A Study on the Teaching Effect of Public Badminton Physical Education Classroom in Colleges and Universities based on Dynamic Stratification

Ruixi Zhang*
College of Physical Education and Health, Dalian University of Technology, Dalian 116024, China
*Corresponding email: zrxpostgraduate@163.com

Abstract

This study selected 120 sophomore students from the 2022 cohort enrolled in badminton public physical education at a university in Liaoning Province as research participants. Several research methods were adopted, including literature review, questionnaire survey, experimental intervention, and mathematical statistics, to conduct an experimental investigation on the teaching model of college badminton courses. The study aims to examine the teaching effectiveness of the dynamic tiered teaching mode and provide references for diversifying physical education teaching methods and improving instructional quality. The results show that there are significant differences in the dimensions of badminton skill level, physical quality and theoretical knowledge mastery among the students in the experimental class after the experiment, and there is also a positive impact on the development of hobbies and sports habits. Therefore, it shows that the use of dynamic layered teaching can improve the quality and efficiency in terms of students' classroom participation, teaching effect in the classroom, the requirements of the course's ideology, and the quality of teaching. It is recommended to avoid the Matthew effect by cross-study across groups, to guide students to correctly view educational equity, to promote teachers' innovation and teaching concepts, and to solve the problem of fairness in grade evaluation to improve the practical effect of dynamic tiered teaching.

Keywords

Teaching effect, Physical education, Badminton, Skill level

Introduction

In 2022, the Ministry of Education issued the *Curriculum Standards for Physical Education and Health in Compulsory Education* stating that physical education and health education are one of the effective pathways to achieving students' all-round development. The curriculum should adhere to principles such as optimizing curriculum design, emphasizing reforms in teaching methods, focusing on comprehensive learning assessment, and paying attention to individual differences among students. Currently, physical education generally adopts uniform teaching objectives and training models, placing excessive emphasis on the transmission of technical skills while neglecting individual differences in ability and aptitude. Consequently, traditional rote-learning approaches are no longer capable of fostering students' all-round development and nurturing their individuality. Therefore, educational reform should focus on placing students at the center of instruction and implementing dynamic differentiated instruction strategies. This reform aims to enhance the theoretical and practical levels of quality education through active exploration of implementation methods.

Dynamic tiered instruction refers to an educational strategy that, building upon tiered instruction, dynamically adjusts teaching content, strategies, and activities based on students' real-time feedback and learning progress. Currently, the academic community has conducted numerous fruitful explorations of tiered teaching methods, primarily focusing on three aspects: integration of teaching formats, practical reforms, and theoretical innovation [1,2].

First, in light of the current educational reform landscape, researchers have integrated models such as the "floating class system", blended learning, and task-driven learning. Under the student-centered

philosophy, they have carried out instructional design, case analysis, and teaching effectiveness evaluation, thereby clarifying practical pathways to support the all-round development of every student. Second, starting from the theoretical context of educational reform, the negative impacts of stratified instruction have been analyzed from the perspective of individualized teaching and teaching according to students' aptitudes, and the practical obstacles in real teaching settings have been identified. Furthermore, corresponding dynamic adjustment and optimization strategies have been proposed to give full play to the positive functions of tiered instruction. Third, based on the requirements of new educational philosophies, implementation pathways for advancing quality education in China have been explored. Findings reveal that label-based stratified teaching fails to satisfy students' personalized development needs. Accordingly, optimization strategies have been proposed, such as building a streamlined, categorized, and tiered talent cultivation system [3].

Given the significant impact of innovation in physical education teaching models, the academic community has paid close attention to the tiered teaching model. However, current research tends to focus more on defining the levels of learners and objectives, with relatively little attention paid to dynamic tiering in badminton, particularly regarding teaching effectiveness and related studies. Dynamic tiering represents a novel approach that breaks away from traditional teaching methods. It establishes a more robust theoretical framework for physical education instruction and aligns with the pedagogical philosophy of integrating personalized education with a student-centered approach.

Based on this, this paper draws from practical experience in university badminton instruction. It employs a systematic approach - including the definition of tiered schemes, the design of tiered objectives, dynamic instructional assessment, and dynamic instructional adjustments - to enhance students' badminton skills and athletic abilities. Furthermore, by adhering to the internal principles of the dynamic teaching model, this study designs targeted instructional plans, providing a practical reference for physical education and even holistic education.

Research subjects and design

Research subjects

The study subjects consisted of 120 sophomore students enrolled in three badminton elective classes of the 2022 cohort at Dalian University of Technology. This study implemented a dynamic tiered teaching model in college badminton instruction and carried out a targeted experimental intervention. The primary purpose was to systematically examine the effects of this model on students' sports interest, exercise habits, ideological-political awareness, physical fitness, theoretical knowledge acquisition, and motor skills. The participants were randomly divided into a dynamic stratified teaching model group (60 students) and a traditional teaching model group (60 students), with the latter serving as the control group. A 16-week training intervention was conducted.

Research methods

(1) Literature review

By searching China National Knowledge Infrastructure (CNKI) and the China Academic Journal Network using the keywords "tiered instruction", "teaching strategies", "teaching practice", and "teaching tailored to individual needs", we carefully reviewed, organized, and analyzed relevant materials. This provided a comprehensive understanding of the current state of research on tiered instruction and established a methodological foundation for the practical research in this study.

(1) Questionnaire survey method

(a) Questionnaire design:

The questionnaire was developed based on the research objectives and revised multiple times according to expert feedback. A total of 120 questionnaires were distributed to all university students in the experimental and control groups via the Questionnaire Star mini-program. To meet the specific needs of this study, the survey covered seven dimensions: "badminton fundamentals", "interests and hobbies", "exercise habits", "awareness of ideological and political education in courses", "physical fitness", "mastery of theoretical knowledge", and "skill level". The experimental results and issues encountered during the experiment were analyzed and discussed, and conclusions and recommendations were drawn based on comparative analysis.

(b) Questionnaire quality control:

Prior to distribution, students were uniformly informed that the questionnaire pertained to adjustments to next semester's courses and the assessment of students' overall proficiency, as well as their individual skill development, to ensure maximum cooperation from the respondents.

(c) Questionnaire distribution and collection:

A total of 155 questionnaires were distributed, of which 152 were returned. After excluding 32 invalid responses and outliers, 120 valid questionnaires remained, resulting in an overall response rate of 77.4%.

