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Dang Duc Hoan
Vietnam National University
of Agriculture, Trau Quy, Gia
Lam, Hanoi, Vietnam

Tran Van Khoi
Hanoi National University of
Education (HNUE) is a
prominent public university in
Hanoi, Vietnam

Nguyen Hung Anh
Vietnam National University
of Agriculture, Trau Quy, Gia
Lam, Hanoi, Vietnam

Corresponding Author:
Nguyen Hung Anh
Vietnam National University
of Agriculture, Trau Quy, Gia
Lam, Hanoi, Vietnam

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Assessment of learning outcomes in virtual physical education during covid-19: Vietnamese undergraduate perspectives

Dang Duc Hoan, Tran Van Khoi and Nguyen Hung Anh

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Abstract

Under social distancing during the COVID-19 pandemic, the widespread adoption of online teaching has raised remarkable concerns regarding the quality of learning, particularly undergraduate physical education (PE) programs. Based on student's perspectives, this study utilized exploratory factor analysis to investigate the factors influencing the learning outcomes from several physical education courses. The survey involved 100 students who participated in PE virtual classrooms in Vietnam. The empirical results identified 5 key determinants of learning outcomes, including accessibility, lecture facilitation, motivation, preparedness, and personality. Severe network congestion emerged as the most significant factor affecting the overall PE learning outcomes. These findings offer valuable insights for enhancing the design of university-level physical education in the online setting.

Keywords: COVID-19, virtual physical education, learning outcomes

Introduction

A fundamental aspect of physical education (PE) is the delivery of cognitive content and instruction designed to develop motor skills, knowledge, and behaviors that encourage physical activity and fitness (Bailey, 2006; Kliziene, Cizauskas, Sipaviciene, Aleksandraviciene, & Zaicenkoviene, 2021) [4]. Achieving this objective is particularly challenging in an online teaching environment, which often leads to a decrease in the effectiveness of PE learning outcomes (Eswaramoorthi *et al.*, 2022; González-Calvo, Barba-Martín, Bores-García, & Hortigüela-Alcalá, 2021) [12, 17]. Existing literature has indicated increased effectiveness and efficiency in online teaching methods (T. Nguyen, 2015; Sun & Chen, 2016; Thịnh, 2022) [50, 51], however, several factors contribute to the decline in learning quality, as reflected in students' lack of understanding and poor performance (Apriyanto & Adi, 2021) [3]. Although the COVID-19 pandemic has left behind numerous negative consequences, it has also introduced the hybrid mode of teaching as a lasting change in the education sector (Pokhrel & Chhetri, 2021) [45]. Consequently, achieving effective learning outcomes in PE remains a persistent challenge (Apriyanto & Adi, 2021; Kliziene *et al.*, 2021) [28].

University-level PE offers young people opportunities for physical activity beyond the compulsory nature of the subject since primary school (Bailey, 2006; D'Agostino, Urtel, Webster, McMullen, & Culp, 2021; Kliziene *et al.*, 2021) [4, 6, 28]. However, during the COVID-19 pandemic, PE had to be adapted to online learning platforms (Daum, Goad, Mosier, & Killian, 2021) [9]. The abrupt change required PE teachers to deliver online instruction despite their lack of training regarding this teaching method, a challenge particularly pronounced in developing countries like Vietnam (D'Agostino *et al.*, 2021; Oanh, Anh, Duong, Nguyễn, & Truong, 2023) [6, 39, 42]. During this period, these countries were just beginning to implement digital transformation across various sectors, yet faced significant limitations in digital resources, infrastructure, and societal awareness regarding the application of technology (T. H. Nguyen, 2022) [41]. As a result, online learning platforms inherently create disparities among students, exacerbating existing social inequalities (D'Agostino *et al.*, 2021) [6]. This has led to a significant disparity in learning outcomes between different student groups in online PE

