The Effects of Cooperative Teaching Method Used in Badminton Teaching on Physical Fitness in Student Ningbo University of Finance & Economics

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Abstract

This study aimed to apply the cooperative teaching method in badminton courses through a teaching experiment. The objectives of the research were: (1) To compare the differences in physical fitness within the experimental and control groups before and after the intervention. 2) To compare the differences in physical fitness between the experimental group and the control group after the intervention. Eighty first-year students from Ningbo University of Finance and Economics participated; they were all avid badminton players without any prior professional experience. They were naturally split into two groups, Group A and Group B, with no discernible differences in their physical fitness or interest in sports. The participants were chosen from elective public courses. Numerous techniques were used in the study, such as expert interviews, experimental design, literature review, and mathematical statistical analysis. The learning effects and physical fitness outcomes (i.e., agility, endurance, explosive strength, and speed) of the two groups were compared before and after the 12-week intervention using independent samples t-tests and paired samples t-tests. The research results were found as follows;

1. In the within-group comparison, both the experimental group and the control group have achieved more significant physical fitness after the experiment, and the achievements of the experimental group are more significant than those of the control group.

2. In the between-group comparison, the differences in physical fitness between the experimental group and the control group are more significant, with the experimental group showing better performance than the control group.

The results support the effectiveness of the cooperative teaching method in improving physical fitness in badminton instruction.

Keywords: Cooperative Teaching Method; Badminton Course; Physical Fitness; Teaching Experiment; Independent Samples T-Test.

Introduction

Physical education (PE) at universities is essential for fostering students' resilience, lifelong health, and interest in learning-skills that are becoming more and more valued in today's society. Because it necessitates the coordinated development of several fitness components (agility, endurance, speed, and explosive power) and can be taught in relatively modest facilities, badminton is a popular course in Chinese universities within this mandate (Loureiro, 2016; Tzetzis, 2006). However, there are still ongoing questions about how well traditional, teacher-centered instruction can encourage active learning, maintain motivation, and produce quantifiable improvements in physical fitness in freshmen who are not specialists.

Cooperative teaching, a student-centered pedagogy that structures interdependence, shared responsibility, and peer support to encourage deeper engagement and performance, has gained popularity in response to these worries. These strategies, which are based on cooperative learning theory and in line with Self-Determination Theory (SDT), aim to meet students' basic psychological needs-autonomy, competence, and relatedness-in order to boost intrinsic motivation and enhance learning outcomes in physical education (Sun, Li, & Shen, 2017; Casey & Goodyear, 2015).

In response to these concerns, cooperative teaching has gained traction as a student-centered pedagogy that structures interdependence, shared responsibility, and peer support to promote deeper engagement and performance. Grounded in cooperative learning theory and aligned with Self-Determination Theory (SDT), such approaches are designed to satisfy students' basic psychological needs-autonomy, competence, and relatedness—thereby enhancing intrinsic motivation and improving

learning outcomes in PE (Sun, Li, & Shen, 2017; Casey & Goodyear, 2015). According to recent reviews and meta-analyses, cooperative models can produce significant advantages in school and university physical education across the cognitive, affective, social, and physical domains (Bores-García et al., 2021; Fernández-Espínola et al., 2020). Nevertheless, there is little evidence from controlled, term-length interventions, and empirical applications that separate objective physical fitness outcomes within university badminton courses are still relatively underrepresented, despite growing adoption.

In order to close this gap, the current study assesses a 12-week cooperative teaching intervention in a university badminton course with an emphasis on the four fundamental elements of physical fitness: speed, explosive power, agility, and endurance. We compare (a) within-group pre-to-post changes for the experimental and control groups, and (b) between-group differences after the intervention, using paired-samples and independent-samples t-tests. This study aims to (1) provide theory-driven, objective evidence of fitness gains attributable to cooperative instruction in badminton by integrating cooperative teaching with an SDT-informed rationale, and (2) inform practical course design for university PE programs that want to shift from teacher-centered delivery toward student-centered models that are both pedagogically sound and performance-enhancing (Casey & Goodyear, 2015; Bores-García et al., 2021; Fernández-Espínola et al., 2020; Sun et al., 2017).

