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What Drives Student Learning Outcomes in Compulsory Physical Education? Evidence from Vietnam's Higher Education Context

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Abstract: Physical Education (PE) is an important component of higher education because it contributes to students' physical health, psychological well-being, social development, and lifelong physical activity engagement. However, the effectiveness of compulsory PE remains uneven in many higher education contexts, particularly when students perceive PE as secondary to academically specialized subjects. This study examines the factors affecting students' learning outcomes in compulsory PE at Vietnam National University of Agriculture. The study investigates the relative effects of Course Content, Teaching Methods, Learning Motivation, and Facilities on students' perceived learning outcomes. A quantitative cross-sectional survey was conducted among 150 undergraduate students enrolled in compulsory PE courses. Data were analyzed using Cronbach's Alpha, Exploratory Factor Analysis (EFA), Pearson correlation analysis, and multiple regression analysis. The findings indicate that all four factors positively and significantly influenced students' learning outcomes. In comparison, Course Content emerged as the strongest predictor, followed by Teaching Methods, Learning Motivation, and Facilities. The results suggest that students' PE learning outcomes are influenced more strongly by curricular relevance and pedagogical quality than by infrastructural conditions alone. This study contributes to the literature by providing empirical evidence from a Vietnamese higher education context and by clarifying the relative hierarchy of determinants affecting compulsory PE learning outcomes. The findings imply that improving PE effectiveness requires an integrated approach centered on meaningful curriculum design, effective pedagogy, student motivation, and supportive learning conditions.

Keywords: Physical Education, Learning Outcomes, Teaching Methods, Learning Motivation, Higher Education.

1. Introduction

Physical Education (PE) is widely recognized as an important component of higher education because it contributes not only to students' physical health but also to their psychological well-being, social development, discipline, teamwork, and long-term engagement in healthy lifestyles. In addition to improving physical fitness, PE provides students with opportunities to develop self-regulation, cooperation, confidence, and positive attitudes toward lifelong physical activity. In this context, PE should not be viewed merely as a compulsory course requirement, but as an educational domain that supports holistic student development and complements academic and professional training (Bailey, 2006; Quennerstedt, 2019).

In recent years, research on PE has increasingly emphasized the importance of pedagogical interaction, motivational climate, student engagement, and meaningful learning experiences. Students' participation and learning in PE are shaped not only by curriculum content or physical facilities, but also by how teachers organize learning activities, provide feedback, support autonomy, and create inclusive and motivating learning environments (Guo *et al.*, 2023; Haerens *et al.*, 2013; Reeve & Cheon, 2021; Tian & Shen, 2023). From the perspective of self-determination theory, students are more likely to engage actively in learning when their basic psychological needs for autonomy, competence, and relatedness are supported (Ryan & Deci, 2000). This theoretical perspective is particularly relevant to university PE because learning outcomes depend

heavily on students' willingness to participate, practice regularly, interact with peers, and perceive physical activity as personally meaningful.

Despite the recognized value of PE, the effectiveness of PE courses remains uneven across higher education institutions, particularly in developing-country contexts. A common challenge is that many university students tend to perceive PE as less important than major-specific or career-oriented subjects. Such perceptions may weaken students' motivation to learn, reduce active participation, and limit their learning outcomes. In addition, conventional teaching approaches, insufficiently updated course content, and inadequate sports facilities may further constrain the quality of PE learning experiences. Previous studies have shown that teacher support, autonomy-supportive instruction, motivational climate, and student-centered teaching are closely associated with students' motivation, engagement, satisfaction, and intention to participate in physical activity (Coterón *et al.,* 2024; Dupont *et al.,* 2009; Haerens *et al.,* 2015; Leo *et al.,* 2022).

In Vietnam, PE is a compulsory component of undergraduate education. This policy reflects broader educational goals related to physical health promotion, personal development, and balanced lifestyles among university students. However, the implementation and effectiveness of compulsory PE may vary considerably across institutions due to differences in teaching quality, curriculum design, student motivation, facilities, and institutional priorities. More importantly, the Vietnamese higher education context presents several characteristics that make the study of PE learning outcomes particularly remarkable. Higher education in Vietnam remains strongly academic- and examination-oriented, leading many students to prioritize major-related subjects over PE. At the same time, universities often operate under uneven infrastructural conditions and limited educational resources. Under such cases, students may participate in PE primarily to satisfy graduation requirements unless they perceive the course as meaningful, relevant, and supportive of their personal development. Vietnamese studies have examined students' interest in PE, ways to improve PE quality, and the role of teaching methods in shaping learning motivation and healthy lifestyles. However, much of the existing evidence remains descriptive, institution-specific, or focused on individual determinants in isolation (Hoan & Quang, 2024; Hoan & Van, 2020).

Although prior research has examined factors such as teaching methods, motivation, facilities, and curriculum-related issues, empirical studies that statistically compare the relative influence of these determinants on PE learning outcomes in Vietnamese higher education remain limited. This gap is theoretically and practically important because universities require evidence-based guidance regarding which dimensions of compulsory PE should be prioritized for improvement. Accordingly, this study extends existing PE research by comparatively examining the relative importance of pedagogical, motivational, curricular, and environmental determinants within a compulsory higher education PE context. While infrastructural investment is often regarded as a visible solution for enhancing PE quality, physical facilities alone may not ensure meaningful learning if teaching methods remain passive, course content lacks relevance, or students are insufficiently motivated to participate. Conversely, in resource-constrained contexts, improvements in pedagogical quality, motivational support, and curriculum relevance may generate substantial educational benefits even when infrastructural conditions remain limited. Therefore, understanding the relative importance of curricular, pedagogical, motivational, and environmental factors is essential for improving compulsory PE in higher education settings. This issue raises an important research question: which factors most strongly influence students' learning outcomes in compulsory university PE?

To address this question, the present study investigates factors affecting learning outcomes in compulsory PE courses at Vietnam National University of Agriculture (VNUA). Specifically, the study aims to: (1) identify the major factors associated with students' learning outcomes in PE; (2) examine the measurement structure of these factors using exploratory factor analysis; (3) estimate the relative effects of teaching methods, learning motivation, course content, and facilities on learning outcomes through multiple regression analysis; and (4) propose practical recommendations for improving the quality and effectiveness of PE in higher education.