(3) Experimental intervention method

Basic skill assessments included fundamental badminton strokes such as forehand, backhand, serve, and return. Teachers observed students' movements and technical proficiency, recorded scores, and conducted simulated practice matches to evaluate their competitive performance. Concurrently, physical fitness tests, such as lung capacity and the 1,000-meter run, were conducted to assess students' overall athletic ability. Questionnaires were administered to students to collect data on their badminton interest, prior experience, and self-assessment. Based on these data, teachers periodically evaluated student progress and formulated personalized intervention plans, such as supplementary practice, movement correction, and targeted coaching.

(4) Mathematical and statistical methods

All data pertaining to badminton experience, interest, exercise habits, ideological-political awareness, physical fitness, theoretical knowledge, and motor skills were collected pre-experiment and post-experiment. These data were quantitatively analyzed using SPSS 13.0 software, with independent samples t-tests employed for inter-group and intra-group comparisons [4]. We will draw conclusions and ultimately provide constructive recommendations.

Research design

(1) Definition of the tiered approach

Classifying students into different proficiency levels is key to implementing a dynamic tiered teaching model. In badminton instruction, emphasis is placed on tiered progression, with a focus on the process of dynamic adjustment [5]. While developing physical education lesson plans, the characteristics of each student in the class must be analyzed. Based on actual teaching outcomes and circumstances, students should be promptly promoted or demoted. Specific teaching objectives, content, and evaluation criteria should be established for each tier, ensuring that students at varying proficiency levels have a clear direction for learning. Using student self-assessment, peer assessment, and specialized skill evaluations as criteria, students in the upper-level group will be demoted if they show prolonged stagnation or a negative attitude toward learning. For students in the middle-level group, promotion or demotion will be determined based on their performance during the learning process. Students in the lower-level group may be promoted after mastering the "fundamentals", thereby encouraging their active progress. The principle of "advancement for the capable and demotion for the underperforming" mobilizes students' initiative in learning badminton under this implicit competitive mechanism.

(2) Student self-assessment and peer assessment

Students' preliminary self-assessment provides the driving force for physical education reform and is one of the key factors in improving teaching quality. Students independently review, reflect on, and group themselves based on their mastery of technical skills and theoretical knowledge - such as understanding of competition rules and the quality of movement execution. On the one hand, the use of self-assessment reflects students' central role in the learning process, stimulating their enthusiasm for mastering badminton skills and fostering robust self-expectations for learning. This approach addresses the drawbacks of mechanical and passive learning and motivates students to achieve self-improvement. On the other hand, leveraging student self-assessment allows teachers to understand students' psychological dynamics and individual characteristics, enabling them to select teaching content tailored to different students. This promotes active innovation in teaching methods and the design of more personalized instructional plans, thereby more effectively improving teaching outcomes.

With the development of the new round of basic education curriculum reform, student evaluation methods have gradually become more diverse. Interactions among students are more frequent than those with teachers, involving greater contact and collaboration; the process of "holding up a mirror" to one another better reflects the level of skill mastery.

Therefore, peer evaluation also holds significant reference value and serves as a positive motivational process. By categorizing students through mutual recommendations, it effectively stimulates individual awareness of their strengths and weaknesses within the group, guiding students toward a positive learning trajectory.

(3) Skill assessment requirements

Racket swing: The examinee must perform 10 racket swings without a shuttlecock within the designated area, using the forehand grip.

Forehand and backhand bouncing: Within the shaded area of the badminton half-court, the candidate must perform continuous bouncing using alternating forehand and backhand grips. If the candidate bounces the shuttlecock continuously on one side only, it will not be counted toward the total number of bounces. If the shuttlecock leaves the designated area (longitudinal boundary) or touches the ground during the test, the attempt is considered complete (see Figure 1).

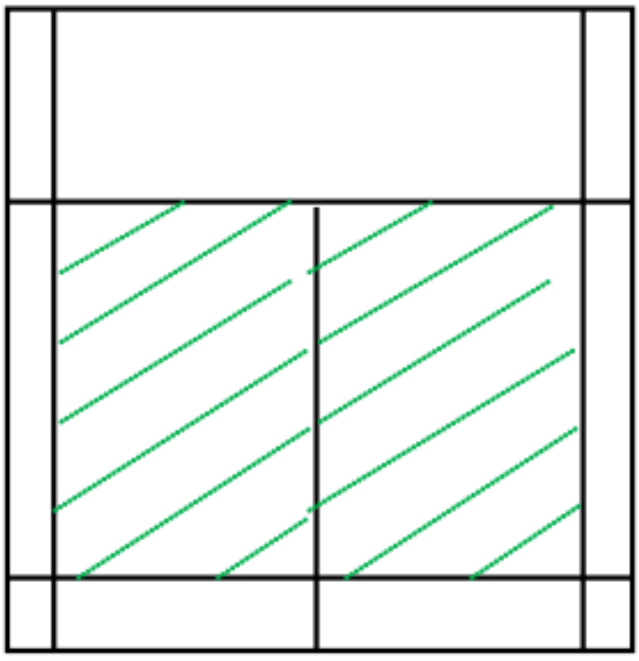

Figure 1. Plan of the assessment area.

Front-to-back court footwork: Candidates perform the test in the designated half-court area. After hitting a high clear, they must step over the back baseline and quickly move to the net. Upon reaching the front court, the racket must touch the net cord; otherwise, the attempt is not counted. This sequence is repeated ten times.

On-court testing of various basic badminton skills is used to assess students' proficiency levels, and students are grouped into ability levels based on the analysis results. (see Figure 2).

Forehand clear: The student starts from Zone G to return a serve into the left (right) half of the backcourt. They must hit 5 straight-line shots and 5 cross-court shots consecutively from the left (right) half of the backcourt, returning to the starting position after each shot.

Forehand clear serve: Right-handed (or left-handed) candidates serve from Zone G, aiming 5 serves to the left half of the court and 5 to the right half.

Forehand and backhand drop shots: Right-handed (or left-handed) candidates start from Zone G, returning the examiner's serves to the right (or left) half of the front court. They must hit 5 consecutive forehand drop shots and 5 backhand drop shots in the right (or left) half of the front court, returning to their original position after each shot.

Forehand lob: Right-handed (or left-handed) candidates start from Zone G to return the examiner's serve to the right (left) half of the backcourt. They must consecutively lob 5 straight-line shots and 5 cross-court shots in the right (left) half of the backcourt, returning to their original position after each shot.

Forehand smash: Candidates holding the racket with their right (left) hand start from Zone G to return the examiner's serve to the right (left) half of the backcourt. They must execute 5 straight-line smashes and 5 cross-court smashes consecutively in the right (left) half of the backcourt, returning to the starting position after each shot.

