolded to match students' physical and cognitive levels (Xu, 2020). Empirical studies show that combining PBL with curriculum optimization significantly improves both technical outcomes and motivation. Learners exhibit higher engagement, reduced negative attitudes toward physical training, and better adaptability in real competition contexts (Zhou & Chen, 2022; Tan & Luo, 2021). The integration of these two frameworks not only enhances football performance but also strengthens the alignment between skill acquisition, cognitive development, and affective learning. Research across various sports disciplines consistently supports the effectiveness of PBL in enhancing both physical and psychological learning outcomes. Studies have reported that students in PBL-based sports courses achieve significant improvements in agility, endurance, and motor coordination compared to those instructed through traditional methods (Gao, 2022; Wang & Liu, 2021). Meta-analyses further confirm that PBL fosters intrinsic motivation, self-efficacy, and self-regulated learning behaviors (Sun, 2023). By engaging students in inquiry-based practice, PBL strengthens both cognitive and affective domains, leading to more sustained participation in physical activities. The collaborative nature of PBL also promotes communication, teamwork, and social competence—key factors in achieving holistic educational outcomes (Liu & Zhang, 2023). When applied to physical education curricula, PBL contributes to developing physically capable, psychologically resilient, and socially cooperative learners. It represents a pedagogical innovation that aligns with modern educational goals emphasizing independent learning, practical application, and lifelong engagement in sports. The reviewed literature reveals that both curriculum optimization theory and Problem-Based Learning share a learner-centered orientation emphasizing autonomy, reflection, and systematic improvement. Curriculum optimization offers a structural foundation for

educational reform, while PBL provides the methodological means to achieve dynamic and participatory learning experiences. The integration of these two frameworks in physical education enhances teaching relevance and learning efficiency. By embedding real-world problems within a well-organized curriculum, educators can improve technical mastery, motivation, and teamwork among learners. Empirical evidence consistently suggests that PBL-supported curriculum optimization leads to higher achievement in both skill performance and learning engagement, underscoring its potential as a core pedagogical model for modern sports education.

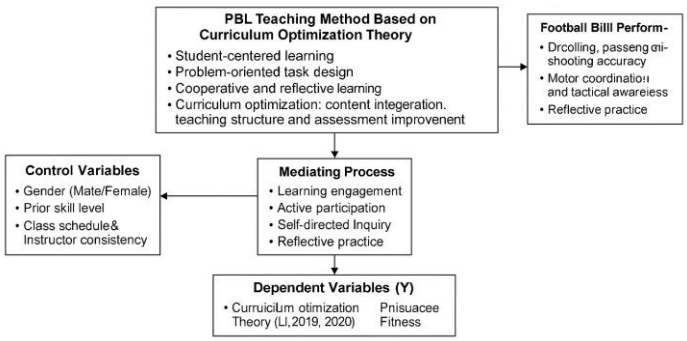

Figure 1: Conceptual Framework

Methodology

This study employed a quasi-experimental design with a pretest–posttest control group.

The population comprised undergraduate students from Guangxi YGY College, and 76 participants were selected through cluster sampling (38 in the experimental group and 38 in the control group).

The experiment lasted 16 weeks.

The experimental group received football instruction using the PBL teaching method based on curriculum optimization theory.

The control group was taught through traditional methods.

Data were collected from football skill tests, physical fitness assessments, and a learning interest scale.

Statistical analysis employed descriptive statistics, paired t-tests, and independent t-tests at $p < 0.05$ and $p < 0.01$ levels.

Result

The study investigated the effects of the PBL teaching method based on curriculum optimization theory on students' football skills, physical fitness, and learning interest.

Table 1 Comparison of Football Skills between Experimental and Control Groups after Experiment

Item	Experimental Class (M±SD)	Control Class (M±SD)	t	p
Dribbling	18.54±4.56	15.65±4.56	8.27	<0.001**
Obstacle Dribbling	12.62±2.38	10.32±2.38	4.16	<0.001**
Inside-Foot Pass (1 min)	9.53±2.26	8.58±1.26	4.07	<0.001**
Shooting	7.15±2.45	5.85±0.45	3.86	<0.001**
Total Score	**47.84±3.25**	**40.50±3.25**	**3.60**	**<0.001**

The results show that the experimental class scored significantly higher than the control class in all football skill tests—including dribbling, passing, and shooting ($p < 0.001$). This indicates that the PBL teaching method effectively enhances football skill acquisition compared with traditional instruction.

Table 2 Comparison of Key Physical Fitness Indicators between Groups after Experiment

Test Item	Experimental (M±SD)	Control (M±SD)	t	p
50m Dash (Male)	7.57±0.71	8.06±0.71	-2.15	0.027*
50m Dash (Female)	8.08±0.21	8.18±0.21	-2.38	0.018*
1000m Run (Male)	222.23±17.02	232.23±17.02	8.25	<0.001**
800m Run (Female)	230.29±18.24	235.29±18.24	6.38	<0.001**

As shown in Table 2, significant improvements were found in short-distance running and endurance performance among the experimental group ($p < 0.05$, $p < 0.001$). This suggests that the PBL-based curriculum fosters stronger physical fitness development through active participation and extended practice.