This study contributes to the literature in three main ways. First, it provides empirical evidence from a compulsory PE context within Vietnamese higher education, where research on university PE remains relatively underdeveloped compared with school-based PE or general studies of physical activity participation. Second, rather than examining pedagogical,

motivational, curricular, or environmental factors separately, the study compares their combined and relative influence on students' learning outcomes. Third, the findings suggest that curricular and pedagogical dimensions may exert a stronger influence on PE learning outcomes than infrastructural conditions alone. As a result, the study offers practical implications for universities seeking to improve PE quality through clarifying the relative hierarchy of these determinants, particularly in resource-constrained higher education settings where enhancing curriculum relevance, teaching practices, and student motivation may be more feasible than large-scale infrastructural investment.

2. Literature Review and Hypothesis Development

2.1. Learning Outcomes in Physical Education

Learning outcomes in Physical Education (PE) are multidimensional and extend beyond the improvement of physical fitness or sport-specific skills. In higher education, PE learning outcomes may include physical competence, knowledge of health and exercise, active participation, self-discipline, teamwork, confidence, motivation for lifelong physical activity, and satisfaction with learning experiences (Mathunjwa *et al.,* 2025). Unlike many classroom-based subjects, PE is strongly practice-oriented. Consequently, students' learning outcomes depend not only on cognitive understanding but also on repeated practice, teacher-student interaction, peer cooperation, and the quality of the learning environment (Shen & Shao, 2022).

Previous studies have emphasized that PE can contribute to students' physical, social, emotional, and behavioral development when learning activities are meaningfully organized and pedagogically supported (Bailey, 2006; Quennerstedt, 2019). In this regard, PE should be understood as a holistic educational process rather than a narrow form of physical training. Students' learning outcomes in PE are shaped by both individual factors, such as motivation and effort, and contextual factors, such as teaching methods, course content, facilities, and the motivational climate created by lecturers (Guo *et al.,* 2023; Moore & Fry, 2017; Tian & Shen, 2023).

In university contexts, PE learning outcomes are especially important because students are at a transitional stage in which their attitudes toward physical activity, health behavior, and lifestyle habits may become more stable. If PE courses provide positive and meaningful learning experiences, they may encourage students to maintain physical activity beyond compulsory coursework. Conversely, if PE is perceived as irrelevant, monotonous, or poorly supported, students may participate only passively and achieve limited learning benefits. Therefore, identifying the key factors that influence PE learning outcomes is essential for improving the quality and effectiveness of compulsory PE in higher education.

Although the determinants of PE learning outcomes can be analytically categorized into pedagogical, motivational, curricular, and environmental dimensions, these factors are closely interconnected in practice. Teaching methods may shape students' motivation and engagement, course content may influence perceived task value and relevance, while facilities may enable or constrain the implementation of effective instructional practices. In compulsory PE contexts, where students may initially show limited intrinsic interest in physical activity, the interactions among these dimensions become particularly important. Understanding their relative influence is necessary for clarifying how meaningful PE learning outcomes are developed in higher education settings.

2.2. Teaching Methods and Learning Outcomes

Teaching methods are among the most important pedagogical determinants of student learning outcomes in PE. In practice-based subjects, effective teaching extends beyond explaining techniques or organizing activities. It also involves clear instruction, appropriate demonstration, constructive feedback, differentiated support, safety guidance, encouragement, and the creation of an interactive learning environment. These elements help students understand movement tasks, correct errors, build confidence, and sustain engagement throughout the learning process.

Research in PE has consistently highlighted the importance of teacher behavior and pedagogical interaction in shaping students' motivation, engagement, and learning experiences. Autonomy-supportive and student-centered teaching approaches can help students feel more competent, connected, and willing to actively participate in PE (Haerens *et al.,* 2013, 2015; Reeve & Cheon, 2021). Similarly, studies on teacher support in PE indicate that students are more likely to engage in learning when they perceive their

teachers as supportive, responsive, and capable of creating a positive motivational climate (Guo *et al.,* 2023; Leo *et al.,* 2022; Tian & Shen, 2023).

In the context of compulsory university PE, teaching methods may be particularly influential because many students initially do not perceive PE as a core academic subject. Under such conditions, students' willingness to participate may depend heavily on how learning activities are delivered and experienced in class. When lecturers rely primarily on traditional, teacher-centered, or repetitive instructional approaches, students may become passive and less motivated. In contrast, interactive teaching methods, individualized feedback, cooperative activities, and meaningful task design can transform PE from a compulsory requirement into a more engaging and educationally valuable experience. Recent studies also suggest that the balance between instructional structure and autonomy-supportive teaching styles can significantly affect students' motivation and engagement in PE (Coterón *et al.,* 2024; Li & Zeng, 2025). Consequently, teaching methods are expected to influence PE learning outcomes positively.

H1: Teaching methods positively affect students' learning outcomes in PE.

2.3. Learning Motivation and Learning Outcomes

Learning motivation refers to students' willingness, interest, effort, and persistence in participating in PE learning activities. Motivation is a central factor in PE because students' outcomes depend heavily on active participation, repeated practice, and sustained effort. Students with stronger motivation are more likely to attend classes regularly, engage in practice tasks, cooperate with peers, and overcome difficulties during physical activities. In contrast, students with lower motivation may participate only formally, avoid challenging tasks, or perceive PE as a compulsory responsibility rather than a meaningful learning opportunity.

Self-determination theory provides a useful theoretical foundation for understanding students' motivation in PE. According to this theory, students are more likely to develop autonomous motivation when their needs for autonomy, competence, and relatedness are supported in the learning environment (Ryan & Deci, 2000). In PE, autonomy may be supported when students have meaningful choices in activities; competence may be enhanced through clear feedback and achievable challenges; and relatedness may be developed through positive relationships with teachers and peers. When these psychological needs are satisfied, students tend to show greater engagement and better learning outcomes.

