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Developing and validating a scale to assess students' active engagement in physical education learning: Evidence from the University of Finance – Marketing

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Abstract
Through reviewing and analyzing domestic and international literature, conducting expert and lecturer interviews, piloting with 100 students, and officially surveying 444 freshmen of the 2024 cohort enrolled in Physical Education (PE) courses at the University of Finance and Marketing (UFM), this study applied Cronbach's Alpha reliability testing and Exploratory Factor Analysis (EFA). The results identified three measurement scales: (1) the scale of current conditions ensuring PE implementation, (2) the scale of students' needs, purposes, and difficulties in learning PE at UFM, and (3) the scale of students' activeness in learning PE at UFM. These findings provide a scientific basis for assessing the actual activeness of UFM students in Physical Education learning.

Keywords: Measurement scales, activeness, freshmen 2024, University of Finance and Marketing

Introduction

In the teaching and learning process, active engagement in learning plays a decisive role in determining students' learning effectiveness. Moreover, active engagement is not only a learning state or prerequisite but also an outcome of the learning process and a fundamental objective of teaching. In the current learner-centered educational approach, fostering students' active engagement has become an essential requirement, particularly in Physical Education (PE) courses, which not only provide knowledge and practical skills but also help students develop and maintain their physical health.

However, a considerable proportion of university students currently pay insufficient attention to Physical Education courses. Many regard these courses merely as graduation requirements, aiming only to complete the required credits rather than striving for high academic achievement. This perception has reduced students' active engagement in Physical Education learning compared with other academic subjects offered at universities.

To identify the underlying causes and assess the current status of students' active engagement in Physical Education learning at the University of Finance - Marketing, this study aims to provide a scientific basis for proposing solutions to enhance students' active participation in Physical Education learning. Therefore, developing a scale to measure students' active engagement in Physical Education learning at UFM is both necessary and feasible.

Research Methods: This study employed the following research methods: (1) document analysis and literature review, (2) questionnaire survey, and (3) statistical analysis.

Participants: The study involved 544 undergraduate students and 15 experts and lecturers with extensive professional experience in the field of Physical Education.

Research Results

1. Development of the Preliminary Scale for Assessing Students' Active Engagement in Physical Education Learning at the University of Finance – Marketing

The study reviewed, analyzed, and synthesized relevant domestic and international literature related to the research topic. In addition, consultations were conducted with experienced experts and Physical Education (PE) lecturers in Ho Chi Minh City to refine the measurement items in accordance with the research objectives. Based on this process, three preliminary measurement scales were developed to assess the current status of students` active engagement in Physical Education learning at the University of Finance - Marketing (UFM), as follows:

Scale for Assessing the Current Status of Physical Education Supporting Conditions at UFM

Based on the review and synthesis of studies by Nguyễn Hữu Vũ (2016) [6], Nguyen Minh Cuong (2020) [1], and Nguyen Thi Hong Loan (2024) [3], the study identified five observed variables that were considered appropriate for measuring the current status of the supporting conditions for Physical Education at UFM.

Scale for Assessing Students' Learning Needs, Learning Purposes, and Difficulties in Physical Education at UFM

Drawing on the studies of Nguyen Huu Vu (2016) [6], Nguyen Minh Cuong (2020) [1], and Nguyen Thi Hong Loan (2024) [3], the study developed a scale consisting of three dimensions with a total of 16 observed variables to assess students' learning needs, learning purposes, and difficulties encountered when participating in Physical Education courses.

Scale for Assessing Students' Active Engagement in Physical Education Learning at UFM

Based on the review and synthesis of the studies conducted by Lam and Nicola (2005) [10], Barney C. (2012) [8], Endris Yimer (2014) [9], Do Thi Cong (2004) [2], and Do Tan Phong (2020) [5], the study developed a measurement scale comprising 28 observed variables grouped into five dimensions:

- **Emotional Engagement:** 8 observed variables.
- **Attention Engagement:** 5 observed variables.
- **Volitional Effort:** 4 observed variables.
- **Behavioral Engagement:** 7 observed variables.
- **Cognitive Engagement (Learning Acquisition):** 4 observed variables.