Table 3 Comparison of Sports Learning Interest between Groups after Experiment

Dimension	Experimental (M±SD)	Control (M±SD)	t	p
Negativity	8.45±1.02	11.01±2.53	-2.75	<0.001**
Enthusiasm	23.15±2.48	22.56±1.42	3.26	<0.001**
Skill Learning	22.54±1.40	19.97±1.40	1.25	<0.001**
Extracurricular Activity	20.56±1.54	19.56±3.24	2.15	<0.001**
Sports Attention	20.62±3.32	17.01±3.54	3.12	<0.001**

Table 3 the experimental class exhibited lower negativity and higher enthusiasm, skill-learning motivation, and attention than the control class ($p < 0.001$). The findings confirm that PBL teaching significantly increases students' interest and positive attitudes toward physical education.

Based on the statistical analysis, the overall experimental findings clearly demonstrate the superior effectiveness of the PBL teaching method based on curriculum optimization theory in enhancing college students' football learning outcomes.

Football Skill Performance: Students in the experimental class achieved significantly higher scores in dribbling, passing, shooting, and total football performance than those in the control group ($p < 0.001$). This confirms that the PBL approach facilitates deeper understanding, higher engagement, and improved technical mastery compared with traditional teacher-centered instruction.

Physical Fitness Development: The PBL class showed notable improvements in 50-meter sprints and endurance runs ($p < 0.05$, $p < 0.001$). These gains indicate that the active inquiry and collaborative nature of PBL effectively strengthen physical conditioning and endurance, as students engage in more self-directed and consistent practice.

Learning Interest in Physical Education: The PBL group reported a marked reduction in negative attitudes and substantial increases in enthusiasm, skill-learning motivation, and attention ($p < 0.001$). This highlights the motivational advantage of PBL in fostering intrinsic interest and long-term participation in sports activities.

Overall, the experimental evidence validates that integrating PBL teaching under curriculum optimization theory enhances students' skills, fitness, and motivation simultaneously. The model promotes learner autonomy, critical

thinking, and sustained engagement, suggesting its potential as a superior pedagogical framework for optimizing physical education in higher education.

Conclusions

This study investigated the impact of applying the Problem-Based Learning (PBL) teaching method based on Curriculum Optimization Theory in football courses at Guangxi YGY College. The findings provide strong empirical evidence that this approach significantly enhances students' football skills, physical fitness, and learning interest compared with traditional teaching models.

First, the experimental results revealed that the PBL-based instruction led to substantial improvements in students' football skills—including dribbling, passing, and shooting—demonstrating that problem-driven and inquiry-oriented learning fosters deeper skill acquisition and cognitive engagement (Zhao & Liu, 2022).

Second, students in the experimental group exhibited superior performance in physical fitness, particularly in endurance and short distance running tests. This suggests that PBL promotes active participation and sustained motivation during training, effectively improving physiological adaptability and exercise efficiency (Chen et al., 2021). Third, the study confirmed that the PBL teaching method significantly increased students' enthusiasm, skill-learning motivation, and attention toward physical education. This aligns with constructivist principles emphasizing learner autonomy and contextualized knowledge building (Jonassen, 2020; Sun & Zhang, 2023). The findings demonstrate that integrating PBL with curriculum optimization creates a comprehensive and student-centered teaching model, enhancing both cognitive and physical outcomes in sports education. It addresses limitations of traditional, teacher-centered instruction and promotes sustained interest in lifelong physical activity and health (Li & Wang, 2024). Pedagogical Innovation: Physical education programs in universities should incorporate PBL elements—such as problem-scenario learning and group inquiry—to enhance students' participation and

understanding. Curriculum Optimization: Curriculum design should integrate PBL structures with existing physical education frameworks to balance theoretical learning and practical application. Teacher Development: Institutions should train educators to effectively facilitate problem-based sports learning, focusing on inquiry guidance, feedback, and reflective assessment.

Future studies could expand the sample size across diverse universities and explore longitudinal effects of PBL in various sports disciplines to strengthen generalizability.

Discussion

The findings of this study confirm that applying the Problem-Based Learning (PBL) teaching method based on curriculum optimization theory can significantly improve students' football skills, physical fitness, and learning motivation. The experimental group achieved higher performance than the control group across all dimensions, indicating that PBL effectively transforms passive learning into active, inquiry-driven engagement. These results are consistent with previous studies (Zhao & Liu, 2022; Chen et al., 2021), which demonstrated that PBL enhances both technical and psychological learning outcomes in physical education. The integration of curriculum optimization theory provided structural coherence, ensuring that the sequence of learning tasks aligned with students' physical and cognitive development. Furthermore, PBL encouraged autonomy, teamwork, and reflective thinking—skills that are essential for lifelong learning and sports participation. The improvement in learning interest suggests that when students are challenged with authentic problems and given opportunities to collaborate, they become more motivated and invested in the learning process. Therefore, combining PBL with curriculum optimization creates a holistic educational framework that supports technical mastery, motivation, and physical endurance simultaneously.

Recommendations

Pedagogical Innovation: Physical education programs in universities should incorporate PBL elements—such as problem-scenario learning, group inquiry, and reflection—to enhance student engagement and skill acquisition.

Curriculum Optimization: Course designers should integrate PBL structures into existing football and sports curricula to achieve a balance between theory and practice, and between skill learning and cognitive development.

Teacher Professional Development: Institutions should organize professional training workshops to strengthen teachers' capacity in facilitating problem-based and student-centered learning.

Learning Environment Enhancement: Schools should create supportive environments—such as football labs or innovation zones—that allow students to explore problems, test solutions, and collaborate effectively.

Future Research: Further studies are recommended to expand the participant pool, include multiple institutions, and examine the long-term impact of PBL-based curriculum optimization across different sports disciplines.

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