Empirical studies in PE have shown that motivational climate, autonomy support, and self-determined motivation are associated with student engagement, satisfaction, intention to participate in physical activity, and perceived performance (Abula *et al.,* 2020; Dupont *et al.,* 2009; Kokkonen *et al.,* 2020; Leo et al., 2022). In addition, motivation is closely linked to students' long-term physical activity behavior and healthy lifestyle orientation, which are important goals of university PE (Lourenço *et al.,* 2022; Trigueros *et al.,* 2019; Zheng *et al.,* 2023). In the Vietnamese higher education context, previous studies have also suggested that students' interest and motivation are important factors in improving the quality and effectiveness of PE learning (Hoan & Quang, 2024; Hoan & Van, 2020). Based on this theoretical and empirical foundation, learning motivation is expected to positively influence PE learning outcomes.

H2: Learning motivation positively affects students' learning outcomes in PE.

2.4. Course Content and Learning Outcomes

Course content refers to the relevance, diversity, practicality, and perceived usefulness of the knowledge and activities included in PE courses. In higher education, PE content should not only focus on technical skills or performance requirements but should also help students understand the value of physical activity for health, stress management, personal development, and lifelong well-being (He, 2024; Woodall *et al.,* 2025). When course content is relevant to students' needs and interests, students are more likely to perceive PE as meaningful and participate actively in learning activities.

The design of PE content can influence students' learning experiences by shaping their interest, perceived task value, and satisfaction. If the curriculum is monotonous, overly performance-oriented, or disconnected from students' daily lives, students may have difficulty recognizing the value of PE. Conversely, diverse and practical content, such as fitness activities, recreational sports, health-related knowledge, teamwork activities, and lifelong physical activity skills, can increase students' engagement and perceived usefulness of the course. Prior research has emphasized

that meaningful PE learning requires pedagogical and curricular approaches that connect physical activity with students' broader development and lived experiences (Moore & Fry, 2017; Quennerstedt, 2019).

Course content is also related to the motivational climate of PE. When students perceive learning tasks as useful, enjoyable, and appropriate to their abilities, they are more likely to develop positive attitudes and stronger intentions to continue physical activity. Studies have shown that motivational climate, task value, and student satisfaction are associated with participation and future physical activity intention in PE contexts (Escartí & Gutiérrez, 2001; Mouratidou *et al.,* 2022; Chin *et al.,* 2020). This relationship may be especially important in compulsory university PE, where students often evaluate the subject based on its perceived relevance to their personal development and broader educational priorities. Therefore, course content that is relevant, practical, and engaging is expected to influence students' learning outcomes positively.

H3: Course content positively affects students' learning outcomes in PE.

2.5. Facilities and Learning Outcomes

Facilities refer to the physical conditions, equipment, spaces, and material resources that support PE teaching and learning. In PE, facilities are particularly important because learning activities often require adequate sports grounds, training spaces, equipment, safety conditions, and supporting infrastructure. Compared with many classroom-based subjects, PE depends more directly on the physical learning environment. Poor facilities may limit the variety of activities, reduce safety, constrain teaching methods, and negatively affect students' participation and satisfaction.

From the perspective of higher education service quality, facilities and physical resources represent an important dimension of students' educational experience. Studies on service quality in higher education have shown that physical facilities, learning resources, and institutional support can influence students' satisfaction, perceived quality, and behavioral intentions (Abbas, 2020; Abdullah, 2006; Teeroovengadum *et al.,* 2019). In the PE context, the role of facilities may be even more visible because students directly use sports equipment and physical spaces during learning activities. Adequate facilities can create safer and more supportive conditions for participation, practice, and skill development. However, facilities should not be interpreted as the only, or necessarily the strongest, determinant of PE learning outcomes. While adequate equipment and spaces are important, their educational value depends substantially on how effectively they are integrated into teaching methods and course design. In resource-constrained higher education contexts, improvements in pedagogical quality, curriculum relevance, and motivational support may sometimes produce stronger educational effects than infrastructure alone. Nonetheless, inadequate facilities may still weaken students' learning experiences, reduce opportunities for effective participation, and constrain the implementation of diverse PE activities. Therefore, facilities are expected to influence students' learning outcomes positively.

H4: Facilities positively affect students' learning outcomes in PE.

2.6. Proposed Research Model

Based on the literature reviewed above, this study proposes that students' learning outcomes in compulsory university PE are influenced by four key determinants: teaching methods, learning motivation, course content, and facilities. These determinants represent pedagogical, individual, curricular, and environmental dimensions of PE learning. Teaching methods reflect the quality of instructional practice and teacher-student interaction. Learning motivation captures students' willingness, interest, and effort in PE participation. Course content represents the relevance, diversity, and practicality of PE learning activities. Facilities refer to the physical and material conditions that support PE teaching and learning. Although these determinants are conceptually distinct, they may interact closely in shaping students' PE experiences. Teaching methods may strengthen learning motivation, course content may influence students' perceptions of relevance and task value, and facilities may support or constrain the implementation of pedagogically effective learning activities. However, because this study focuses on identifying the relative influence of these determinants on learning outcomes, the proposed model examines their direct relationships with students' learning outcomes in compulsory university PE. The proposed model includes four independent variables and one dependent variable: teaching methods (TM), learning motivation (LM), course content (CC), and facilities (FA), while the dependent variable is learning outcomes (LO), as shown in Figure 1.