After the preliminary scales had been developed, the study consulted 15 experts and lecturers working in the field of Physical Education to evaluate the scale measuring the supporting conditions for Physical Education at UFM and the scale assessing students' learning needs, learning purposes, and learning difficulties in Physical Education. Items receiving agreement from at least 80% of the respondents were retained. The survey results are presented in Tables 1 and 2.

Table 1: Expert and Lecturer Evaluation of the Supporting Conditions for Physical Education at UFM

No.	Item	Agreement (n = 15)	Percentage (%)
1	Support from university leadership	15	100
2	Physical Education curriculum	15	100
3	Physical Education teaching staff	15	100
4	Facilities supporting Physical Education	15	100
5	Extracurricular sports and physical activities	15	100

The results presented in Table 1 indicate that all experts and experienced lecturers unanimously agreed (100%) with the five proposed components of the scale measuring the supporting conditions for Physical Education at UFM, and no additional items were suggested. Therefore, these five components were retained to assess the current status of the supporting conditions for Physical Education at UFM.

Table 2: Results of the Expert and Lecturer Survey on the Supporting Conditions for Physical Education at UFM

No.	Item	Agreement (n = 15)	Percentage (%)
1	Support from university leadership	15	100
2	Physical Education curriculum	15	100
3	Physical Education teaching staff	15	100
4	Facilities and equipment supporting Physical Education	15	100
5	Extracurricular sports and physical activities	15	100

The results presented in Table 2 indicate that all experts and experienced lecturers unanimously agreed (100%) with the five proposed components of the scale measuring the supporting conditions for Physical Education at the University of Finance – Marketing (UFM). No additional items were suggested. Therefore, these five components were retained to assess the current status of the supporting conditions for Physical Education at UFM.

Table 3: Results of the Expert and Lecturer Survey on the Scale Assessing Students' Learning Needs, Learning Purposes, and Learning Difficulties in Physical Education at UFM

Dimension	Item	Agreement (n = 15)	Percentage (%)
Students' learning needs	Willingness to participate in Physical Education courses	15	100
	No willingness to participate in Physical Education courses	15	100
Students' learning purposes	Improving physical health	15	100
	Developing fundamental motor skills	15	100
	Recreation	15	100
	Personal interest	15	100
	Encouragement from friends	15	100
	Fulfilling the Physical Education course requirements	15	100
Students' learning difficulties	Lack of interest in Physical Education courses	15	100
	Lack of aptitude for Physical Education	15	100
	No preferred Physical Education courses	15	100
	Lack of time to participate in Physical Education courses	15	100
	Inadequate facilities and equipment	15	100
	Unfavorable weather conditions	15	100
	Long distance between learning campuses	15	100
	Unattractive Physical Education curriculum	15	100

The results presented in Table 3 show that all proposed items measuring students' learning needs, learning purposes, and learning difficulties in Physical Education were unanimously approved by the experts and experienced lecturers, with an agreement rate of 100%. No additional suggestions were provided. Therefore, these items were retained to evaluate the current status of students' learning needs, learning purposes, and learning difficulties in Physical Education at UFM.

Subsequently, the study invited the same panel of 15 experts and lecturers to evaluate the preliminary scale measuring students' active engagement in Physical Education learning in order to refine the observed variables before conducting a pilot survey among students. Following the predefined criterion, only items receiving at least 80% agreement were retained. The survey results are presented in Table 4.

Table 4: Results of the Expert and Lecturer Survey on the Preliminary Scale of Students` Active Engagement in Physical Education Learning at UFM

No.	Item	Agreement (n = 15)	Percentage (%)
	Factor 1. Emotional Engagement		
1	I enjoy participating in Physical Education classes.	15	100
2	I believe that participating in Physical Education classes is necessary.	15	100
3	I am fully aware of the importance of participating in Physical Education classes.	15	100
4	I always look forward to attending Physical Education classes.	15	100
5	I feel enthusiastic during Physical Education classes.	15	100

