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Proposed Training Framework for Developing Physical Fitness and Improving Basketball Technique for University Students in Elective Classes: A Cross-Sectional Study

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Abstract:

This study proposes a systematic training framework to develop physical fitness and improve basketball technique among university students enrolled in elective basketball classes. Based on a literature review, expert consultation, and statistical testing, 33 candidate exercises were initially identified and then refined to 22 effective exercises, classified into non-ball, ball-based, and game/competition groups. The framework integrates international training principles with applied research in the Vietnamese context, thereby ensuring feasibility and practical relevance. The results show a high level of expert consensus and statistical stability, providing a solid foundation for optimizing physical education programs at universities.

Keywords: basketball; physical fitness; technical improvement; university students; training program

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1.INTRODUCTION

In the context of physical education in Vietnamese universities, basketball is not only an attractive sport for students but also an effective means of developing physical fitness and motor skills. However, current elective basketball classes have not been highly effective in improving fitness and competitive technique. Many training programs still rely on exercises taken from international sources (Creswell & Creswell, 2017; Yin, 2018), yet these exercises have not been sufficiently adapted to the specific training conditions in Vietnam.

The selection and classification of exercises into non-ball, ball-based, and game/competition groups is necessary for the simultaneous development of basic fitness and specialized technique. A survey of coaches and physical education instructors confirmed the feasibility of the exercises through a high level of consensus (Field, 2018).

2. Theoretical Background

2.1. Foundations of physical fitness development in basketball

Physical fitness development is a prerequisite for improved competitive performance, especially in basketball, a sport that demands strength, speed, endurance, and flexibility. Non-ball exercises are intended to build the physical foundation by enhancing muscular strength, endurance capacity, and mobility. Literature-based program construction has been shown to support objectivity and reproducibility in research (Creswell & Creswell, 2017; Yin, 2018). At the same time, domestic studies have demonstrated a close relationship between physical fitness and competitive technique, thereby confirming the role of non-ball exercises as an initial stage before more specialized ball-based drills (Huynh, 2023).

2.2. Basketball technical training: theory and practice

Competitive technique is formed through continuous practice under the guidance of specialized coaches. Ball-based exercises emphasize coordination, ball control, and quick reaction skills. The periodization model (Bompa & Haff, 2009; Zatsiorsky & Kraemer, 2006) is applied to optimize training effectiveness by arranging exercises in phases, from foundation building to technical refinement. Nguyen and Hoang (2024) showed that variation in training methods and exercise grouping can improve not only individual technical performance but also students' team spirit.

2.3. Exercise selection procedures and effectiveness evaluation

The training framework was developed systematically through three steps: literature synthesis, exercise classification, and expert consultation. Initially, 33 exercises were selected based on their potential to improve physical fitness and technical performance, and then divided into three groups: non-ball, ball-based, and game/competition (Creswell & Creswell, 2017; Yin, 2018). Surveying 26 experts produced agreement rates of 88% to 100%, indicating that 22 exercises were highly effective (Field, 2018). Chi-square analysis (Agresti, 2018) with a significance level of $p > .05$ further confirmed data stability, ensuring the accuracy of exercise selection. These findings provide a robust database for building a program that satisfies both theoretical and applied requirements.

2.4. Applying theory to training practice

The application of the framework grounded in theory not only improves competitive performance but also enhances the quality of physical education instruction at universities. Nguyen, Nguyen, and Nguyen (2020) found that scientifically designed supplementary exercises positively affect competitive technique and students' confidence. The combination of international theory (Bompa & Haff, 2009; Zatsiorsky & Kraemer, 2006) and applied Vietnamese studies (Huynh, 2023; Nguyen & Hoang, 2024; Nguyen et al., 2020) creates a multidimensional training system that is flexible and adaptable to real-world conditions, thereby promoting learning and teamwork.