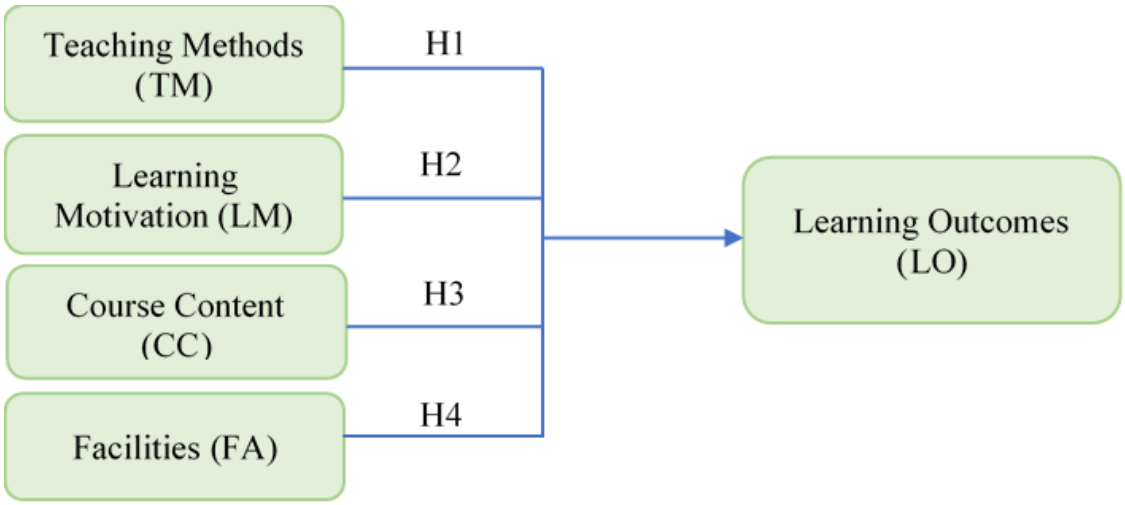

Figure 1. Conceptual framework

3. Methodology

3.1. Research Design

This study employed a quantitative cross-sectional survey design to examine the factors affecting students' learning outcomes in compulsory Physical Education (PE). A cross-sectional design was considered appropriate because the study aimed to capture students' perceptions of teaching methods, learning motivation, course content, facilities, and learning outcomes at a specific point in time. This design is commonly used in educational research to identify relationships among variables and to estimate the relative influence of multiple predictors on a given outcome. The quantitative survey was supported by expert consultation with lecturers and specialists in PE and higher education. The consultation process was used to refine the questionnaire items, ensure the contextual relevance of the measurement scales, and improve the clarity of the research instrument before formal data collection. Therefore, the qualitative component was not designed as an independent qualitative inquiry, but rather as a supporting procedure to strengthen content validity and contextual interpretation of the quantitative findings.

3.2. Sample and Data Collection

Data were collected from 150 undergraduate students enrolled in compulsory PE courses at Vietnam National University of Agriculture (VNUA). The respondents were selected using convenience sampling across different academic years. This sampling approach was adopted because the study focused on students who had direct learning experience in PE courses and could evaluate teaching methods, learning motivation, course content, facilities, and their own learning outcomes.

The sample size satisfied commonly recommended thresholds for multivariate analysis and exploratory factor analysis. According to Hair et al. (2013), a minimum ratio of 5-10 observations per measurement item is generally considered acceptable for factor analysis and regression-based research. With 18 observed measurement items included in the questionnaire, the sample size of 150 exceeded the minimum recommended level and was therefore considered adequate for the statistical procedures employed in this study.

Although convenience sampling may limit the generalizability of the findings, it is commonly used in exploratory educational studies that aim to examine relationships among constructs within a specific institutional context. To improve the sample's relevance, only students who had participated in PE learning activities were invited to complete the questionnaire. Participation was voluntary, and respondents were informed that their answers would be used only for research purposes. The survey was administered anonymously to reduce social desirability bias and encourage honest responses.

In addition to the student survey, expert consultation was conducted with 20 lecturers and experts in PE and higher education. These consultations helped assess whether the questionnaire items were understandable, contextually appropriate, and consistent with the actual conditions of PE teaching and learning at the university. Feedback from lecturers and experts was used to refine item wording, improve content validity, and contextualize the interpretation of the empirical results.

3.3. Measurement Scales

The questionnaire was developed based on the study's conceptual framework and relevant literature on PE learning outcomes, teaching methods, student motivation, course content, facilities, and higher education service quality. All constructs were measured using multiple-item scales on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The use of multiple-item scales is appropriate for measuring latent constructs because it allows researchers to capture different dimensions of each concept and assess internal consistency reliability.

The measurement items were adapted from previous studies and adjusted to fit the context of compulsory PE in Vietnamese higher education. Teaching Methods (TM) measured students' perceptions of lecturers' instructional clarity, feedback, interaction, teaching organization, and student-centered teaching practices. This construct was informed by studies on teacher support, autonomy-supportive teaching, and student engagement in PE (Guo *et al.,* 2023; Haerens *et al.,* 2013; Reeve & Cheon, 2021; Tian & Shen, 2023). Learning Motivation (LM) measured students' interest, willingness, effort, persistence, and active participation in PE learning activities. This construct was grounded in self-determination theory and prior studies on motivation in PE (Abula *et al.,* 2020; Leo *et al.,* 2022; Ryan & Deci, 2000). Course Content (CC) measured students' perceptions of the relevance, diversity, practicality, and attractiveness of PE course content, drawing on studies on meaningful PE experiences and curriculum relevance (Moore & Fry, 2017; Quennerstedt, 2019). Facilities (FA) measured the adequacy, accessibility, safety, and quality of sports facilities and equipment, drawing on the broader literature on learning environments and service quality in higher education (Abbas, 2020; Teeroovengadum *et al.,* 2019). Learning Outcomes (LO) measured students' perceived improvement in physical competence, knowledge, participation, teamwork, discipline, and satisfaction with PE learning (Bailey, 2006; Shen & Shao, 2022). The full list of measurement items and construct coding is presented in Appendix A.

3.4. Data Analysis

Data were analyzed using SPSS Statistics 20.0. The analysis was conducted in several stages to ensure that the measurement scales were reliable and that the proposed relationships among variables could be appropriately examined. First, descriptive statistics were used to summarize the data and provide an overview of students' evaluations of teaching methods, learning motivation, course content, facilities, and learning outcomes. Mean values and standard deviations were calculated for each construct.

Second, reliability analysis was conducted using Cronbach's Alpha to assess the internal consistency of each measurement scale. A Cronbach's Alpha value of 0.70 or above was considered acceptable for social science and educational research (Hair *et al.,* 2013). Items with weak item-total correlations would be considered for removal if they reduced the scale's reliability. Third, Exploratory Factor Analysis (EFA) was performed to examine the underlying factor structure of the measurement items. EFA was used because the study aimed to validate whether the observed items clustered into the expected constructs in the context of compulsory university PE. The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. A KMO value above 0.60 and a significant Bartlett's test indicate that the data are appropriate for factor analysis (Hair *et al.,* 2013). Factor extraction was based on eigenvalues greater than 1, and factor loadings were examined to determine whether items adequately represented their intended constructs. To assess the potential influence of common method bias associated with self-reported survey data, Harman's single-factor test was also conducted. According to this procedure, common-method bias is considered less problematic when a single factor accounts for only a small portion of the total variance. After confirming scale reliability and factor structure through Cronbach's Alpha and EFA, composite mean scores were calculated by averaging the retained items within each validated construct. These composite scores were subsequently used in the correlation and regression analyses.