Research objectives

1. To compare the differences in physical fitness within the experimental and control groups before and after the intervention.

2. To compare the differences in physical fitness between the experimental group and the control group after the intervention.

Literature review

1. Instruction in badminton

Parimi (2024) elaborated on how learning the long serve technique in badminton is impacted by various imagery types. In badminton instruction, autonomy-supportive behaviors foster intrinsic motivation, knowledge acquisition, motor skill development, and performance, according to (Behzadnia,

2019). In badminton instruction, Hidayat (2023) showed that integrating self-talk with mental imagery had a major effect on the motor skills of teenage badminton beginners.

Gillet (2016) investigated the applicability of self-determination theory (SDT) in physical education, emphasizing the role that psychological needs play in athletic performance and recovery. The advantages of autonomy-supportive pedagogical approaches in sports coaching, particularly in skill acquisition, were covered (Occhino, 2014). SDT was further utilized (Llanos-Muñoz, 2023) when creating physical education programs for elementary school pupils.

Tzetzis (2006) highlighted how important appropriate feedback is for learning new skills, especially when teaching badminton. The importance of intrinsic motivation in performance was reinforced (Leo, 2020). Rodrigue (2025) who connected student motivation and classroom engagement to physical education outcomes. SDT's fundamental role in student-centered teaching was reinforced (White, 2021) systematic review of its applications in physical education.

2. Collaborative Education

Peer-assisted learning (PAL) has been shown to dramatically improve academic and social skills in higher education settings (Christensen, 2025; Swallow, 2023). Dennis (2020) argued that for maximum impact, PAL should be combined with simulation-based learning. Winnykamen (2002); Lee & Ward (2005) examined the theoretical underpinnings and real-world implementations of PAL in physical education, noting possible differences by gender and dyad type.

The four main learning objectives of physical education-physical, cognitive, affective, and social-are addressed by cooperative learning models, according (Casey & Goodyear, 2015). A meta-analysis (Liu, 2021) emphasized the significance of student-centered process design in cooperative learning. Mežan (2023) discovered that when it comes to the development of children's motor skills, cooperative learning outperforms direct instruction. Young teachers' favorable attitudes toward cooperative models were emphasized (Fernández Rivas, 2016), who also noted improvements in social interaction. Cooperative learning has a major impact on peer relationships, motivation, and future intentions for physical activity, according (Cecchini Estrada, 2019; Tang, 2024). The growing use of cooperative teaching in physical education was advocated (Wang, 2022).

In conclusion, cooperative teaching models are widely accepted around the world and are becoming more and more popular in China. However, there are still few empirical uses of badminton instruction, indicating a need for further contextual research.

3. Badminton Physical Fitness

In order to demonstrate the sport's requirements for agility, speed, endurance, strength, and coordination, Loureiro (2016) created and validated an agility test for badminton. Doshi (2021) used factor analysis to identify three important fitness indicators: agility, explosive power, and speed endurance. The significance of cardiovascular and neuromuscular characteristics in badminton performance was reaffirmed (Tai, 2022; Lim, 2023).

In their examination of the psychological and physiological aspects of fitness in physical education, Leahy (2019) demonstrated how player roles–such as offensive versus defensive–affect the emphasis placed on fitness training. In order to examine the mechanics and interactions of fitness dimensions, Howard (2020) suggested using interdisciplinary approaches. In order to provide insights into training optimization, Pan (2024) used biomechanical analysis to investigate motor experience and muscle synergy in the badminton jump smash.

607 related studies from 1998 to 2024 were found by searching the China National Knowledge Infrastructure (CNKI) with keywords like "cooperative teaching method," "badminton teaching," and "physical fitness." Although there were few studies in the beginning, after 2008, there was a noticeable increase in research. Only seven studies, however, particularly examined cooperative teaching in badminton, highlighting a gap that this study seeks to fill.