Defensive skills: Candidates holding the racket with their right (left) hand start from Zone G to return the examiner's smashes into the right (left) half of the backcourt. They must consecutively return 5 straight-line smashes and 5 cross-court smashes in the right (left) half of the backcourt, returning to their original position after each shot.

Flat drive and block technique: Left-handed candidates start from Zone H to return the examiner's drive to the right (left) half of the court. They must consecutively execute 5 flat drives and 5 blocks in the right (left) half of the backcourt, returning to their original position after each shot.

Lob technique: Candidates holding the racket in their

(left) hand start from Zone H and return the examiner's smashes to the right (left) half of the court. They must perform 5 forehands and 5 backhands consecutively in the right (left) half of the backcourt, returning to their original position after each shot.

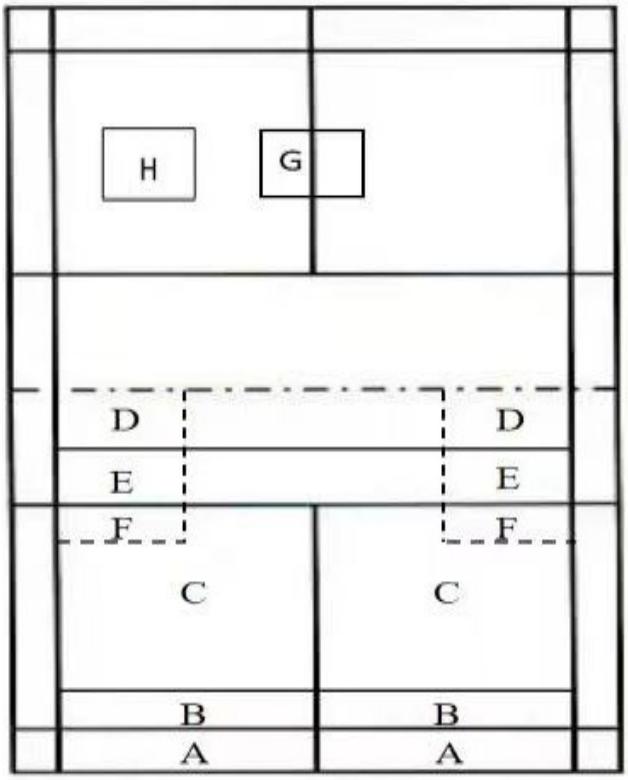

Figure 2. Schematic diagram of the site zoning.

(4) Skill assessment scoring

Prior to the experiment, the experimental group will be tested on forehand and backhand ball-bouncing, forehand high clear, and forehand high clear serve. Each test is worth 25 points. Groups with a total score exceeding 70 points will be placed in Group 3; those scoring 50-70 points will be placed in Group 2; those scoring below 50 points will be placed in Group 1.

Racket swing: 2.5 points for correct grip and body rotation; 1.5 points for correct grip but no body rotation (relying solely on arm strength); 0 points for incorrect grip and lack of power. Perform 10 consecutive swings; the total score is recorded.

Forehand and backhand bounce: Alternate between forehand and backhand bounces within the designated area; 2.5 points are awarded for each successful bounce. The total score is the sum of all bounces.

Forehand clear: 1.5 points for landing in Zone A of the backcourt; 1 point for landing in Zone B of the backcourt; 0 points for landing in Zone C of the midcourt; 0 points for landing out of bounds, in the wrong zone, or hitting the net. Perform 10 consecutive repetitions and calculate the total score.

Forehand high clear: 1.5 points for landing in Zone A, 1 point for landing in Zone B, 0.5 points for landing in Zone C, and 0 points for landing out of bounds or hitting the net. Perform 10 consecutive repetitions and calculate the total score.

Forehand and backhand drop shots: 1.5 points for landing in the front court Zone D, 1 point for landing in the back court Zone E, 0.5 points for landing in the center court Zone F, and 0 points for landing out of bounds or into the net. Perform 10 consecutive shots and calculate the total score.

Forehand drop shot: 1.5 points for landing on the front court (Zone D), 1 point for landing on the back court (Zone E), 0.5 points for landing on the middle court (Zone F), and 0 points for landing out of bounds or into the net. Perform 10 consecutive shots and calculate the total score.

Forehand smash: 1 point for a shot landing in Zone C that is threatening and fast; 0.5 points for a shot landing in Zone C but with a relatively flat and long trajectory; 0 points for a shot landing out of bounds or into the net. Perform 10 consecutive attempts and calculate the total score.

Defensive technique: 1 point for a shot landing in Zone A; 0.5 points for a shot landing in Zones B or C; 0 points for a shot landing out of bounds or into the net. Perform 10 consecutive attempts and calculate the total score.

Flat drive technique: 1 point for landing in Zone C; 0.5 points for landing on the front court; 0 points for landing out of bounds or into the net. Perform 10 consecutive attempts and calculate the total score.

Lob technique: 1 point for landing in Zone A; 0.5 points for landing in Zone B; 0 points for landing out of bounds or into the net. Perform 10 consecutive attempts and calculate the total score.

(5) Evaluation of skill execution

Correct skill execution is a prerequisite for the accurate performance of techniques. Badminton places high demands on speed and technique; standard movements enhance the precision and stability of shots, thereby enabling more effective control over the ball's trajectory and speed. Emphasizing standard badminton movements helps improve technical proficiency, reduce

the risk of injury, enhance match performance and efficiency, and promote the athlete's overall technical progress. The evaluation of skill execution is shown in Table 1.

Table 1. Skill performance evaluation form.

Skill item	Beginner group (Group 1)	Advanced group (Group 2)	Competition group (Group 3)
Swing	No side-step; incorrect racket face and setup; movements are rather haphazard; essentially a "fly swatter" style	Can distinguish between forehand and backhand grips	Includes body rotation and racket setup movements
Forehand and backhand ball bouncing	Lacks ball awareness and fluidity; incorrect grip	Grips the racket correctly but can't hit the ball	Can keep the ball in the air
Front-to-back court footwork	Has never practiced footwork; lacks understanding; plays solely to make contact with the ball	Rambling, haphazard running	Clear running form, relatively coordinated
Forehand high clear	Completely inexperienced; plays solely to hit the ball	Can hit the ball but cannot control the direction	Movements are relatively coordinated, and technique is generally correct
Forehand high clear serve	Does not understand the proper grip for serving	have a basic understanding of the requirements for serving, but often make mistakes.	Understands the basics of the forehand high clear but cannot consistently execute it; knows the proper stance for returning serves
Forehand drop shot	Incorrect hand technique, unreasonable footwork, faulty stroke mechanics, struggles to complete the motion	Understands the concept and has started experimenting, but the implementation isn't very polished	Can achieve the desired ball-shooting effect
Forehand smash	Lacks understanding, does not know how to apply the skills	Only heard of the concept but have never tried to apply it	Aware of the need to sell at the peak
Defensive techniques	Completely at a loss when facing a low ball from the opponent	Relying on instinct to return the opponent's shot, but often making mistakes	Can use the power of a smash to block the ball back
Flat drive technique	No understanding whatsoever, has no idea what is going on	Relying on instinct, he manages to block the ball back, but cannot generate power on his own	Clear understanding of the concept, with a power-generating motion
Lob technique	Lacks understanding; instinctively hits every ball upward	Knowing he needs to keep his distance when hitting the ball, but he often misses it	His form is fairly standard, and he is generally able to control his power, direction, and placement