Fourth, Pearson correlation analysis was conducted to examine the direction and strength of the relationships among teaching methods, learning motivation, course content, facilities, and learning outcomes. This step provided preliminary evidence of associations among the variables before conducting regression analysis. Finally, multiple regression analysis was used to estimate the relative effects of the four independent variables on students' learning outcomes. The regression model included Teaching Methods, Learning Motivation, Course Content, and Facilities as predictors, and Learning Outcomes as the dependent variable. The model can be expressed as follows:

$$LO = \beta_0 + \beta_1 * TM + \beta_2 * LM + \beta_3 * CC + \beta_4 * FA + \varepsilon \quad (1)$$

Where LO represents learning outcomes, TM represents teaching methods, LM represents learning motivation, CC represents course content, and FA represents facilities. β_0 is the constant, β_1 - β_4 are regression coefficients, and ε is the error term.

To ensure the appropriateness of the regression model, multicollinearity was assessed using the Variance Inflation Factor (VIF). VIF values below commonly accepted thresholds indicate that multicollinearity is not a serious concern (Hair *et al.,* 2013). The coefficient of determination (R2), adjusted R2, standardized beta coefficients, t-values, and significance levels were used to evaluate the model's explanatory power and the relative influence of each predictor.

4. Results

4.1. Descriptive Statistics and Reliability Analysis

Table 1 presents the descriptive statistics and reliability analysis for the study constructs. The mean scores ranged from 2.376 to 3.002, indicating that students' evaluations varied from below neutral to approximately neutral. Among the constructs, Course Content received the highest mean score (M = 3.002), followed by Teaching Methods (M = 2.884), Learning Outcomes (M = 2.593), Facilities (M = 2.398), and Learning Motivation (M = 2.376). These findings suggest that students evaluated the relevance and practicality of PE course content relatively more positively, whereas learning motivation and facilities were perceived less favorably. The comparatively low mean score for learning motivation may reflect the broader challenge of sustaining student engagement in compulsory PE within academically oriented university environments.

The reliability analysis indicates that all constructs achieved satisfactory internal consistency. Cronbach's Alpha coefficients ranged from 0.836 to 0.856, exceeding the commonly recommended threshold of 0.70 for social science and educational research (Hair *et al.,* 2013). These results demonstrate that the measurement items within each construct were internally consistent and appropriate for subsequent statistical analyses. The corrected item-total correlation values ranged from 0.504 to 0.783, which are above the commonly accepted minimum threshold of 0.30.

Table 1. Descriptive statistics and reliability (N=150)

Items	Variables	Item Means	Corrected item-Total correlation	Cronbach's Alpha
Teaching Methods (TM)	TM1	2.884	.728	.850
	TM2		.665	
	TM3		.678	
	TM4		.675	
	TM5		.574	
Learning Motivation (LM)	LM1	2.376	.691	.855
	LM2		.731	
	LM3		.655	
	LM4		.642	
	LM5		.623	
Course Content (CC)	CC1	3.002	.655	.856
	CC2		.717	
	CC3		.725	
	CC4		.700	
Facilities (FA)	FA1	2.398	.657	.836
	FA2		.682	
	FA3		.688	
	FA4		.654	
Learning Outcomes (LO)	LO1	2.593	.710	.850
	LO2		.783	
	LO3		.666	
	LO4		.648	
	LO5		.504	

This indicates that all items contributed adequately to their respective constructs and that no item needed to be removed at this stage. Overall, the scales demonstrated satisfactory reliability and could therefore be retained for exploratory factor analysis, correlation analysis, and regression analysis. Specifically, Course Content had the highest reliability coefficient (α = 0.856), followed by Learning Motivation (α = 0.855), Teaching Methods and Learning Outcomes (α = 0.850), and Facilities (α = 0.836). These results demonstrate that the measurement items within each construct were internally consistent and appropriate for subsequent statistical analyses.

The corrected item-total correlation values ranged from 0.504 to 0.783, which are above the commonly accepted minimum threshold of 0.30. This indicates that all items contributed adequately to their respective constructs and that no item needed to be removed at this stage. Overall, the scales demonstrated satisfactory reliability and could therefore be retained for exploratory factor analysis, correlation analysis, and regression analysis.

Overall, these findings indicate that the scales used in the study demonstrated satisfactory reliability and could be used in subsequent exploratory factor analysis, correlation analysis, and regression analysis.

4.2. Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was conducted to examine the underlying factor structure of the measurement items. Before performing EFA, the suitability of the data was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. As shown in Table 2, the KMO value was 0.789, exceeding the recommended minimum threshold of 0.60. This indicates that the sample was adequate for factor analysis. Bartlett's Test of Sphericity was statistically significant (χ^2 = 1226.403, df = 153, p < 0.001), confirming that the correlation matrix was suitable for factor extraction. The EFA was performed using Principal Component Analysis with Varimax rotation and Kaiser Normalization. As presented in Table 3, four components had eigenvalues greater than 1 and were retained. These four components together explained 66.670% of the total variance, indicating an acceptable factor solution for educational and social science research. The first component explained 23.432% of the variance, the second component 18.883%, the third 14.576%, and the fourth 9.778%.

The rotated component matrix further confirmed the expected four-factor structure. As shown in Table 4, all items loaded strongly on their intended factors, with factor loadings ranging from 0.700 to 0.856. Teaching Methods items loaded on the first component, Learning Motivation items loaded on the second component, Course Content items loaded on the third component, and Facilities items loaded on the fourth component. Since all factor loadings exceeded the commonly recommended minimum of 0.50, no items were removed from the scale. The rotation converged in five iterations, indicating a stable factor solution.