Conceptual framework

This research is an empirical study. Based on the relevant theories of cooperative teaching methods, physical fitness in badminton, and badminton teaching, the researcher defines the research conceptual framework by incorporating references. The specific details are as follows:

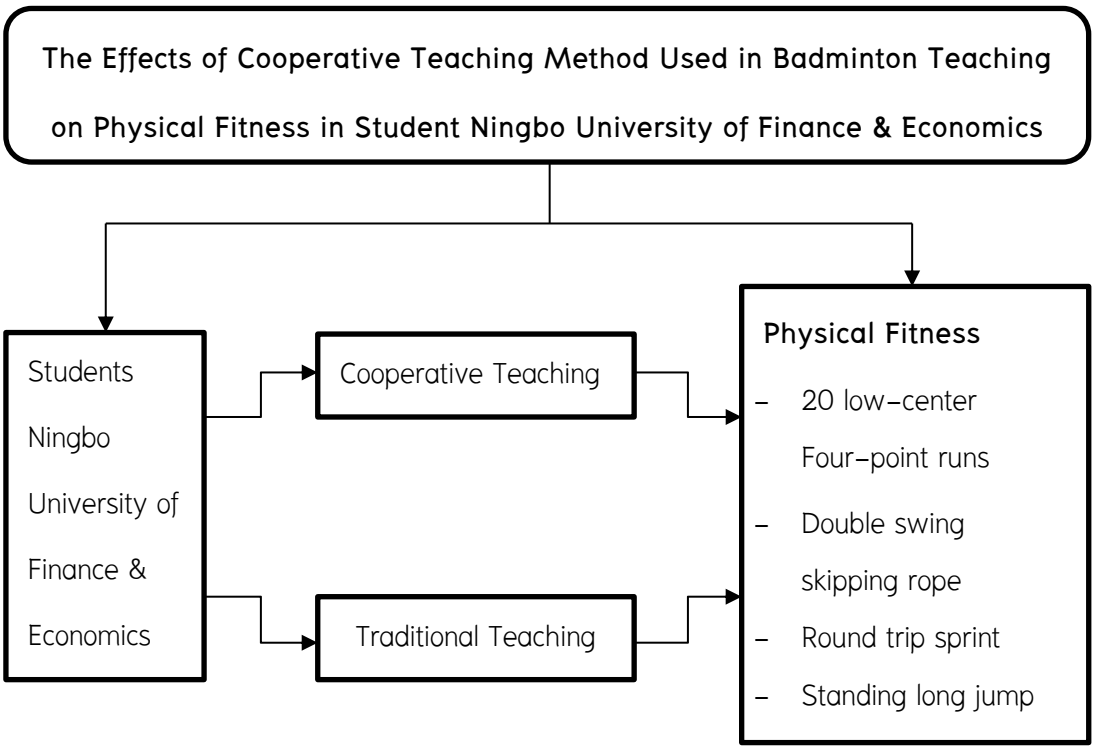


Figure 1 Show conceptual framework

Research Methodology

The research methodology used in this study was quantitative. The study was carried out at Ningbo University of Finance and Economics' North District Sports Center. The population was made up of university freshmen who were all avid badminton players without any professional background in the game. Eighty students enrolled in public elective badminton courses made up the sample. They were divided into two groups at random, with forty students in each: the experimental group and the control group. One 90–minute session per week was held for the duration of the 12–week intervention.

The following tools and techniques were employed:

1. Review of Literature: Academic databases like Web of Science and PubMed were used to review pertinent theoretical and empirical research on pedagogy, badminton instruction, and cooperative teaching models. To give the study theoretical support, the gathered literature was examined and synthesized.

2. Mathematical Statistics: Before and after the experiment, data from students in the control group and experimental group were analyzed both intra– and inter–group using the independent sample

T-test and the paired sample T-test. The data was analyzed using SPSS software, and the change trends before and after the experiment were displayed using clear charts.

3. Expert Interview: For this study, a total of 24 lesson plans-one for each class-were created. After expert evaluations and interviews, the lesson plans were experimentally implemented.

Research results

Objective 1. After the intervention, both the experimental and control groups showed notable increases in physical fitness, according to the within-group comparison. Nonetheless, the experimental group's level of improvement was noticeably higher than the control group's. This implies that, in comparison to traditional instruction, the cooperative teaching approach had a greater influence on improving students' physical performance.

Table 1 Paired t-test analysis results of physical fitness in the experimental group before and after the experiment.