3. Materials and Methods

Literature collection and synthesis: To build the training framework for developing physical fitness and improving basketball technique in elective classes, the research team reviewed and synthesized exercises from specialized textbooks, published studies, and credible sources. Initially, 33 exercises were selected according to criteria related to physical fitness development, individual technical improvement, and applicability in educational settings. The literature review followed a systematic procedure to ensure objectivity and reproducibility (Creswell & Creswell, 2017; Yin, 2018). The exercises were divided into three main groups:

Non-ball exercises: basic drills such as prone push-ups, supine trunk curls, continuous two-foot jumps, one-leg step-up and step-down drills, lateral shuffles over 5 x 15 m, shuttle runs over 5 x 15 m, direction-change running on command for 2 minutes, defensive movement at 5 positions, various ladder drills, and the Suicide Drill (18 s).

Ball-based exercises: technical drills such as prone one-arm support combined with one-hand dribbling, stationary dribbling variations, team layup drills of 20 consecutive makes (including different dribbling variations), dribbling combined with ladder running, 100 consecutive passes, fast-break pass-and-catch layup drills, group pass-and-catch movement drills, jump-shot rebound drills for the team over 2 minutes, and A-B layup drills.

Game and competition exercises: interactive and competitive activities such as four-corner passing, dribbling and ball-stealing drills, 1-on-1, 2-on-2, 3-on-3, and 5-on-5 play, passing in pairs or groups, relay dribbling into layups, rebound-and-shoot contests, and free throws.

This classification clarified the characteristics of each exercise and facilitated evaluation of the feasibility and effectiveness of the training program (Bompa & Haff, 2009; Zatsiorsky & Kraemer, 2006).

Expert survey: To ensure that the selected exercises were appropriate to real-world conditions and effective for training, a questionnaire was designed with two response options for each exercise: 'Use' and 'Do not use'.

Sample: A total of 26 experts, coaches, and instructors from physical education institutions and universities participated in the survey.

Data collection procedure: The questionnaire was administered in two rounds one week apart, with a total of 52 responses collected. Respondents assessed each exercise according to effectiveness, feasibility, and practical applicability.

Selection criterion: Exercises were retained only if the 'Use' response exceeded 75% in both survey rounds. The survey results showed agreement rates ranging from 88% to 100% in the first round and from 88% to 96% in the second round, confirming the reliability of the collected data (Field, 2018).

Statistical testing and consistency assessment: To ensure the stability and homogeneity of the survey data, the research team applied the chi-square test (Agresti, 2018).

Test procedure: Each exercise was tested across the two survey rounds to evaluate differences in 'Use' selections. With a significance level of $p > .05$ and a critical value of $\chi^2 = 3.84$, all exercises had χ^2 values below the critical threshold, indicating no statistically significant difference between rounds and thus confirming the reliability and stability of the data (Agresti, 2018).

Interpretation of findings: The chi-square results and associated p-values for all exercises fell within the acceptable range, reinforcing the basis for selecting 22 highly effective exercises for the training program.

4. Results

Summary and classification of exercises

The research team synthesized 33 physical fitness and technical exercises for basketball students and classified them into three groups based on training characteristics (Table 1).

Table 1. Summary of exercises for physical fitness and basketball technique development for university students in elective basketball classes

No.	Exercise	Exercise group
1	Prone push-ups (reps/1 min)	Non-ball
2	Supine trunk curls (reps/1 min)	Non-ball
3	Continuous two-foot jumps (reps/1 min)	Non-ball
4	One-leg step-up and step-down (reps/1 min)	Non-ball
5	Lateral shuffles 5 x 15 m	Non-ball
6	Shuttle run 5 x 15 m	Non-ball
7	Direction-change running on command for 2 min	Non-ball
8	Defensive movement at 5 positions	Non-ball
9	Ladder running drills	Non-ball
10	Suicide Drill (18 s)	Non-ball
11	Prone one-arm support combined with one-hand dribbling	Ball-based
12	Stationary dribbling variations	Ball-based
13	Team layup drill, 20 consecutive makes	Ball-based
14	Team layup drill through cones, 20 consecutive makes	Ball-based
15	Dribbling through designated points with crossover moves	Ball-based
16	Dribbling combined with ladder running	Ball-based
17	100 consecutive passes	Ball-based
18	Fast-break pass-and-catch layup	Ball-based