Design of tiered learning objectives

Tiered learning objectives serve as a guiding and motivational tool and are a crucial component of physical education curriculum design. Based on the overarching objectives of badminton instruction, physical education teachers formulate specific learning

objectives for students at the foundational, consolidation and improvement, and competitive levels [6]. By setting reasonable instructional requirements tailored to students' varying physical abilities and prior knowledge, this approach addresses the growing disparity between high- and low-performing students in traditional classrooms. Specifically:

Group 1 - beginner objectives: Students should develop a basic understanding of badminton and master fundamental stationary skills, including stable grip, racket positioning, and swinging mechanics. This foundational training in posture adjustment and coordination will establish a solid basis for subsequent combined skill practice.

Group 2 - intermediate goals: proficiently master a variety of individual skills, including improving the technical quality of strokes such as forehand clears, forehand serves, dropshots, lobs, and flat drives, and be able to effectively apply forecourt and backcourt techniques in practice.

Group 3 - advanced goals: Strengthening tactical awareness and deepen the understanding and application of badminton techniques.

Such a targeted teaching design is highly consistent with the hierarchical objectives set for beginners, intermediate learners, and advanced students in badminton instruction. Physical education teachers should determine the design of instructional content and the selection of teaching methods based on specific circumstances, respecting the cognitive foundations and learning abilities of students at each level. This approach aims to move away from a "one-size-fits-all" teaching model, ensuring that every individual student gains meaningful learning outcomes during the physical education process. It truly implements a tiered teaching model and fully utilizes the guiding function of tiered objectives. This tiered objective design facilitates the comprehensive development of every student and enhances the richness of the curriculum.

Results of tiered instruction

The characteristics of students at each level can be summarized as follows: Group 1: Swings the racket without turning the body; exhibits incorrect racket face and racket positioning; primarily uses a "fly swatter" grip; aims only to make contact with the ball; lacks understanding of proper racket and ball handling during serves; struggles to execute movements; and is helpless when facing the opponent's returns. Group 2: Can hit the ball but cannot control direction; has a basic understanding of serving requirements but frequently makes mistakes; does not know how to generate power proactively; often misses the ball. Group 3: They generate power relatively smoothly when striking the ball, demonstrate body rotation and racket positioning, have good ball control, understand the types of footwork, and are relatively coordinated. They grasp the basic principles of the forehand high clear but cannot consistently execute it accurately. They understand the stance for returning serves, can execute drop shots effectively, have an awareness of attacking the high point to apply downward pressure, perform movements in a relatively standardized manner, and are generally able to control power, direction, and landing points. The final grouping results were: Group 1 with 16 students, Group 2 with 31 students, and Group 3 with 13 students.

Application of the teaching model

(1) Development of the teaching process

The experimental class and the control class, as well as the different ability groups, followed the same teaching content, all adopting a teaching format of reviewing existing knowledge before introducing new material. The control class adopted a traditional teaching model. The teacher clearly specified the teaching objectives of the badminton course, including the technical movements and relevant knowledge that students were required to master. Subsequently, the teacher introduced the course content, including the technical movements to be learned and the classroom arrangement. The teacher explained the key points of technical movements, highlighted difficulties and essentials, and provided demonstrations to help students establish an initial understanding of complete technical movements. Students then carried out synchronized imitation practices in accordance with the teacher's explanations and demonstrations. During the practice, the teacher applied unified assessment criteria, provided individual verbal corrections, gave collective feedback on common problems, and performed supplementary demonstrations. Students conducted repeated practice to consolidate their grasp of technical movements, and a learning assessment was administered at the end of the session. The teaching flowchart for the traditional class is shown in Figure 3.

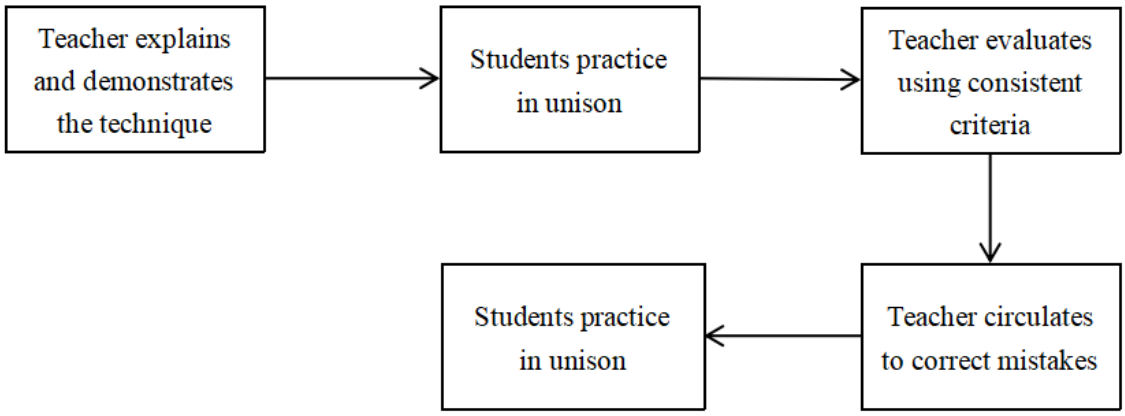

Figure 3. Flowchart of traditional classroom instruction.

Teaching practices in experimental classes focus primarily on the instructional process. Building upon formal classroom instruction, teachers strictly adhere to the principle of "tailoring instruction to individual students and adapting to their needs". They clearly announce the lesson content, explain technical essentials and key challenges, introduce the course material, demonstrate technical movements, and set corresponding learning objectives for different ability levels. Students are developing individuals, and due to differences in physical fitness and athletic aptitude, their rates of development vary. These variability differences can be minimized through the teaching process. However, the use of a fixed-tier model imposes certain constraints on students' comprehensive development. Therefore, we propose adopting a dynamic tiered teaching model. Through scientific coordination of time and space, we optimize teaching elements to form a flowchart for experimental class instruction, as shown in Figure 4.