Table 2. KMO and Bartlett's Test

Test		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.789
Bartlett's Test of Sphericity	Approx. Chi-Square	1226.403
	df	153
	Sig.	.000

Table 3. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.218	23.432	23.432	4.218	23.432	23.432
2	3.399	18.883	42.315	3.399	18.883	42.315
3	2.624	14.576	56.891	2.624	14.576	56.891
4	1.760	9.778	66.670	1.760	9.778	66.670

Extraction Method: Principal Component Analysis

Table 4. Rotated Component Matrix[a]

Variables	Component			
	1	2	3	4
TM1	.819			
TM4	.802			
TM2	.795			
TM3	.791			
TM5	.700			
LM2		.856		
LM1		.807		
LM4		.768		
LM3		.765		
LM5		.738		
CC3			.842	
CC2			.834	
CC4			.829	
CC1			.804	
FA2				.838
FA3				.808
FA4				.800
FA1				.780

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

[a]. Rotation converged in 5 iterations.

In addition to the EFA for the independent variables, factor analysis was also conducted for the dependent variable, Learning Outcomes. As shown in Table 5, one component had an eigenvalue greater than 1. This component explained 62.938% of the total variance, indicating that the five Learning Outcomes items represented a coherent single-factor structure.

To further assess the potential influence of common method bias, Harman's single-factor test was conducted. The first unrotated factor accounted for 23.432% of the total variance, well below the commonly referenced threshold of 50%. This result suggests that common-method bias was unlikely to pose a serious concern in the present study.

Overall, the EFA results provide empirical support for the study's measurement structure. The four independent variables: Teaching Methods, Learning Motivation, Course Content, and Facilities, were clearly extracted, while Learning Outcomes formed a separate single-factor construct. These results indicate that the measurement scales had satisfactory construct validity and were appropriate for subsequent correlation and regression analyses.

4.3. Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships among the study variables before performing multiple regression analysis. The results are presented in Table 6. All four independent variables were positively and significantly correlated with Learning Outcomes at the $p < 0.01$ level. Among the independent variables, Course Content showed the strongest positive correlation with Learning Outcomes ($r = 0.68$), followed by Teaching Methods ($r = 0.61$), Learning Motivation ($r = 0.55$), and Facilities ($r = 0.48$).

Table 5. Total Variance Explained for Learning Outcomes

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.147	62.938	62.938	3.147	62.938	62.938
2	.690	13.795	76.733			
3	.499	9.986	86.719			
4	.396	7.921	94.640			
5	.268	5.360	100.000			

Table 6. Pearson Correlation Matrix

Variable	CC	TM	LM	FA	LO
CC	1				
TM	0.47**	1			
LM	0.49**	0.52**	1		
FA	0.44**	0.39**	0.42**	1	
LO	0.68**	0.61**	0.55**	0.48**	1

Table 7. Model Summary and ANOVA Results

Model	R	R Square	Adjusted R-Square	Change Statistics					Durbin-Watson
				R Square Change	F Change	df1	df2	Sig. F Change	
1	.787	.619	.608	.619	58.9	4	145	.000	1.574

These results suggest that students who evaluated course content more favorably, perceived teaching methods more positively, reported stronger learning motivation, and perceived better facilities tended to report higher PE learning outcomes.

The correlations among the independent variables ranged from 0.39 to 0.52, indicating low-to-moderate to moderate associations. Therefore, the correlation results provide preliminary support for the proposed hypotheses and indicate that the variables were appropriate for inclusion in the multiple regression model.

4.4. Multiple Regression Analysis

Multiple regression analysis was conducted to estimate the relative effects of Teaching Methods (TM), Learning Motivation (LM), Course Content (CC), and Facilities (FA) on students' Learning Outcomes (LO) in compulsory PE. The model summary is presented in Table 7.

The regression model explained 61.9% of the variance in students' PE learning outcomes (R^2 = 0.619), with an adjusted R2 of 0.608. This indicates that the four predictors together accounted for a substantial proportion of the variation in students' perceived learning outcomes. The Durbin-Watson statistic was 1.574, suggesting no serious autocorrelation. The regression coefficients are presented in Table 8. All four predictors had positive and statistically significant effects on Learning Outcomes.

The results indicate that Course Content had the strongest positive effect on Learning Outcomes ($\beta = 0.35$, $t = 6.12$, $p < 0.001$). This finding suggests that students who perceived PE course content as relevant, practical, diverse, and engaging were substantially more likely to report positive learning outcomes. The relatively strong effect size of Course Content indicates that perceived curricular relevance may play a particularly important role in compulsory university PE contexts. Teaching Methods had the second strongest effect on Learning Outcomes ($\beta = 0.28$, $t = 5.04$, $p < 0.001$).

Table 8. Regression Coefficients

Factor	Standardized Coefficients (Beta)	t-value	Sig.	Tolerance	VIF
Course Content (CC)	0.35	6.12	0.000	0.680	1.437
Teaching Methods (TM)	0.28	5.04	0.000	0.711	1.409
Learning Motivation (LM)	0.22	3.98	0.000	0.634	1.471
Facilities (FA)	0.15	2.87	0.005	0.781	1.336

Table 9. Hypothesis testing results

Hypothesis	Relationship	Result
H1	Teaching Methods -> Learning Outcomes	Supported
H2	Learning Motivation -> Learning Outcomes	Supported
H3	Course Content -> Learning Outcomes	Supported
H4	Facilities -> Learning Outcomes	Supported

This result indicates that clear instruction, appropriate demonstration, constructive feedback, interactive teaching, and task adaptation contribute significantly to students' perceived learning outcomes in PE. Although Teaching Methods was not the strongest predictor, its relatively high standardized coefficient highlights the importance of pedagogical quality in compulsory PE.

Learning Motivation also had a positive and significant effect on Learning Outcomes ($\beta = 0.22$, $t = 3.98$, $p < 0.001$). This suggests that students who showed stronger interest, effort, persistence, and willingness to participate in PE activities tended to achieve better perceived learning outcomes. This finding supports the argument that motivation remains a critical condition for meaningful participation and engagement in practice-oriented learning environments. Finally, Facilities had a positive but comparatively weaker effect on Learning Outcomes ($\beta = 0.15$, $t = 2.87$, $p = 0.005$). This finding suggests that infrastructural conditions alone may not guarantee effective PE learning if pedagogical quality, curriculum relevance, and student motivation remain insufficient.