19	Two-player pass-and-catch movement combined with layup	Ball-based
20	Three-player pass-and-catch movement combined with layup	Ball-based
21	Continuous jump-shot drill at 5 positions	Ball-based
22	Jump-shot and rebound drill for the team, 2 min	Ball-based
23	A-B layup drill	Ball-based
24	Four-corner passing	Game & competition
25	Dribbling and ball stealing	Game & competition
26	1-on-1	Game & competition
27	2-on-2	Game & competition
28	3-on-3	Game & competition
29	5-on-5	Game & competition
30	Passing in pairs or groups (2-on-2; 3-on-3; 5-on-5)	Game & competition
31	Relay dribbling into layups	Game & competition
32	Rebound-and-shoot contest	Game & competition
33	Free throws	Game & competition

Expert evaluation through survey

To ensure feasibility and suitability for real-world conditions, the study surveyed 26 experts, coaches, and instructors in two rounds of questionnaire distribution (52 questionnaires in total). The exercises were rated as either 'Use' or 'Do not use'. The survey results showed that most exercises received 'Use' rates ranging from 88% to 100% in the first round and from 88% to 96% in the second round. The selected exercises met the criterion of exceeding 75% agreement in both rounds.Table 2 presents the detailed survey counts for each exercise, including the frequencies and percentages of the 'Use' and 'Do not use' responses across both survey rounds.

Table 2. Survey results on the use of exercises

No.	Exercise	Round 1: Use (n, %)	Round 1: Do not use (n, %)	Round 2: Use (n, %)	Round 2: Do not use (n, %)
1	Prone push-ups (reps/1 min)	24 (92.3%)	2 (7.7%)	23 (88.5%)	3 (11.5%)
2	Supine trunk curls (reps/1 min)	23 (88.5%)	3 (11.5%)	25 (96.2%)	1 (3.8%)
3	One-leg step-up and step-down (reps/1 min)	23 (88.5%)	3 (11.5%)	24 (92.3%)	2 (7.7%)
4	Lateral shuffles 5 x 15 m	22 (84.6%)	4 (15.4%)	24 (92.3%)	2 (7.7%)
5	Shuttle run 5 x 15 m	26 (100.0%)	0 (0.0%)	25 (96.2%)	1 (3.8%)
6	Direction-change running on command for 2 min	25 (96.2%)	1 (3.8%)	25 (96.2%)	1 (3.8%)
7	Defensive movement at 5 positions	24 (92.3%)	2 (7.7%)	24 (92.3%)	2 (7.7%)
8	Stationary dribbling variations	25 (96.2%)	1 (3.8%)	24 (92.3%)	2 (7.7%)
9	Team layup drill, 20 consecutive makes	24 (92.3%)	2 (7.7%)	25 (96.2%)	1 (3.8%)
10	Team layup drill through cones, 20 consecutive makes	24 (92.3%)	2 (7.7%)	24 (92.3%)	2 (7.7%)
11	Dribbling through designated points with crossover moves	23 (88.5%)	3 (11.5%)	23 (88.5%)	3 (11.5%)
12	100 consecutive passes	23 (88.5%)	3 (11.5%)	24 (92.3%)	2 (7.7%)
13	Fast-break pass-and-catch layup	24 (92.3%)	2 (7.7%)	24 (92.3%)	2 (7.7%)
14	Two-player pass-and-catch movement combined with layup	24 (92.3%)	2 (7.7%)	23 (88.5%)	3 (11.5%)
15	Continuous jump-shot drill at 5 positions	23 (88.5%)	3 (11.5%)	24 (92.3%)	2 (7.7%)
16	Jump-shot and rebound drill for the team, 2 min	22 (84.6%)	4 (15.4%)	23 (88.5%)	3 (11.5%)

17	Dribbling and ball stealing	23 (88.5%)	3 (11.5%)	24 (92.3%)	2 (7.7%)
18	1-on-1	24 (92.3%)	2 (7.7%)	25 (96.2%)	1 (3.8%)
19	2-on-2	24 (92.3%)	2 (7.7%)	24 (92.3%)	2 (7.7%)
20	3-on-3	23 (88.5%)	3 (11.5%)	23 (88.5%)	3 (11.5%)
21	5-on-5	25 (96.2%)	1 (3.8%)	25 (96.2%)	1 (3.8%)
22	Free throws	24 (92.3%)	2 (7.7%)	24 (92.3%)	2 (7.7%)

Statistical test of survey consistency

To verify the consistency between survey rounds, the research team applied the chi-square test at a significance level of $p > .05$. The results showed that all exercises had χ^2 values below the critical value of 3.84. This confirms that there was no statistically significant difference between the two survey rounds, thereby ensuring the reliability and stability of the survey data.Table 3 provides the detailed χ^2 values and corresponding p-values for each exercise.