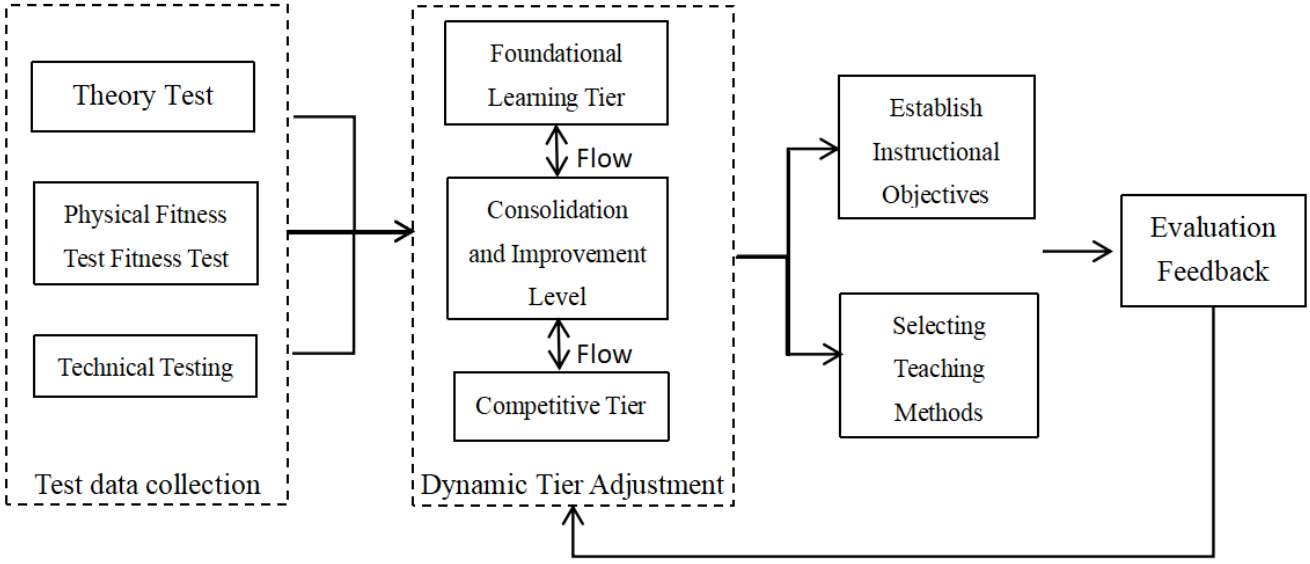

Figure 4. Flowchart of the experimental class teaching process.

Based on the theory of the Zone of Proximal Development, students are initially grouped according to pretest data. Teaching objectives and methods are then tailored to each level, with periodic adjustments made based on post-assessment feedback to optimize learning efficiency. For Group 1 students, teachers should provide individualized instruction, using techniques such as broken-down practice and simplified exercises to help students develop a comprehensive understanding of the technical movements. For the second group of students, instruction focuses on refining technical movements. Teachers need to pay attention to students' skill characteristics and gaps, enabling them to gradually improve their skill levels and athletic abilities based on their existing foundation. For the third group of students, the teaching process specifically reinforces their badminton skill levels and provides precise corrections and adjustments for any issues that arise. Overall, teachers regularly analyze students' learning progress and promptly adjust teaching plans and objectives accordingly.

(2) Tiered technical assessment

Badminton technical assessments serve as vital tools for evaluating, monitoring, and promoting students' technical development in the sport, holding profound significance for both individual progress and the enhancement of professional proficiency [7,8]. These assessments evaluate learning outcomes after completing specific instructional phases to facilitate subsequent dynamic adjustments. Contemporary teaching philosophies advocate the integrated use of formative and summative assessments, emphasizing that evaluation should not focus solely on students' final grades but rather on their dynamic developmental process.

In tiered instruction, both evaluation methods should be employed to gain a more comprehensive and in-depth understanding of students' learning performance and growth at different levels. During testing, individual differences and specific circumstances should not be overlooked, and evaluation criteria should be adapted to each student's level. For Group 1 with weaker foundational skills, evaluators should focus on motivational assessment. For Group 2, teachers should correct errors and refine movements in line with their improving performance. For Group 3 with stronger foundations, stricter standards should be applied and balanced evaluation emphasized to encourage them to pursue higher goals.

Results and analysis

Comparative analysis of pre- and post-experiment questionnaire results for the experimental class

As shown in Tables 2, 3, 4, and 5, there was no significant difference in badminton proficiency between the experimental and control groups. However, after implementing dynamic stratified instruction, the experimental group demonstrated slight improvements in interest, exercise habits, and awareness of ideological and political education in physical education compared to the control group. This indicates that adopting a dynamic stratified teaching model in university badminton physical education courses is more effective in stimulating students' interest in badminton, enhancing their enthusiasm for exercise, and improving their core physical education competencies.

Table 2. Comparison of basic badminton skills among students in the experimental class before and after the experiment.

Question	Option	Pre-test data (n=60)		Post-test control group data (n=60)		Post-test experimental group data (n=60)	
		n	%	n	%	n	%
Have you ever played badminton outside of school?	A. Yes	27	45.00	34	56.67	36	60.00
	B. No	33	55.00	26	43.33	24	40.00
Of the following badminton equipment: badminton shoes, badminton rackets, badminton apparel, badminton bags, and protective gear, how many do you own?	A. 5 types	2	3.33	6	10.00	8	13.33
	B. 3-5 types	9	15.00	14	23.33	17	28.33
	C. Fewer than 3 types	49	81.67	40	66.67	35	58.34
What price range do you typically look for when purchasing a badminton racket?	A. 500-1,000 yuan	7	11.67	10	23.33	14	23.33
	B. 200-500 yuan	12	20.00	19	35.00	20	33.34
	C. 100-200 yuan	18	30.00	17	16.67	17	28.33
	D. Less than 100 yuan	23	38.33	14	25.00	9	15.00
What is your average annual spending on badminton equipment?	A. Over 400 yuan	3	5.00	10	16.67	11	18.33
	B. 200-300 yuan	3	5.00	11	18.33	15	25.00
	C. 100-200 yuan	4	6.67	20	33.33	13	21.67
	D. Less than 100 yuan	50	83.33	19	31.67	21	35.00
How familiar are you?	A. Know more than 5	5	8.33	8	13.33	15	25.00
	B. Know 3-5	7	11.67	4	6.67	15	25.00