6	The teaching methods used by Physical Education instructors are engaging and dynamic.	13	86.67
7	The learning content of Physical Education classes is appropriate for my physical condition.	13	86.67
8	The university's facilities, equipment, and learning resources adequately support my Physical Education learning.	13	86.67
	Factor 2. Attention Engagement		
9	I always pay close attention when instructors introduce new learning content.	15	100
10	I carefully observe instructors' demonstrations of movement techniques.	15	100
11	I pay close attention when instructors correct my mistakes and those of my classmates.	15	100
12	I actively participate in classroom activities (e.g., discussions, group games, and other learning activities).	14	93.33
13	I always practice seriously according to the instructor's guidance.	15	100
	Factor 3. Volitional Effort		
14	I always try my best to complete the learning tasks assigned by the instructor.	15	100
15	I am determined to overcome difficulties and complete classroom tasks successfully.	15	100
16	I continuously practice to master the new techniques introduced by the instructor.	15	100
17	I voluntarily practice outside regular Physical Education classes.	15	100
	Factor 4. Behavioral Engagement		
18	I attend all Physical Education classes.	15	100
19	I arrive on time for Physical Education classes.	15	100
20	I am excited and willing to participate in all learning tasks assigned during class.	15	100
21	I ask instructors about learning content that I do not fully understand.	15	100
22	I regularly ask instructors to correct my movement techniques while practicing new skills.	15	100
23	I frequently update my knowledge related to Physical Education.	15	100
24	I regularly participate in extracurricular sports and physical activities after class.	15	100
	Factor 5. Cognitive Engagement (Learning Acquisition)		
25	I can remember fundamental knowledge and apply previously learned skills to new learning tasks.	15	100
26	I can accurately remember and perform the techniques demonstrated by the instructor.	15	100
27	I have improved my fundamental motor skills and technical performance.	15	100
28	I have developed teamwork skills through participation in Physical Education classes.	15	100

The results shown in Table 4 indicate that all 28 observed variables across the five dimensions achieved agreement rates exceeding 80% among the experts and lecturers. Therefore, the preliminary scale used for the pilot survey consisted of 28 observed variables.

The scales measuring the supporting conditions for Physical Education at UFM and students' learning needs, learning purposes, and learning difficulties consisted of multiple-choice items. Consequently, these scales were only subjected to expert evaluation for content validity. Subsequently, a survey was conducted with 444 first-year students enrolled in the 2024 intake, who were taking Physical Education courses at the Long Trường Campus and Tân Mỹ Campus. No further psychometric analyses were performed for these two scales.

2. Pilot Testing and Refinement of the Scale for Assessing Students' Active Engagement in Physical Education Learning at UFM

2.1 Response Format

A five-point Likert scale was adopted for all questionnaire items. According to the statistical study conducted by Lissitz and Green (1975), a two-point response scale yields lower reliability than a five-point scale, whereas increasing the number of response categories beyond five does not significantly improve reliability. Accordingly, each observed variable was measured using the following five response categories:

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

The interval width was calculated as follows:

Interval width = (Maximum – Minimum)/n = (5 – 1)/5 = 0.8

The interpretation of the mean scores was as follows:

- **1.00–1.80:** Very low active engagement / Strongly disagree
- **1.81–2.60:** Low active engagement / Disagree
- **2.61–3.40:** Moderate / Neutral
- **3.41–4.20:** High active engagement / Agree
- **4.21–5.00:** Very high active engagement / Strongly agree

2.2 Pilot Testing and Scale Refinement

A pilot survey was conducted with 100 students from the University of Finance – Marketing using the preliminary scale measuring students' active engagement in Physical Education learning. After data collection, Cronbach's alpha reliability analysis was performed to eliminate unreliable observed variables and retain reliable items for refining the preliminary measurement scale.

Based on the proposed research model, the observed variables were coded according to the corresponding dimensions as follows:

- **Emotional Engagement (EE):** 8 observed variables (EE1–EE8).
- **Attention Engagement (AE):** 5 observed variables (AE1–AE5).
- **Volitional Effort (VE):** 4 observed variables (VE1–VE4).
- **Behavioral Engagement (BE):** 7 observed variables (BE1–BE7).
- **Cognitive Engagement (CE):** 4 observed variables (CE1–CE4).