compared to the more equitable outcomes of traditional, in-person PE (Nghi, Nguyen Tat, Huu Phuc, & Mậu Vũ, 2021)^[38]. Research on virtual PE has primarily been conducted in developed countries, where PE teachers play a key role in designing online resources tailored to meet the diverse learning and physical activity needs of students (D'Agostino *et al.*, 2021^[6]; Esser-Noethlichs, Lund, & Bjørke)^[11]. Furthermore, existing literature has mainly focused on the design features of online teaching tools, with an emphasis on promoting equity in physical activity and enhancing learner satisfaction (D'Agostino *et al.*, 2021; Daum *et al.*, 2021; Martin, Sun, & Westine, 2020; Oanh *et al.*, 2023)^[6, 8, 36, 42, 50]. Moreover, there is a significant lack of research within the context of developing countries, such as Vietnam. Hence, this study seeks to address this gap by examining students' perspectives on blended approaches to PE during the COVID-19 pandemic, to enhance both learning outcomes and teaching quality. Utilizing a sample of 100 students, we conducted an Exploratory Factor Analysis (EFA) to identify the various aspects influencing learning outcomes in the virtual PE setting at the university level. This research is particularly pertinent as many higher educational programs in Vietnam are increasingly blended toward hybrid teaching models.

Methodology

Related Literature and Conceptual Framework

Online education, which can be pedagogically structured rather than solely self-directed, is a form of electronically supported learning that utilizes the Internet to facilitate a distance learning and teaching environment (Bailey, 2006; Oanh *et al.*, 2023; Pokhrel & Chhetri, 2021)^[4, 42, 45]. Unlike traditional educational methods, online education does not require learners to attend physical classes (Martin *et al.*, 2020)^[36]. In general, the learning outcomes of online PE is influenced by five primary factors: lecture facilitation, accessibility, teacher preparedness, student motivation, and individual personality (Kalajas-Tilga, Koka, Hein, Tilga, & Raudsepp, 2020; Nghi *et al.*, 2021; T. Nguyen, 2015; Pawlowska, Westerman, Bergman, & Huelsman, 2014; Sun & Chen, 2016)^[25, 38, 40, 43, 50]. First, the factor of lecture facilitation encompasses the teacher's knowledge reserve and organizational skills of teaching and supporting learning (Oanh *et al.*, 2023)^[42]. Teachers play a crucial role in guiding and tutoring students in these virtual settings, as a knowledgeable and enthusiastic educator can significantly enhance student engagement and learning experiences (Sun & Chen, 2016). According to Eom *et al.* (2006)^[10, 50], teacher competence directly influences the quality of student learning and serves as a key indicator of the effectiveness of online PE classes. Second, virtual classrooms are highly dependent on technical factors and the external environment. (Hartoto *et al.*, 2022; Ikhsan *et al.*, 2019; Kim *et al.*, 2021)^[19, 23, 27]. Therefore, accessibility is influenced by IT skills, the quality of internet resources, technology training, and the quality of the indoor environment (Liaw, 2008; Tran Dinh Manh, 2021)^[32]. Third, pre-class preparation of lecture content is crucial for developing appropriate materials that facilitate online learning (Daniel, 2020)^[7]. Effective preparation is closely linked to the quality of both teaching and learning (Nghi *et al.*, 2021)^[38]. It involves the creation of comprehensive lesson plans, relevant content, and the use of appropriate online materials, such as videos, images, and quizzes, to enhance students' understanding and improve their motor skills and