Question	Option	Pre-test data (n=60)		Post-test control group data (n=60)		Post-test experimental group data (n=60)	
		n	%	n	%	n	%
	C. Know 1-3	22	36.67	28	46.67	22	36.67
	D. Don’t know	26	43.33	20	33.33	8	13.33
How familiar are you with badminton (multiple answers allowed)?	A. Game rules	35	58.33	36	60	53	88.33
	B. Grip	40	66.67	44	73.33	56	93.33
	C. Footwork	17	28.33	41	68.33	48	80.00
	D. Tactics and techniques	5	8.33	36	60.00	39	65.00
	E. Don’t know any of these	14	23.33	5	8.33	1	1.67
Have you ever searched for information about badminton (the sport)?	A. Yes	24	40.00	29	48.33	43	71.67
	B. No	36	60.00	31	51.67	17	28.33
Why did you search for information about badminton (the sport)? (multiple answers allowed)	A. Watching matches	31	51.67	47	78.33	52	86.67
	B. Learning about athletes	16	26.67	38	63.33	38	63.33
	C. Learning about rackets, uniforms, shoes, and badminton balls	18	30.00	43	71.67	49	81.67
	D. To learn playing skills	29	48.33	56	93.33	55	91.67
	E. To prevent or treat sports injuries	7	11.67	29	48.33	31	51.67
	F. To understand the rules of the game	23	38.33	52	86.67	56	93.33
How familiar are you with major badminton tournament formats?	A. Know 5 or more	1	1.67	14	23.33	18	30.00
	B. Know 3–5	3	5.00	21	35.00	21	35.00
	C. Know 1–3	16	26.67	5	8.33	12	20.00
	D. Not familiar with any	40	66.66	20	33.34	9	15.00
Have you ever participated in a badminton tournament?	A. Yes, have participated in many	1	1.67	7	11.67	12	20.00
	B. Yes, have participated once or twice	7	11.67	18	30.00	21	35.00
	C. No, no competition experience	52	86.66	35	58.33	27	45.00

Table 3. Comparison of badminton interest among students in the experimental class before and after the experiment.

Question	Option	Pre-test data (n=60)		Post-test control group data (n=60)		Post-test experimental group data (n=60)	
		n	%	n	%	n	%
Are you interested in joining badminton practice?	A. Very interested	5	8.33	22	36.67	26	43.33
	B. Quite interested	13	21.67	30	50.00	18	30.00
	C. Somewhat interested	37	61.67	6	10.00	16	26.67

Question	Option	Pre-test data (n=60)		Post-test control group data (n=60)		Post-test experimental group data (n=60)	
		n	%	n	%	n	%
	D. Not very interested	5	8.33	2	3.33	0	0.00
Are you a member of the school badminton club?	A. Yes	4	6.67	15	25.00	17	28.33
	B. No	56	93.33	45	75.00	43	71.67
Why are you taking badminton classes?	A. Personal interest	30	50.00	33	55.00	34	56.67
	B. Physical health	11	18.33	11	18.33	11	18.33
	C. Willpower and character	0	0.00	2	3.33	2	3.33
	D. Team spirit	4	6.67	4	6.67	4	6.67
	E. Influence of social media, TV, or sports stars	0	0.00	0	0.00	1	1.67
	F. Influence of friends	6	10.00	7	11.67	8	13.33
	G. Forced to choose because I didn’t get into other sports	9	15.00	3	5.00	0	0.00
Would you be willing to participate in school-organized badminton-related activities?	A. Yes	27	45.00	32	53.34	36	60.00
	B. No	11	18.33	11	18.33	7	11.67
	C. It depends	22	36.67	17	28.33	17	28.33
Do you actively practice your badminton skills in your free time?	A. Always	5	8.33	7	11.67	15	25.00
	B. Sometimes	41	68.34	42	70.00	43	71.67
	C. Never	14	23.33	11	18.33	2	3.33

Table 4. Comparison of exercise habits among students in the experimental class before and after the experiment.

Question	Option	Pre-test data (n=60)		Post-test control group data (n=60)		Post-test experimental group data（n=60）	
		n	%	n	%	n	%
Do you engage in physical activity in your free time?	A. Often	12	20.00	15	25.00	16	26.67
	B. Occasionally	39	65.00	44	73.33	43	71.66
	C. Never	9	15.00	1	1.67	1	1.67
How often do you engage in physical activity each week?	A. 5 or more times	5	8.33	6	10.00	9	15.00
	B. 3-5 times	21	35.00	30	50.00	30	50.00
	C. Less than 3 times	34	56.67	24	40.00	21	35.00
How long do you engage in physical activity each time?	A. 1 hour or more	12	20.00	19	31.67	26	43.33
	B. 0.5-1 hour	32	53.33	33	55.00	29	48.34
	C. Less than 0.5 hour	16	26.67	8	13.33	5	8.33
Do you engage in physical activity with others?	A. Yes	44	73.33	48	80.00	50	83.33
	B. No	16	26.67	12	20.00	10	16.67

Table 5. Comparison of course-based ideological and political education awareness among experimental class students before and after the experiment.

Question	Option	Pre-test data (n=60)		Post-test control group data (n=60)		Post-test experimental group data (n=60)	
		n	%	n	%	n	%
Do you agree with the statement that "teachers' teaching methods and approaches influence your motivation in class"?	A. Agree	53	88.33	57	95.00	59	98.33
	B. Disagree	7	11.67	3	5.00	1	1.67
Do you believe that participating in badminton can promote an individual's healthy development and social adaptability in daily life?	A. Yes	55	91.67	58	96.67	59	98.33
	B. No	5	8.33	2	3.33	1	1.67
Which core competencies do you believe badminton courses can enhance? (Multiple selections allowed)	A. Sense of rules	46	76.67	52	86.67	54	90.00
	B. Comprehensive abilities	51	85.00	54	90.00	54	90.00
	C. Sportsmanship	48	80.00	52	86.67	57	95.00
	D. Health philosophy	48	80.00	53	88.33	52	86.67
Which of the "Four-in-One" school physical education goals for the new era do you believe badminton courses can achieve? (Multiple selections allowed)	A. Enjoyment	55	91.67	57	95.00	57	95
	B. Improved physical fitness	52	86.67	57	95.00	58	96.67
	C. Well-rounded personality	47	78.33	50	83.33	55	91.67
	D. Strengthened willpower	46	76.67	53	88.33	54	90.00
What do you believe are the value orientations of badminton courses? (Multiple selections allowed)	A. Strengthen ideological guidance to cultivate moral character	48	80.00	54	90.00	54	90.00
	B. All-round development in morality, intelligence, physical fitness, aesthetics, and labor	48	80.00	52	86.67	54	90.00
	C. Healthy physical, mental, and social development	51	85.00	54	90.00	52	86.67