Physical Fitness	Pair (Average value± Standard deviation)		Difference	t	p
	Pre	Post	(pre-post)		
20 low-center four-point runs (agility)	139.7±12.0	130.5±8.4	9.16	3.187	0.003*
Double swing skipping rope (endurance)	344.1±8.7	353.0±6.8	-8.92	-5.815	<0.001*
Round trip sprint (speed)	78.9±11.4	69.2±5.3	9.75	5.796	<0.001*
Standing long jump (power)	2.0±0.1	2.1±0.2	-0.06	-2.335	0.025*

* $p<0.05$

Following the implementation of the cooperative teaching approach, Table 1 demonstrates the experimental group's notable improvement in all four aspects of physical fitness: agility, endurance, speed, and explosive power. At the $p < 0.05$ level, every change is statistically significant, suggesting that the intervention had a significant effect.

Table 2 Paired t–test analysis results of physical fitness in the control group before and after the experiment.

Physical Fitness	Pair (Average value± Standard deviation)		Difference	t	p
	Pre	Post	(pre–post)		
20 low–center four–point runs (agility)	139.6±12.2	135.5±10.5	4.19	2.29	0.028*
Double swing skipping rope (endurance)	344.8±8.3	348.5±8.9	–3.73	–2.302	0.027*
Round trip sprint (speed)	78.0±11.1	72.5±8.0	5.51	2.042	0.048*
Standing long jump (power)	2.04±0.10	1.97±0.24	0.07	2.205	0.033*

* $p<0.05$

The control group's pre– and post–test results are shown in Table 2. All aspects of physical fitness showed statistically significant gains, but the change was less pronounced than in the experimental group, suggesting that conventional teaching techniques were less successful.

Objective 2. Following the intervention, the experimental group performed better than the control group in every measured area of physical fitness, according to the between–group comparison. The statistically significant differences in post–test scores between the two groups showed that the cooperative teaching method was more effective than the traditional teaching approach at improving students' physical capabilities.

Table 3 Pre-test analysis results for physical fitness between the experimental and control groups before the intervention.

Physical Fitness	Group (Average value± Standard deviation)		t	p
	Experimental Group (n=40)	Control Group (n=40)		
20 low-center four-point runs (agility)	139.65±11.99	139.56±11.88	0.034	0.973
Double swing skipping rope (endurance)	344.10±8.68	344.77±8.30	-0.355	0.723
Round trip sprint (speed)	78.94±11.40	78.04±11.11	0.357	0.722
Standing long jump (power)	2.02±0.11	2.04±0.10	-0.588	0.558

* $p<0.05$

Before the intervention, there were no statistically significant differences between the experimental and control groups' levels of physical fitness, as shown in Table 3 ($p > 0.05$). This implies that both groups were similar at baseline, confirming the experiment's validity.

Table 4 Independent samples t-test analysis results for physical fitness between the experimental and control groups after the intervention.

Physical Fitness	Group (Average value± Standard deviation)		t	p
	Experimental Group (n=40)	Control Group (n=40)		
20 low-center four-point runs (agility)	130.49±8.39	135.45±10.48	-2.312	0.023*
Double swing skipping rope (endurance)	353.02±6.78	348.50±8.88	2.562	0.012*
Round trip sprint (speed)	69.20±5.30	72.53±7.95	-2.209	0.030*
Standing long jump (power)	2.09±0.17	1.97±0.24	2.626	0.010*

* $p<0.05$

The experimental and control groups' post-test physical fitness differences are statistically significant ($p < 0.05$), as shown in Table 4. The experimental group demonstrated better results in every aspect of physical fitness, demonstrating the beneficial impact of the cooperative teaching approach.

Discussion

The three fundamental psychological needs at the heart of SDT—autonomy, competence, and relatedness—are supported by the cooperative teaching approach used in this study and are necessary for promoting intrinsic motivation (Sun, Li, & Shen, 2017). Cooperative teaching fosters competence and autonomy by supporting student-led group projects and cooperative problem solving. Additionally, cooperative structures that foster mutual reliance among members fulfill the need for relatedness and foster a positive learning atmosphere (Johnson & Johnson, 2009).