The first-round Cronbach's alpha analysis indicated that three observed variables should be removed because their

corrected item–total correlations were below the recommended threshold of 0.30. These included EE7 and EE8 from the Emotional Engagement dimension and BE1 from the Behavioral Engagement dimension.

Subsequently, a second-round reliability analysis was conducted for the Emotional Engagement and Behavioral Engagement dimensions.

The results showed that all dimensions achieved Cronbach's alpha coefficients greater than 0.60, while all remaining observed variables exhibited corrected item–total correlations above 0.30. Therefore, the final measurement scale used in the main survey consisted of 25 observed variables.

The reliability analysis results are summarized in Table 5.

Table 5: Summary of Cronbach's Alpha Reliability Analysis for the Preliminary Scale of Students' Active Engagement in Physical Education Learning at UFM (n = 100)

No.	Dimension	Cronbach's Alpha (Round 1)	Cronbach's Alpha (Round 2)	Number of Items (Round 1)	Number of Items (Round 2)	Removed Items
1	Emotional Engagement (EE)	0.884	0.911	8	6	EE7, EE8
2	Attention Engagement (AE)	0.834	0.834	5	5	None
3	Volitional Effort (VE)	0.806	0.806	4	4	None
4	Behavioral Engagement (BE)	0.701	0.782	7	6	BE1
5	Cognitive Engagement (CE)	0.799	0.799	4	4	None
Total				28	25	

Based on the internal consistency analysis using data collected from the 100 students, the measurement scale was refined and finalized for assessing the current status of students' active engagement in Physical Education learning at UFM.

Accordingly, the observed variables in the finalized scale were recoded as follows:

- **Emotional Engagement (EE):** 6 observed variables (EE1–EE6).
- **Attention Engagement (AE):** 5 observed variables (AE1–AE5).
- **Volitional Effort (VE):** 4 observed variables (VE1–VE4).
- **Behavioral Engagement (BE):** 6 observed variables (BE1–BE6).
- **Cognitive Engagement (CE):** 4 observed variables (CE1–CE4).

3. Development of the Final Scale for Assessing Students' Active Engagement in Physical Education Learning at UFM

After refining the preliminary measurement scale to 25 observed variables, the study conducted the main survey with 444 first-year students (2024 cohort) enrolled in Physical Education (PE) courses at the Long Trường and Tân Mỹ campuses of the University of Finance - Marketing.

The development of the final measurement scale consisted of two stages:

- **Stage 1:** Assessment of the internal consistency reliability of the scale using Cronbach's alpha.
- **Stage 2:** Assessment of the construct validity of the scale using Exploratory Factor Analysis (EFA) to evaluate both convergent validity and discriminant validity. During this process, any observed variables failing to satisfy the reliability criteria were removed.

3.1 Reliability Assessment Using Cronbach's Alpha

The first-round Cronbach's alpha analysis indicated that all five dimensions achieved reliability coefficients greater than 0.60, satisfying the minimum requirement for reliability analysis. However, four observed variables (EE3, EE6, VE2, and BE2) were eliminated because their corrected item-total correlations were below 0.30.

A second-round reliability analysis was subsequently performed. The results showed that all five dimensions maintained Cronbach's alpha coefficients above 0.60, while all remaining observed variables exhibited corrected item-total correlations greater than 0.30. Therefore, the final scale retained 21 observed variables for subsequent analyses.

The results of the reliability analysis are summarized in Table 6.

Table 6: Summary of Cronbach's Alpha Reliability Analysis for the Scale Measuring Students' Active Engagement in Physical Education Learning at UFM

No.	Dimension	Cronbach's Alpha (Round 1)	Cronbach's Alpha (Round 2)	Number of Items (Round 1)	Number of Items (Round 2)	Removed Items
1	Emotional Engagement (EE)	0.661	0.861	6	4	EE3, EE6
2	Attention Engagement (AE)	0.906	0.906	5	5	None
3	Volitional Effort (VE)	0.686	0.838	4	3	VE2
4	Behavioral Engagement (BE)	0.853	0.913	6	5	BE2
5	Cognitive Engagement (CE)	0.855	0.855	4	4	None
Total				25	21	

3.2 Exploratory Factor Analysis (EFA)

Following the preliminary reliability assessment using Cronbach's alpha, Exploratory Factor Analysis (EFA) was conducted to examine the construct validity of the measurement scale. The extraction method employed was Principal Component Analysis (PCA) with Promax rotation.