engagement (Kazakova *et al.*, 2021)^[26]. The majority of empirical studies confirmed that course design is a key component of successful online teaching (Kazakova *et al.*, 2021)^[26]. Fourth, motivation refers to the capacity to pursue a clear goal with inspiration, respect, and a sense of responsibility throughout the learning or working process (Filgona, Sakiyo, Gwany, & Okoronka, 2020; Kalajas-Tilga *et al.*, 2020)^[14, 25]. In the context of PE, students with higher levels of motivation tend to exhibit better learning outcomes, because the acquisition of motor skills and engagement in physical activities are significantly influenced by the motivation level (Bailey, 2006)^[4]. Student motivation can be assessed through their expectations for knowledge improvement and their engagement in problem-solving tasks (Moll-Khosrawi *et al.*, 2021; Nguyen Van Truong, 2021). Lastly, Pawlowska *et al.* (2014)^[37, 41, 43] identified student personality as a consistent predictor of student satisfaction, while the classroom environment consistently predicts academic performance (Fandos-Herrera, Jiménez-Martínez, Orús, Pérez-Rueda, & Pina, 2023)^[13]. Moreover, the interaction between these two factors plays a crucial role in determining both student satisfaction and learning outcomes. Moreira, Pedras, and Pombo (2020) further established that personality is the strongest predictor of class performance, even when controlling for variables such as the type of learning approach and well-being. These findings suggest that education policies should prioritize the development of personality traits in adolescents as a strategy to enhance the success of learning outcomes (Ginns, Liem, & Martin, 2011)^[16].

Sampling and Data Analysis

The study utilized an online survey of a sample of 100 students who had experienced virtual PE classes during the COVID-19 pandemic in Vietnam. The online survey was conducted using a questionnaire via Google form and email, with a total sample of 100 respondents collected between February and April 2022. According to Hair *et al.* (2006)^[18], the minimum sample size required for exploratory factor analysis (EFA) should be at least 50, with a sample size greater than 100 being preferable. Additionally, the observation-to-measure variable should be 5:1, indicating that each variable requires a minimum of five observations. In this study, there are 19 variables representing all factors in the research model (Table 1), thus the minimum required sample size is $19 \times 5 = 95$. The 5-point Likert scale was utilized, ranging from 'strongly disagree' (1) to 'strongly agree' (5). To evaluate the reliability of each scale and exclude extraneous variables prior to conducting EFA, variables with a corrected item-total correlation of less than 0.3 were removed. A scale is considered to have good reliability when its Cronbach's alpha coefficient ranges between 0.70 and 0.80. Nevertheless, a Cronbach's alpha of 0.60 or higher is still considered acceptable (Hair *et al.*, 2006)^[18]. Following the assessment of reliability using Cronbach's alpha, the observed variables were subjected to EFA to evaluate the convergent and discriminant validity of the scale. EFA was then used to reduce a set of k observations into a smaller set of F ($F < k$) more significant factors. This reduction is based on the linear relationships between factors and observed variables. The number of fundamental factors depends on the research model, wherein they are orthogonally rotated to ensure no intercorrelation.

The study also employed multivariable regression analysis using the least squares method to assess the relationship between the independent factors and the PE learning outcomes (LOC), providing insights into the extent to which each factor influences the overall LOC. The degree of influence of various factors on the LOC is represented by the following equation:

$$LOC = b_0 + b_1F_1 + b_2F_2 + b_3F_3 + b_4F_4 + b_5F_5 + \epsilon$$

Where:

LOC: The learning outcomes of online PE during the COVID-19 pandemic

b_0 : Constant term b_1, b_2, b_3, b_4, b_5 : Estimated coefficients

F_1, F_2, F_3, F_4, F_5 : Factors impacting the learning outcomes of PE

ϵ : Residual term

Table 1: EFA Variable Definition

N	Variables	Questionnaire/Variable Specification	References
Lecture facilitation (F1)			
1	F1.1	Lecturers are pedagogically qualified?	(Eom <i>et al.</i> , 2006) ^[10] ; (Oanh <i>et al.</i> , 2023) ^[42] ; (González-Calvo <i>et al.</i> , 2021) ^[17] ; Sun & Chen, 2016), (Pokhrel & Chhetri, 2021); (Abdullah, Saw Fen, Samsudin, Tze Ying, & Chong Yuan, 2024) ^[1, 45, 50]
2	F1.2	Lecturers possess adequate knowledge to effectively support their teaching and supporting learning?	
3	F1.3	Lecturers show enthusiasm during online classes?	
4	F1.4	Lecturers make consistent efforts to improve the quality of learning?	
Accessibility (F2)			
5	F2.1	I received training in basic IT skills and the use of Microsoft Teams from the university?	(Kalajas-Tilga <i>et al.</i> , 2020), (Apriyanto & Adi, 2021) ^[3] , (Liaw, 2008), (Tran Dinh Manh, 2021), (Hartoto <i>et al.</i> , 2022); (Ikhsan <i>et al.</i> , 2019); (Kim <i>et al.</i> , 2021); (Das, 2022) ^[8, 19, 23, 25, 27, 32]
6	F2.2	The quality of the internet good and stable online learning?	
7	F2.3	The surrounding environment is conducive to participating in online lectures?	
8	F2.4	I have sufficient facilities and tools to support online learning?	
Motivation (F3)			
9	F3.1	I have always set clear targets for myself in online PE learning?	(Kalajas-Tilga <i>et al.</i> , 2020); (Pokhrel & Chhetri, 2021); (Apriyanto & Adi, 2021); (Abdullah <i>et al.</i> , 2024) ^[1] ; (Filgona <i>et al.</i> , 2020); (Albrecht & Karabenick, 2018) ^[2, 14, 25, 45]
10	F3.2	I have put forth a strong effort in online learning, similar to my efforts in non-virtual classes?	
11	F3.3	I have tried my best to complete all assigned homework?	
12	F3.4	I have actively interacted with lecturers to clarify any points of misunderstanding?	
Preparedness (F4)			
13	F4.1	Teachers modified the lesson plans to be more suitable for online classes?	(Kliziene <i>et al.</i> , 2021) ^[28] ; (Pokhrel & Chhetri, 2021) ^[45] ; (Nghì <i>et al.</i> , 2021) ^[38] ; (Eswaramoorthi <i>et al.</i> , 2022) ^[12] ; (Daniel, 2020) ^[7] ; (Kazakova <i>et al.</i> , 2021); (Das, 2022) ^[8] ; (Mancenido, 2023) ^[26, 35]
14	F4.2	Teachers adjusted the course content of physical activities to fit the conditions of the COVID-19 pandemic?	
15	F4.3	Teachers frequently use online materials, such as videos, media, and pictures, to help students understand concepts and provide skill demonstrations?	
Personality (F5)			
16	F5.1	I want to present my ideas and thoughts in online classes?	(Esser-Noethlichs <i>et al.</i> ; Fandos-Herrera <i>et al.</i> , 2023) ^[11, 13] , (Apriyanto & Adi, 2021) ^[3] , (Pokhrel & Chhetri, 2021), (Ginns <i>et al.</i> , 2011), (Pawlowska <i>et al.</i> , 2014) ^[16, 43, 45]
17	F5.2	I am always interested in the instructions for physical activities?	
18	F5.3	I always try to practice thoroughly, following the lecturer's instructions?	
Learning outcomes (LOC)			
19	TOC1	The appeal of online classes is equal to that of face-to-face classes?	(Bailey, 2006) ^[4] ; (Apriyanto & Adi, 2021) ^[3] ; (Abdullah <i>et al.</i> , 2024); ^[1] (Hongsuchon, Emary, Hariguna, & Qhal, 2022); (Das, 2022) ^[8, 22] ; (Mancenido, 2023) ^[35]
20	TOC2	Students can easily acquire motor skills in online classes, similar to face-to-face classes?	
21	TOC3	Online classes help improve the ability to learn independently?	