The Tolerance and VIF values indicate that multicollinearity was not a serious concern in the regression model, as all VIF values were substantially below commonly accepted thresholds. Overall, the regression results support all four proposed hypotheses. More importantly, the relative strength of the predictors suggests the following hierarchy of influence on PE learning outcomes: Course Content -> Teaching Methods -> Learning Motivation -> Facilities (Table 9).

Overall, the findings demonstrate that students' learning outcomes in compulsory PE are shaped by a combination of pedagogical, motivational, curricular, and environmental factors. However, the relative strength of the predictors suggests that students' PE learning outcomes are influenced more strongly by curricular relevance and pedagogical quality than by infrastructural conditions alone. In practical terms, these findings indicate that universities should not rely exclusively on sports facilities as the primary strategy for improving PE quality. Instead, greater attention should also be directed toward curriculum renewal, meaningful course design, student-centered teaching practices, and strategies that enhance students' motivation and active participation in PE learning activities.

5. Discussion

The purpose of this study was to examine the factors affecting students' learning outcomes in compulsory Physical Education (PE) at Vietnam National University of Agriculture (VNUA). The findings show that all four proposed factors, namely: course content, teaching methods, learning motivation, and facilities, positively and significantly influence students' learning outcomes. Among these factors, course content had the strongest effect, followed by teaching methods, learning motivation, and facilities. This hierarchy suggests that students' PE learning outcomes are shaped not only by pedagogical and motivational factors, but more fundamentally by whether students perceive PE learning as relevant, meaningful, and practically valuable.

The strongest effect of Course Content is particularly important because it extends existing PE literature beyond the conventional emphasis on teacher behavior or facilities. In the present study, students' evaluations of curricular relevance, practicality, diversity, and usefulness exerted a stronger influence on learning outcomes than either motivation or infrastructural conditions. This finding suggests that, within compulsory university PE, students may engage more actively when they perceive the course as personally meaningful rather than only institutionally required. In academically oriented university contexts such as Vietnam, where PE is often perceived as secondary to major-specific academic subjects, students may participate passively unless the curriculum clearly demonstrates practical value for health, stress management, teamwork, self-discipline, and lifelong well-being.

This interpretation is consistent with the argument that meaningful PE learning requires curricular approaches connecting physical activity with students' lived experiences, interests, and broader personal development (Moore & Fry, 2017; Quennerstedt, 2019). However, the present study contributes additional contextual insight by showing that curricular relevance may become even more influential under compulsory PE conditions. When course content is overly technical, repetitive, or disconnected from students' perceived needs, students may view PE primarily as an administrative requirement rather than a meaningful educational experience. Conversely, diverse and practically oriented PE content, including health-related fitness, recreational activities, teamwork experiences, and lifelong physical activity skills, may strengthen students' perceptions of task value and educational usefulness. This finding is broadly consistent with previous studies linking task value, motivational climate, and student satisfaction to participation and future physical activity intention (Mouratidou *et al.,* 2022; Chin *et al.,* 2020), while also suggesting that curriculum design deserves greater attention in higher education PE research.

Teaching methods were the second strongest predictor of PE learning outcomes. This finding confirms the important role of pedagogical quality in compulsory university PE. It is consistent with previous research emphasizing teacher support, instructional clarity, constructive feedback, autonomy-supportive teaching, and positive teacher-student interaction in PE contexts (Guo et al., 2023; Reeve & Cheon, 2021; Tian & Shen, 2023). In practice-oriented subjects such as PE, lecturers do not only transfer knowledge; they guide movement practice, correct technical errors, provide encouragement, organize meaningful activities, and create a safe and motivating learning climate. Therefore, effective teaching methods remain essential for helping students understand learning tasks, participate actively, and develop confidence in their physical abilities.

The positive effect of teaching methods also suggests that curriculum content alone is insufficient unless delivered through appropriate pedagogical strategies. Even well-designed, practically relevant course content may produce limited educational benefits if delivered through passive, repetitive, or highly teacher-centered instruction. In contrast, student-centered teaching strategies, cooperative learning activities, differentiated instruction, and autonomy-supportive approaches may strengthen students' engagement with the curriculum itself. This interpretation supports previous studies demonstrating that autonomy-supportive and well-structured teaching enhances students' motivation, participation, and engagement in PE (Coterón *et al.,* 2024; Li & Zeng, 2025). The present findings reinforce the argument that effective PE learning depends not only on "what" students learn but also on "how" learning experiences are organized pedagogically.

Learning Motivation also had a positive and significant effect on learning outcomes, although its influence was weaker than that of Course Content and Teaching Methods. This result remains theoretically important because PE learning outcomes depend heavily on active participation, repeated practice, persistence, and willingness to engage in physical activity. The finding is consistent with Self-Determination Theory, which argues that students are more likely to participate actively and persistently when their needs for autonomy, competence, and relatedness are supported (Ryan, 2017). Students with stronger learning motivation are more likely to participate consistently, practice actively, cooperate with peers, and recognize the long-term value of physical activity for health and personal development (Ryan & Deci, 2020). The role of motivation identified in this study is also consistent with empirical evidence linking autonomous motivation, motivational climate, teacher support, and psychological need satisfaction to student engagement, physical activity intention, and perceived performance (Abula *et al.,* 2020; Kokkonen *et al.,* 2020; Zheng *et al.,* 2023). In the Vietnamese higher education context, this finding aligns with previous studies

suggesting that students' interest and motivation are important conditions for improving PE quality and learning effectiveness (Hoan & Quang, 2024; Hoan & Van, 2020). However, the comparatively weaker effect of motivation relative to course content and teaching methods is remarkable. This result indicates that students' motivation in compulsory PE is partly shaped by broader curricular and pedagogical experiences rather than functioning as an entirely independent factor. In other words, students may become more motivated when they perceive PE content as relevant and when teaching practices support meaningful participation. This interpretation highlights the interdependence between curricular, pedagogical, and motivational dimensions of PE learning.