Objective 1 Findings: An SDT perspective can help explain the experimental cohort's improved within-group gains. Students who use a cooperative structure are more likely to feel autonomous, competent, and related, all of which increase intrinsic motivation and improve engagement and performance (Fernández-Espínola et al., 2020). Beyond what was possible with conventional techniques, this offers a theoretical explanation for the observed gains.

Objective 2 Findings: Dyson et al., (2004) research on Sport Education, Tactical Games, and Cooperative Learning highlights that student-centered, interactive environments promote cognitive, social, and physical gains, which is consistent with the experimental group's between-group superiority. Students work together and solve problems in these settings, which enhances fitness results and strengthens the fundamental psychological needs of SDT.

Theoretical and Practical Implications: By combining SDT with cooperative learning theory, it becomes clear that enhancing physiological outcomes calls for a pedagogical change that fosters students' competence, autonomy, and sense of community rather than just skill drills. This method supports the need for creative, student-centered physical education strategies (Fernández-Espínola et al., 2020) and is consistent with both the motivational frameworks and Sport Education models (Dyson et al., 2004).

Knowledge from research

The diagram illustrates the positive effects of applying the Cooperative Teaching Method in Badminton on various components of physical fitness. The method is shown to effectively enhance four key physical abilities:

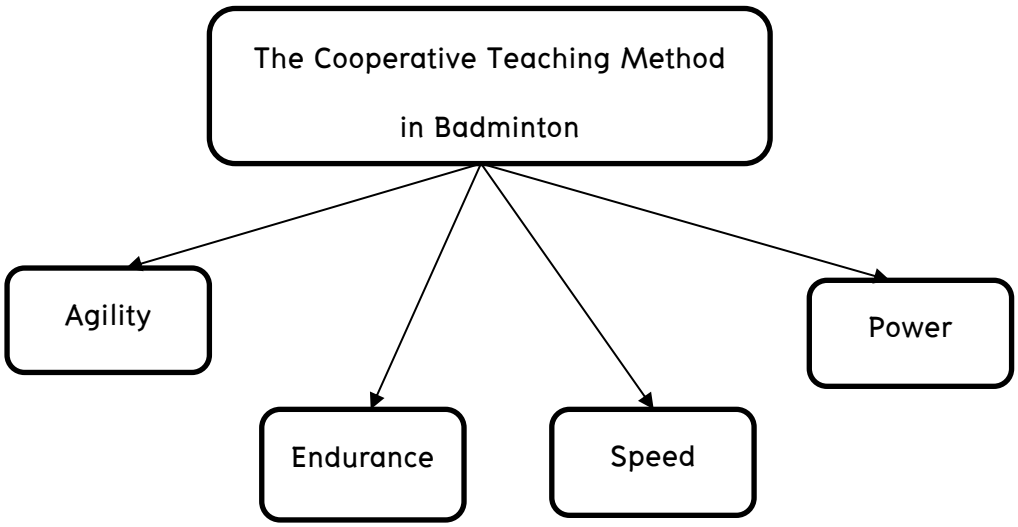


Figure 2 The Cooperative Teaching Method in Badminton on various components of physical fitness.

Conclusion

This study looked at how university badminton players' physical fitness was affected by cooperative teaching methods. Both the experimental and control groups improved after a 12–week intervention, but the experimental group's gains in physical fitness were noticeably larger because it employed cooperative teaching. According to the results, cooperative teaching increases student engagement and is useful in improving important aspects of physical fitness. Therefore, it is advised that cooperative teaching be incorporated into physical education curricula in order to enhance student–centered learning and physical competence.

Suggestions

1. Useful Consequences

The baseline differences between students in the experimental and control groups must be taken into account when designing experimental studies involving cooperative teaching models in

university–level physical education. By accounting for these variations, bias is reduced and the validity of the findings is guaranteed. Additionally, the experiment's goals ought to be well–defined, and the teaching methods ought to be methodically organized and carried out.

2. Research Ideas for the Future

The current study demonstrates that cooperative learning strategies successfully improve physical fitness in badminton instruction at the collegiate level. Future studies could examine how these teaching methods affect cognitive and affective learning outcomes, how they vary across sports disciplines, and their long–term effects. Future research on the incorporation of cooperative teaching into more comprehensive curriculum reforms in higher education physical education programs is also advised.

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