Comparative analysis of physical fitness among experimental class students before and after the experiment

As shown in Table 6, a comparison of the mean values reveals that both lung capacity and 1000-meter run performance exhibited significant differences ($p<0.05$) following the implementation of the stratified teaching model [9]. This indicates that the use of this teaching model played a significant role in improving students' cardiorespiratory endurance and overall physical fitness. Since dynamic stratified instruction accounts for individual differences and emphasizes student-centered

learning, it allows rational allocation of exercise loads by athletic ability. Consequently, it prevents students from being sidelined and enhances the effectiveness of badminton instruction.

Table 6. Comparison of physical fitness levels among students in the experimental class before and after the experiment.

Category	n	Vital capacity (mL)		1000-meter run (seconds)	
		Pretest scores	Post-test scores	Pretest scores	Post-test scores
Experimental group	60	3878.15±833.446	4270.53±794.298	288.38±81.844	251.02±14.972
Control group	60	3605.24±740.072	3672.80±776.975	282.93±67.036	263.67±24.800
p		>0.05	<0.05	>0.05	<0.05

Comparative analysis of theoretical knowledge acquisition among students in the experimental class before and after the experiment

This study designed a questionnaire with a maximum score of 75 points; the survey results are shown in Table 7. The data reveal that after implementing dynamic stratified instruction, students demonstrated a more comprehensive grasp of badminton knowledge, as evidenced by no significant difference in the pre-test ($p>0.05$) but a significant difference in the post-test ($p<0.05$). This result clearly indicates that the differentiated instruction model effectively leads to a deeper understanding of theoretical knowledge among students.

Table 7. Comparison of theoretical knowledge mastery among experimental class students before and after the experiment.

Category	n	Theoretical knowledge (points)	
		Pre-test scores	Post-test scores
Experimental group	60	33.42±14.453	51.17±10.183
Control group	60	35.42±14.651	45.58±10.660
p		>0.05	<0.05

Comparative analysis of motor skill improvement in experimental class students before and after the experiment

A comparison of the mean scores in Table 8 reveals that students in the experimental group demonstrated more significant improvement in badminton racket-swinging skills, forehand and backhand bouncing, forehand clear, forehand clear serve, and other technical indicators [10]. Before the experiment, there was no significant difference in skill scores between the experimental and control groups ($p>0.05$). However, in the post-test, the scores of the two groups showed a significant difference ($p<0.05$). This indicates that the implementation of this model enables students to master the power, angle, and rhythm of the stroke more proficiently, resulting in more accurate and effective racket movements, and also demonstrates an improvement in the quality of physical education instruction.

Table 8. Comparison of improvements in swing skills among experimental class students before and after the experiment.

Category	n	Physical education score (points)	
		Pre-test scores	Post-test scores
Experimental group	60	82.50±5.084	93.97±2.379
Control group	60	83.80±3.497	87.70±4.735
p		>0.05	<0.05

As shown in Table 9, a comparison of the mean scores reveals that there was no significant difference in ball-juggling performance between the experimental and control groups before the experiment ($p>0.05$); however, the post-test scores of the experimental group showed a significant difference compared to those of the control group ($p<0.05$). This indicates that the use of dynamic stratified instruction is more effective in

helping students master ball handling skills and improve their eye-hand coordination.

Table 9. Comparison of ball-juggling skill improvement levels among experimental class students before and after the experiment.

Category	n	Physical education score (points)	
		Pre-test scores	Post-test scores
Experimental group	60	87.75±6.932	92.65±4.591
Control group	60	88.47±4.820	89.75±6.055
p		>0.05	<0.05

As shown in Table 10, in the training of forehand high clear shots using the dynamic stratified teaching model, the experimental group demonstrated a significantly greater improvement in forehand high clear shot technique compared to the control group. An independent samples t-test revealed no significant difference in the students' ball-bouncing scores between the two groups prior to the experiment ($p>0.05$). However, after the experiment concluded, the performance of students in the experimental group showed a significant difference compared to that of the control group ($p<0.05$). This result clearly indicates that the use of this model effectively improves students' technical proficiency and competitive performance, as well as their ability to better control the flow of the game.

Table 10. Comparison of skill improvement in forehand clear shots among experimental class students before and after the experiment.

Category	n	Physical education score (points)	
		Pre-test scores	Post-test scores
Experimental group	60	82.53±5.127	94.13±2.228
Control group	60	84.12±3.756	88.02±4.753
p		>0.05	<0.05

A comparison of Table 11 reveals that there was no significant difference in skill performance before the experiment ($p>0.05$), whereas there was a significant difference in performance after modifying the traditional teaching model ($p<0.05$). This indicates that the use of this teaching model is highly effective in improving students' ability to execute forehand high clear shots. The dynamic, tiered teaching approach encourages students to compete and assist one another, fostering a positive multi-directional learning environment that effectively promotes improvements in their motor skills.

Table 11. Comparison of improvements in the forehand high clear serve among experimental class students before and after the experiment.

Category	n	Physical education score (points)	
		Pre-test scores	Post-test scores
Experimental group	60	87.93±7.566	92.37±4.812
Control group	60	88.60±4.819	89.75±6.055
p		>0.05	<0.05

Results of dynamic instructional adjustments

The rotation cycle lasted one month. After completing each phase of instruction, teachers made real-time adjustments based on students' actual mastery of skills, providing actionable recommendations for students who needed to be moved up or down a level [11]. The results of these adjustments were as follows: Six students were moved up in Group 1, four in Group 2 (with two moved down), and one in Group 3 (with one moved down).

Discussions and recommendations

Discussions

(1) The application of the dynamic stratified teaching model can optimize student classroom engagement.

This individualized attention not only makes students feel valued but also helps establish positive teacher-student relationships. It simultaneously provides more personalized learning opportunities, allowing teaching strategies and content to be adjusted according to individual differences, enabling each student to learn badminton skills in an environment tailored to their athletic level and learning needs.