Facilities had a positive and significant effect on learning outcomes, but their effect was the weakest among the four predictors. This result suggests that sports facilities and equipment remain necessary for supporting PE teaching and learning, but they are not sufficient on their own to ensure strong learning outcomes. Adequate facilities can provide safer practice conditions, expand the range of learning activities, and improve students' satisfaction with the learning environment. This finding is consistent with higher education service quality research, which highlights the role of physical resources, institutional support, and learning environments in shaping student satisfaction and perceived educational quality (Abbas, 2020; Hwang & Choi, 2019; Nhung & Hoan, 2026). At the same time, the comparatively weaker effect of Facilities has important practical and theoretical implications. The findings suggest that infrastructure primarily functions as an enabling condition rather than the central driver of PE learning outcomes. The availability of facilities alone does not necessarily lead to improved learning outcomes when course content is perceived as irrelevant, teaching practices lack effectiveness, or students demonstrate low levels of learning motivation. Conversely, meaningful educational improvements may still occur in resource-constrained contexts when lecturers adapt activities effectively, design relevant learning tasks, and create supportive learning environments. This result is particularly important for developing-country higher education systems where large-scale infrastructural investment may be financially constrained. The findings challenge infrastructure-centered assumptions by suggesting that curriculum renewal and pedagogical improvement may produce stronger educational benefits than facilities alone.

Overall, the findings support the proposed research model and demonstrate that a combination of curricular, pedagogical, motivational, and environmental factors influences PE learning outcomes. More importantly, the results clarify the relative hierarchy of these determinants within compulsory university PE. The strongest influence of Course Content suggests that improving PE effectiveness requires greater attention to curricular relevance and meaningful learning experiences rather than focusing exclusively on infrastructure or administrative requirements. This study contributes to the literature by providing empirical evidence from a Vietnamese higher education context and by demonstrating that, under compulsory PE conditions, students' perceptions of curricular relevance may be more influential than infrastructural conditions in shaping learning outcomes.

6. Practical Implications

The findings provide several implications for improving compulsory PE in higher education. First, because course content had the strongest effect on learning outcomes, universities should prioritize curriculum renewal. PE content should be relevant, diverse, practical, and connected to students' health, daily life, and lifelong physical activity needs. In addition to traditional sports, courses may include health-related fitness, recreational activities, injury prevention, stress management, teamwork, and lifelong exercise planning.

Second, as teaching methods were the second strongest predictor, curriculum renewal should be supported by effective pedagogical practice. Universities should strengthen professional development for PE lecturers, particularly in student-centered teaching, autonomy support, differentiated instruction, constructive feedback, and motivational communication. These strategies can help transform course content into meaningful learning experiences.

Third, since learning motivation significantly influences learning outcomes, lecturers should create supportive learning environments that enhance students' interest, confidence, perceived competence, and awareness of the long-term value of physical activity. Students should be encouraged to view PE not only as a compulsory requirement, but also as an opportunity to develop physical competence, discipline, teamwork, and healthy lifestyle habits.

Finally, although facilities had the weakest effect, they remain necessary supporting conditions. Universities should improve safe practice spaces, basic

equipment, maintenance, and scheduling, while ensuring that facility investment aligns with curricular and pedagogical needs. Overall, improving PE outcomes requires an integrated approach centered on relevant content, effective teaching, student motivation, and appropriate learning conditions.

6. Conclusion, Limitations and Future Research

This study examined the factors affecting students' learning outcomes in compulsory Physical Education (PE) at VNUA. The findings demonstrate that Course Content, Teaching Methods, Learning Motivation, and Facilities all positively and significantly influenced students' perceived learning outcomes. Among these factors, Course Content emerged as the strongest predictor, followed by Teaching Methods, Learning Motivation, and Facilities. These results indicate that students' PE learning outcomes are influenced not only by environmental conditions and individual motivation, but also, more fundamentally, by whether PE learning is perceived as relevant, meaningful, practical, and pedagogically engaging.

The study contributes to the existing literature in several ways. First, it provides empirical evidence from a Vietnamese higher education context, where research on compulsory university PE remains relatively limited compared with school-based PE or general physical activity studies. Second, the study examines the combined and relative effects of curricular, pedagogical, motivational, and environmental determinants within a single analytical framework. Third, the findings clarify the relative hierarchy of these determinants, showing that curricular relevance and pedagogical quality exert stronger influences on PE learning outcomes than infrastructural conditions alone. This contribution is particularly important for compulsory PE contexts in developing-country higher education systems, where institutional resources may be constrained and where students often perceive PE as secondary to academically specialized subjects.

The findings also contribute important practical implications. The strong influence of Course Content suggests that improving compulsory PE requires greater attention to curriculum renewal, curricular relevance, and meaningful learning experiences. Thus, PE courses should be designed not only to develop technical skills but also to strengthen students' awareness of health, teamwork, stress management, discipline, and lifelong physical activity. At the same time, improving pedagogical quality and strengthening student motivation remain essential conditions for enhancing learning effectiveness. Although Facilities positively influenced learning outcomes, their comparatively weaker effect suggests that infrastructural investment alone is unlikely to ensure meaningful educational improvement without corresponding curricular and pedagogical development.

Despite these contributions, several limitations still occur. First, the study employed convenience sampling within a single university context, which may limit the generalizability of the findings to other higher education institutions or national contexts. Second, the study relied on self-reported learning outcomes, which may be affected by subjective evaluations and common method bias; however, procedural and statistical checks indicated that common method variance was not a serious concern. Third, the study adopted a cross-sectional design; as a result, the findings identify statistical associations rather than long-term causal relationships among variables.

Future research may address these limitations in several ways. Studies involving larger, more diverse samples across multiple universities would improve the generalizability of the findings and enable comparative analysis across institutional contexts. Longitudinal or mixed-method approaches may also provide deeper insight into how students' motivation, engagement, and learning experiences evolve in compulsory PE. In addition, future studies should employ employ Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM), or Partial Least Squares Structural Equation Modeling (PLS-SEM) to validate the measurement structure and examine potential mediating or moderating relationships among curricular, pedagogical, motivational, and environmental factors. Such approaches may further clarify the complex mechanisms that shape PE learning outcomes in higher education contexts.

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