Source: Author elaboration

Results: Cronbach's alpha can be considered 'too high' when the value exceeds 0.9, indicating that many variables within the scale may be redundant (Nguyễn Đình Thọ, 2012)^[39, 52]. Conversely, a value 'too low,' specifically below 0.5, suggests inconsistency within the scale, warranting the removal of certain variables. An alpha score greater than 0.5 indicates an acceptable level of internal consistency for the scale used in the dataset, making those variables suitable for further analysis (Hoàng Trọng & Chu Nguyễn Mộng Ngọc, 2008)^[21, 39]. In this study, the alpha coefficients for the factors ranged

from 0.828 to 0.883, all exceeding 0.8. Additionally, the Cronbach's alpha values for all variables were above 0.5, ranging from 0.589 to 0.816 (Table A1, Appendix). These results indicate a relatively high internal consistency, suggesting that the variables were reliable enough for exploratory factor analysis (EFA). The reliability test demonstrated that the indicators were consistent with the measuring instruments. This finding aligns with previous studies in other service sectors (Hartoto *et al.*, 2022; Trần Đình Mạnh, 2021)^[19, 53].

Table 2: Total Variance Explained of Variables

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^a
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.604	36.690	36.690	6.604	36.690	36.690	2.935
2	2.681	14.893	51.582	2.681	14.893	51.582	2.772
3	1.628	9.045	60.627	1.628	9.045	60.627	2.733
4	1.408	7.822	68.449	1.408	7.822	68.449	2.481
5	1.060	5.889	74.338	1.060	5.889	74.338	2.459

Note: Extraction Method: Principal Component Analysis. ^aWhen factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Kaiser-Meyer-Olkin (KMO) is a test conducted to examine the strength of the partial correlation (how the factors explain each other) between variables. A KMO value greater than 0.5 is recommended as acceptable as well as good enough for analyzing the factors. Bartlett's Test of Sphericity is a measure of sampling adequacy with statistically significant values being less than 0.05. Based on the referenced value, the results were as follows: KMO = 0.856 and the significance of Bartlett's Test = 0.000 indicated a sufficient number of items for each factor and the correlations between variables were all zero. As a result of the factor analysis, three

factors were extracted to examine the validity of the brokerage's competency: KMO = 0.856 (> 0.5), sig. < 0.05, and Eig. > 1 (Table A2, Appendix). The Eigenvalues show how variance can be explained by a particular factor out of the total variance. According to Kaiser (1960)^[24], an Eigenvalue should be greater than 1 and the Total Variance Explained should be larger than 50%. Based on the statistical results in Table 2, five factors were significant and they explained 74.338% (>50%) of the variation for all the variables in EFA.

Table 3: Rotated Factor Matrix

No	Variables	Factors				
		1	2	3	4	5
1	F2.2	0.804	-	-	-	-
2	F2.4	0.792	-	-	-	-
3	F2.3	0.789	-	-	-	-
4	F2.1	0.751	-	-	-	-
5	F1.2	-	0.814	-	-	-
6	F1.3	-	0.814	-	-	-
7	F1.1	-	0.803	-	-	-
8	F1.4	-	0.757	-	-	-
9	F3.2	-	-	0.796	-	-
10	F3.4	-	-	0.750	-	-
11	F3.1	-	-	0.747	-	-
12	F3.3	-	-	0.745	-	-
13	F5.3	-	-	-	0.869	-
14	F5.1	-	-	-	0.867	-
15	F5.2	-	-	-	0.810	-
16	F4.2	-	-	-	-	0.818
17	F4.3	-	-	-	-	0.808
18	F4.1	-	-	-	-	0.796

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.

Factor loading represents the correlation between an observed variable and the underlying factor. A higher factor loading coefficient indicates a stronger correlation between the observation and the factor, and vice versa. According to Hair *et al.* (2006)^[18], a factor loading score greater than 0.5 signifies a high-quality observation variable (Table 3). As a result, all variables in the exploratory factor analysis (EFA) were significant, with a total of 18 variables being categorized into five distinct factor groups in the rotated matrix including lecture facilitation (F1), accessibility (F2), motivation (F3), preparedness (F4), and personality (F5) which influence the PE learning outcomes. Pearson's correlation coefficient is employed to determine whether a statistically significant linear relationship exists between sets of variables. The significance values (sig.) are greater than 0.05, indicating that the independent variables have a linear correlation with the dependent variable (Table A3, Appendix).