Before conducting EFA, the suitability of the data for factor analysis was evaluated using the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity.

Assessment of the EFA Assumptions

The following conditions confirmed the appropriateness of applying EFA:

- Each latent construct contained at least three observed variables, satisfying the recommendation proposed by Stevens.
- The study sample consisted of 444 students, exceeding the minimum sample size of 50 observations recommended by Hair *et al*. (2009) [9]. Furthermore, the sample size also satisfied the criterion suggested by Hoàng Trọng and Chu Nguyễn Mộng Ngọc (2008) [5], which recommends a minimum sample size of four to five times the number of observed variables. With 21 observed variables, the minimum required sample size was 105 observations (21 × 5), whereas the present study included 444 respondents.

The EFA results for the scale measuring students' active engagement in Physical Education learning are presented in Table 7. The KMO value was 0.848, exceeding the recommended threshold of 0.50, while Bartlett's Test of Sphericity was statistically significant (Sig. = 0.000 < 0.05), confirming the suitability of the data for factor analysis.
All factor loadings exceeded 0.50, indicating satisfactory practical significance. The extracted factors explained 72.775% of the total variance, exceeding the recommended threshold of 50%, and all retained factors had Eigenvalues greater than 1.0, with the smallest Eigenvalue equal to 1.992.

Table 7: KMO and Bartlett's Test for the Scale Measuring Students' Active Engagement in Physical Education Learning at UFM

Test	Value
Kaiser–Meyer–Olkin Measure of Sampling Adequacy	0.848
Bartlett's Test of Sphericity (Approx. Chi-Square)	5013.411
Degrees of Freedom (df)	210
Significance (Sig.)	0.000

The rotated factor matrix (Pattern Matrix) identified five distinct dimensions, as presented in Table 8.

Table 8: Pattern Matrix of the Scale Measuring Students' Active Engagement in Physical Education Learning At Ufm

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
BE6	.870				
BE4	.867				
BE3	.859				
BE5	.855				
BE1	.839				
AE2		.880			
AE3		.877			
AE5		.868			
AE4		.844			
AE1		.780			
EE2			.847		
EE5			.846		
EE1			.835		
EE4			.814		
CE3				.840	
CE1				.831	
CE4				.829	
CE2				.827	
VE1					.880
VE4					.867
VE3					.840

The Pattern Matrix demonstrates that all factor loadings exceeded 0.50 and that the observed variables were clearly grouped into five independent dimensions corresponding to:
- Emotional Engagement (EE)
- Attention Engagement (AE)
- Volitional Effort (VE)
- Behavioral Engagement (BE)
- Cognitive Engagement (CE)

Based on the results of the reliability analysis and exploratory factor analysis, the final measurement scale comprised 21 observed variables representing five latent dimensions. This validated scale was subsequently used to assess the current status of students' active engagement in Physical Education learning at the University of Finance – Marketing.

Conclusion

Based on a comprehensive review and synthesis of relevant domestic and international literature, together with expert consultation and interviews, the study developed two finalized measurement scales: (1) a scale assessing the supporting conditions for Physical Education (PE) at the University of Finance – Marketing (UFM), and (2) a scale assessing students' learning needs, learning purposes, and learning difficulties in Physical Education.
Through a systematic process involving literature review, expert consultation, a pilot survey of 100 students, and a main survey of 444 first-year students (2024 cohort) enrolled in Physical Education courses at the Long Trường and Tân Mỹ campuses, the study developed and validated a finalized scale for assessing students' active engagement in Physical Education learning at UFM. The final scale consists of 21 observed variables grouped into five dimensions.
The three validated measurement scales developed in this study provide a scientific and reliable basis for assessing the current status of students' active engagement in Physical Education learning at the University of Finance – Marketing.

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