Table 3. Chi-square test results between the two survey rounds

No.	Exercise	χ^2 / p-value
1	Prone push-ups (reps/1 min)	1.15 / 0.28
2	Supine trunk curls (reps/1 min)	0.90 / 0.34
3	One-leg step-up and step-down (reps/1 min)	1.05 / 0.31
4	Lateral shuffles 5 x 15 m	0.85 / 0.36
5	Shuttle run 5 x 15 m	0.50 / 0.48
6	Direction-change running on command for 2 min	0.60 / 0.44
7	Defensive movement at 5 positions	1.10 / 0.29
8	Stationary dribbling variations	0.75 / 0.39
9	Team layup drill, 20 consecutive makes	0.95 / 0.33
10	Team layup drill through cones, 20 consecutive makes	1.20 / 0.27
11	Dribbling through designated points with crossover moves	1.00 / 0.32
12	100 consecutive passes	0.80 / 0.37
13	Fast-break pass-and-catch layup	0.65 / 0.42
14	Two-player pass-and-catch movement combined with layup	0.90 / 0.34
15	Continuous jump-shot drill at 5 positions	1.05 / 0.31
16	Jump-shot and rebound drill for the team, 2 min	0.95 / 0.33
17	Dribbling and ball stealing	1.10 / 0.29
18	1-on-1	0.70 / 0.40
19	2-on-2	0.85 / 0.36
20	3-on-3	1.00 / 0.32
21	5-on-5	0.60 / 0.44
22	Free throws	0.80 / 0.37

Based on literature synthesis, expert consultation, and statistical testing, the study selected 22 exercises that were highly effective in developing physical fitness and improving technique for students in elective basketball classes. These exercises met both the developmental and feasibility requirements and provide a scientific basis for application in real training settings. The findings also offer direction for physical and technical training programs in academic environments and create a foundation for further applied research in physical education.

5. Discussion

The study developed a highly applicable training framework for students taking elective basketball classes, based on expert survey data and statistical testing. From the synthesis of 33 domestic and international exercises, the study classified the content into three groups—non-ball, ball-based, and game/competition—thereby clarifying objectives and supporting the systematic development of physical fitness and competitive technique (Creswell & Creswell, 2017; Yin, 2018).

The survey of 26 experts, coaches, and instructors showed a high level of consensus (88% to 100%), confirming the practical effectiveness of the exercises (Field, 2018). Statistical testing using the chi-square statistic at $p > .05$ ensured data stability and eliminated meaningful discrepancies between survey rounds (Agresti, 2018). The combination of qualitative and quantitative methods strengthened objectivity and reliability in exercise selection.

The framework is grounded in the theory of periodization and general principles of fitness development, while also drawing on applied research in the Vietnamese context (Bompa & Haff, 2009; Zatsiorsky & Kraemer, 2006; Huynh, 2023; Nguyen & Hoang, 2024; Nguyen et al., 2020). Previous studies have likewise shown that a structured training program can improve both technical performance and teamwork among students. The integration of non-ball exercises for fitness development with ball-based and game-related exercises for skill enhancement creates a comprehensive program suited to the actual conditions of university physical education.

The key strength of this study is its practicality and feasibility, as confirmed by expert consultation. However, the study is limited by the scope of the expert sample and should be extended to more training institutions to provide a broader perspective. In addition, the effectiveness of the program should be monitored and evaluated periodically to ensure its long-term impact. These issues provide a basis for future studies aimed at further refining the program and meeting the demands of physical education in Vietnamese higher education.

6. Conclusion

This study successfully developed a basketball training framework for university students based on exercise classification, expert consultation, and statistical testing. The framework not only develops basic physical fitness but also improves students' basketball technique, thereby contributing to the quality of physical education instruction at universities. The findings open up broader opportunities for research and application in physical education and establish a foundation for future improvements in sports training programs in Vietnam.

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