(2) The application of the dynamic stratified teaching model can effectively enhance the teaching effectiveness of college general physical education courses [12]. By adjusting teaching strategies in real time, it enhances students' interest, habits, health, theoretical knowledge, and skill levels. Through effective guidance and the promotion of healthy competition, instructors help improve overall teaching quality.

(3) The implementation of the dynamic stratified teaching model aligns with the requirements of integrating ideological and political education into the curriculum. Innovating student-centered teaching models in school physical education can promote the coordinated development of youth sports and education, accelerating the realization of the "four-in-one" school physical education goals in the new era. Integrating ideological and political education into the talent development system enhances the quality and efficiency of talent cultivation in higher education.

(4) The application of the dynamic tiered teaching model optimizes teaching quality. By establishing differentiated goals, methods, assessments, and paces, it ensures that every student comprehends and applies the content. Emphasizing the shaping of students' social values extends the educational significance of physical education activities. Through cognitive, goal-oriented, and achievement-based motivation, instructors help students transition from passive to active learning.

Recommendations

(1) Implementing cross-group learning to avoid the Matthew Effect. If group-based instruction is limited to collaboration within groups, the initial small disparities between ability levels will gradually widen. Students at lower levels lack interaction and collaboration with higher-performing peers, missing opportunities for skill improvement, which hinders the overall development of all students. Therefore, emphasize cross-group interaction and learning to build an open and shared learning environment.

(2) Guiding students to view educational equity correctly. The implementation of differentiated instruction typically involves considerations of skill levels and individual aptitudes. Some students perceive these considerations as discriminatory treatment, leading to psychological stress. This indicates that teachers need to adjust groupings flexibly, emphasize focusing on personal progress rather than comparing oneself to others, and provide regular feedback and evaluations to visualize students' progress.

(3) Teachers must continuously innovate and advance pedagogical concepts. Teachers are required to engage in timely reflection during classroom implementation, monitor teaching effectiveness, and encourage students to provide feedback on their learning needs to gather constructive suggestions. At the same time, by staying abreast of educational research findings and empirical studies to understand cutting-edge theories, and by utilizing digital tools to improve teaching methods, teachers can optimize instructional design and validate the effectiveness of their pedagogical concepts.

(4) Addressing issues of fairness in grading. Dynamic tiered instruction assesses students on the same content using different evaluation standards, which helps alleviate the negative psychological impact on students with weaker foundations or those placed in beginner groups. The evaluation aims to facilitate longitudinal comparison, support personalized development, and prevent excessive grade disparities from affecting scholarship eligibility.

Conclusion

It is undeniable that the implementation of dynamic tiered instruction in university physical education has not yet been fully adopted and still faces certain issues open to debate. However, it is worth noting that the Party's educational policy calls for raising educational standards and promoting the development of a high-quality education system. The dynamic stratification model, by designing targeted teaching methods and assessment approaches that emphasize student agency, ensures that every student can achieve optimal learning outcomes in an environment suited to their needs. Practice has shown that this teaching model can comprehensively enhance students' overall qualities,

including physical fitness, skill levels, and interest in sports. Integrating the badminton teaching process into curriculum-based ideological and political education aligns with the educational philosophy of the new era. Currently, the development of youth sports is increasingly focused on university physical education. This represents not only a challenge for the ongoing reform of university physical education but also a key area for breaking away from traditional teaching methods. As dynamic tiered teaching in university physical education continues to advance and improve, universities are better aligning with modern educational philosophies and the demands of the times. This development provides valuable insights and references for further refining physical education, enhancing teaching effectiveness, and promoting educational reform.

Funding

This work was not supported by any funds.

Acknowledgements

The author would like to show sincere thanks to those techniques who have contributed to this research.

Conflicts of Interest

The author declares no conflict of interest.

References

[1] Shi, H., Cheung, A. C., Cheung, E. S. (2020) The impact of stratified teaching on the academic performance of Chinese middle school students: a meta-analysis. *Science Insights Education Frontiers*, 7(1), 735-760.

[2] Tang, C. (2025) Analysis of physical education teaching quality based on hierarchical fuzzy set theory. *International Journal of Computational Intelligence Systems*, 18(1), 31.

[3] Deng, Z., Xiang, H., Tang, W., Cheng, H., Qin, Q. (2024) BP neural network-enhanced system for employment and mental health support for college students. *International Journal of Information and Communication Technology Education (IJICTE)*, 20(1), 1-19.

[4] Li, Y., Cheng, H., Qin, Q. (2025) Evaluations and improvement methods of deep learning ability in blended learning. *International Journal of e-Collaboration (IJeC)*, 21(1), 1-17.

[5] Chen, T., Tasnaina, N., Tongdecharoen, W. (2023) An application of dynamic layer teaching program to enhance a learning outcome in basic badminton course for college students. *International Journal of Sociologies and Anthropologies Science Reviews*, 3(5), 391-402.

[6] Akbaruddin, A., Suherman, W. S., Komari, A., Saputra, W., Permana, M. F., Bayetov, K., Kurtoğlu, A., Khamraeva, Z. B., Lobo, J., Setiawan, E. (2025) Differentiated instruction in physical education: influences on student passion, study habits and fitness levels. *International Journal of Kinesiology & Sports Science*, 13(1), 33.

[7] Li, Y., Jawis, M. N. (2024) Construction and effect of interactive teaching methods in the college badminton classroom using fuzzy-assisted virtual reality modeling: a case study in Chinese universities. *Journal of Fuzzy Extension and Applications*, 5(2), 199-222.

[8] Zheng, Y., Chen, J. (2025) A triangular fuzzy neutrosophic model for assessing and optimizing educational quality in university badminton initiatives: a comprehensive study. *Neutrosophic Sets and Systems*, 274.

[9] Warburton, V. E., Wang, J. C., Bartholomew, K. J., Tuff, R. L., Bishop, K. C. (2020) Need satisfaction and need frustration as distinct and potentially co-occurring constructs: need profiles examined in physical education and sport. *Motivation and Emotion*, 44(1), 54-66.

[10] Ali, S. K. B. S., Siong, N. U. (2023) Effectiveness of a comprehensive module in improving serving skills and lob shots during badminton training. *Journal of Physical Education and Sport*, 23(5), 1130-1141.

[11] Lin, M. L., Chen, N. C., Luo, Y. J., Liao, C. C., Kao, C. C. (2024) From tradition to innovation: Analyzing strategies and support for enhancing badminton course teaching quality through educational technology. *Behavioral Sciences*, 14(9), 857.

[12] Qian, Y. (2024) Badminton teaching modes and students' academic performance: basis for teaching and learning approaches. *Journal of Education and Educational Research*, 7(2), 144-148.