The results of the multivariate regression analysis indicate that the variables in the model are significant and positively correlated with the dependent variable. Among them, the factor accessibility has the largest impact with a coefficient of 0.307, while the factor personality has the smallest impact at 0.224. The factors accessibility and motivation exhibited similar effects, with coefficients of 0.295 and 0.286, respectively. The significance value (Sig.) of 0.000 (<0.05) indicates the fitness of the model. The variance inflation factors (VIF) for all factors are below 2, suggesting the absence of multicollinearity. The Adjusted R-squared value of 0.543 indicates that 54.3% of the variance is explained by the independent variables in the model. The regression model is depicted with the unstandardized coefficients below:

$$\text{LOC} = -1.025 + 0.309F_1 + 0.315F_2 + 0.301F_3 + 0.225F_4 + 0.220F_5 + \varepsilon$$

Table 4: Linear Regression Analysis of Research Model

Variables	Unstandardized Coefficients	Standardized Coefficients	Sig.	Collinearity Statistics
	B	Beta		VIF
(Constant)	-1.025		0.000	
Accessibility (F2)	0.315	0.307	0.001	1.159
Lecture facilitation (F1)	0.309	0.295	0.001	1.608
Motivation (F3)	0.301	0.286	0.002	1.629
Preparedness (F4)	0.225	0.252	0.001	1.642
Personality (F5)	0.220	0.224	0.002	1.403

Note: t statistics of the overall model = 0.000. $R^2 = 0.566$. Adjusted $R^2 = 0.543$. Durbin-Watson = 1.523

Discussions

The regression confirmed that all variables positively influenced the PE learning outcomes at a statistically significant level. First, the factor accessibility accounted for the largest impact of a coefficient of 0.307, meaning either a one percent increase in the trained IT skills, the connectivity, the learning environment, or the learning tools and equipment, there is an associated 0.307 percent increase in the positive learning outcomes. The result is in line with the studies of (Ridwan *et al.*, 2021; Tuma *et al.*, 2021) [47, 54]. Besides, the factor of accessibility might lead to dissatisfaction, particularly when the lecturers are unavailable to provide technical support or students are unable to find timely assistance (Yang & Cornelius, 2004; Zhang & Perris, 2004) [55, 57]. In addition, the unavailability of reliable internet networks or connectivity disruptions in remote areas poses significant challenges to online PE learning outcomes. Despite the apparent simplicity of providing effective technical support and high-speed connectivity to enhance student accessibility, implementing these solutions remains challenging.

The second largest estimated coefficient accounted for the variable of lecture facilitation (0.295). In the virtual classroom, the students' effective interaction and engagement are often rooted in the lecture facilitation which is comprised of the pedagogical skills, enthusiasm, and knowledge of the lecturer (Lorenza & Carter, 2021; Ridwan *et al.*, 2021) [33, 47]. Given the numerous disadvantages of online classes compared to traditional ones, the lecture facilitation becomes a pivotal factor in enhancing students' understanding, performance, skill development, and attitudinal shifts. In some cases, the lecture's enthusiasm is critical in stimulating peer interactions, which reduces negative students' reactions i.e.... frustration, confusion, and dissatisfaction (Rovai, 2003) [48].

Third, PE requires high motivation with the improvement of motor skills. However not all students are interested in physical activities, therefore, high motivation is essential in online PE. Besides the factors relating to the learning environment and students' personality and interests play a vital role in online PE learning outcomes (Moll-Khosrawi *et al.*, 2021) [37]. The estimated coefficient of the factor motivation accounted for 0.286, representing the self-determination of students toward positive PE class performance (Kalajas-Tilga *et al.*, 2020) [25]. As a result, this factor determines the level of concentration and knowledge achievements of the students (Chang *et al.*, 2021; Ridwan *et al.*, 2021) [5, 47].

Fourth, the factor of preparedness accounted for an estimated coefficient of 0.252, meaning a positive relationship with the dependent variable. Indeed, the attractiveness of online PE lectures is often utilized by a variety of materials such as videos, photographs, and quick games to aid students'

understanding of the topic, consequently making learning activities more effective (Ge, 2021). Moreover, most interviewed lecturers in this study agreed that the course design structure and evaluation method should be adapted to better suit the online setting, more focusing on engaging learning opportunities (Yang & Durrington, 2010) [56]. The survey also indicated that students at VNUA prefer consistent design and content across different courses to facilitate ease of navigation. The study by Yang and Cornelius (2004) [55] reported that students become frustrated with courses when they are poorly designed. This frustration may lead to poor learning outcomes for students in online courses, causing them to perceive online education as convenient but ineffective compared to the conventional.

Finally, the factor of students' personalities accounted for an estimated coefficient of 0.224. In traditional teaching models, students' personalities have been identified as essential factors influencing learning outcomes. Personality reflects students' opinions, individual characteristics, and modes of self-expression in front of the class (Fandos-Herrera *et al.*, 2023) [13]. Combined with a desire for recognition, personality promotes students' attention and participation in lessons, group discussions, and debates with teachers. These activities, driven by personality traits, enhance the learning outcomes. In PE, beyond the aforementioned influences, personality also helps students feel confident in practicing physical exercises assigned by teachers. The empirical results at this point align with the findings of Nguyen Van Truong (2021) [41].

Conclusion

Utilizing exploratory factor analysis (EFA) and multiple regression techniques, this study identified five groups of factors influencing the learning outcomes of online PE (PE) programs including lecture facilitation, accessibility, motivation, preparedness, and students' personality. In developing countries such as Vietnam, accessibility to online PE courses significantly impacts learning outcomes. PE inherently focuses on teaching movement and intentionally developing human motor skills. Consequently, the learning environment for PE traditionally requires a physical space that enables learners to move and practice in synchronization with the instructor's movements. This necessity is disrupted in online education models, rendering accessibility the most challenging factor affecting learning outcomes. Furthermore, consistent with other educational models, factors such as motivation, lecture facilitation, preparedness, and students' personality also play significant roles in influencing learning outcomes in PE.

Limitations of the study were the potential problem of endogeneity from unobserved variables. Numerous other factors that may influence the learning outcomes of PE were not explored. Further, the research design centered on the

perspectives of the student, therefore narrowing the scope of the study. The study was not extrapolated to the entire educational system across different universities in Vietnam due to the results pertained from a small research sample and cross-section data.

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Appendix

Table 1: Reliability Test of Variables

Factors	Number of Variables	Cronbach's Alpha	Corrected Item-Total Correlation
Lecture facilitation (F1)	4	0.828	0.653
			0.686
			0.698
			0.589
Accessibility (F2)	4	0.883	0.772
			0.722
			0.780
			0.716
Motivation (F3)	4	0.841	0.616
			0.749
			0.662
			0.679
Preparedness (F4)	3	0.860	0.673
			0.766
			0.770
Personality (F5)	3	0.879	0.724
			0.761
			0.816

Table 2: KMO and Bartlett's Test

KMO		0.856
Adequacy Bartlett's Test of Sphericity	Approx. Chi-Square	993.671
	df	153
	Sig.	<0.001

Table 3: Pearson's Correlation Coefficient

	F1	F2	F3	F4	F5
Pearson Correlation	0.414	0.629	0.504	0.595	0.413
Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
N	100	100	100	100	100