

Thai Version of the Modified Physical Activity Enjoyment Scale (PACES) for High School Students

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Objective: To evaluate the properties of Thai version of the modified physical activity enjoyment scale (PACES) for high school students.

Materials and Methods: There were two steps in this study; developed Thai version of PACES and evaluated its properties by using factor analysis. The participants in the present study were high school students in Phetchabun province, Thailand. There were 27,744 high school students in Phetchabun province. The authors use a simple random sampling method to recruit participants for the total of 800: 400 from junior and senior high school. The development of Thai version of PACES was performed by using back translations and comprised of positive and negative items. Structural equation model (SEM) with confirmatory factor analysis (CFA) was used to evaluate the structural validity and reliability.

Results: An age range of participants was 12 to 18 years. The final model combined both positive and negative items had the t score for positive items of 13.72 ($p < 0.01$) and for negative items of 19.44 ($p < 0.01$), respectively. The construct reliability was 0.936 with the average variance extracted of 0.482. Factor loading for positive and negative items in the final model was 0.58 and 0.49, respectively. The final model had acceptable goodness of fit indices.

Conclusion: The Thai version of modified PACES was feasible to evaluate the enjoyment of physical activity in high school students.

Keywords: Fitness; Adolescent; Sports; Obesity

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Physical activity is a crucial activity in all age groups of humans. Being active may reduce risks of obesity, several cardiovascular diseases, and obstructive sleep apnea⁽¹⁻⁷⁾. There are several motivation and barriers for being active and adhere to physical activities. The present study from twin pairs found that sub-dimension mastery ($p = 0.018$), physical fitness ($p = 0.029$), and psychological state ($p = 0.039$) were significant different between twins who were active and inactive⁽⁸⁾. Another important factor is enjoyment of the physical activity which was found to be the most powerful factor for being physically active and

fitness of French policemen⁽⁹⁾.

The physical activity enjoyment scale (PACES) is a tool used to evaluate enjoyment of physical activity; firstly reported in children and adolescent⁽¹⁰⁾. Later, it has been used in several populations such as fitness group exercisers, older adults, adults with functional limitations⁽¹¹⁻¹³⁾. Originally, the PACES comprised of 18 items on a 7-point scale. It was modified by Motl et al. to be more feasible with 16 items on a 5-point Likert scale⁽¹⁴⁾. Of those, nine items are positive items related to physical activity enjoyment, while the other seven items are negative items. The PACES has been translated to other languages such as German. There is no Thai version of the modified PACES. The present study aimed to evaluate the properties of Thai version of the modified PACES for high school students.

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Materials and Methods

There were two steps in the present study; developed Thai version of PACES and evaluated its properties by using factor analysis. The participants in the present study were high school students in Phetchabun province, Thailand. There were 27,744 high school students in Phetchabun province. The authors use a simple random sampling method to recruit participants for the total of 800: 400

from junior and senior high school. Based on the survey study in a large sample size, a study population of 400 is appropriate. The present study protocol was exempted for ethical consideration (HEC-01-64-038), Rajamangala University of Technology Isan, Thailand.

The development of Thai version of PACES was performed by using back translations. The original version of PACES was translated to Thai by two experts independently and the Thai version PACES was translated back to English by two experts independently. The Thai version PACES was tested for reliability by Cronbach's alpha coefficient for two times with a duration of four weeks (Supplement file). The

coefficients were 0.86 ($p<0.01$) and 0.85 ($p<0.01$).

Structural equation model (SEM) with confirmatory factor analysis (CFA) was used to evaluate the structural validity and reliability. This process was performed by using Lisrel software version 8.80. There were two steps for this process: first and second order confirmatory factor analysis. The first order confirmatory factor analysis was performed to evaluate measurement model of each item, while the second order confirmatory factor analysis was variance matrix, goodness of fit and internal consistency.

The variance matrix was variances among item factors, latent factors, or observed factors which were reported as factor loading (λ_i) of raw score, standardized score, and standard error of factor; t score which is significant if the t score is over 1.96; and squared multiple correlations: (SMC) which should be more than 0.50. The goodness of fit indices are Chi-square, degree of freedom (df), p-value, relative Chi-square (Chi-square/df), root mean square error of approximation (RMSEA), normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), root mean square residual (RMR), standardized root mean square residual (SRMR), goodness of fit index (GFI), adjusted goodness of fit index (AGFI). The internal consistency was evaluated by using construct reliability and average variance extracted.

Table 1. Baseline characteristics of high school students who participated in the physical activity enjoyment scale (n=800)

Factors	n	%
Level		
Junior high school	400	50.00
Senior high school	400	50.00
Sex		
Male	318	39.75
Female	482	60.25
Age, years		
12	72	9.00
13	166	20.75
14	117	14.63
15	81	10.13
16	127	15.88
17	151	18.88
18	86	10.75
Physical activity		
1 to 2 days/week	478	59.75
3 to 5 days/week	234	29.25
>5 days/week	88	11.00
Duration of physical activity/time		
<30 minutes	318	39.75
31 to 60 minutes	368	46.00
>60 minutes	114	14.25
Types of physical activities		
Walk	629	78.63
Jogging	446	55.75
Badminton	342	42.75
Soccer	173	21.63
Rhythmic	130	16.25
Swimming	108	13.50
Takraw	72	9.00
Futsal	69	8.63
Basketball	61	7.63
Chairball	33	4.13
Table tennis	31	3.88

Results

There were 800 participants in the present study with an age range of 12 to 18 years. A male: female ratio was approximately 1.5: 1 (Table 1). The majority of participants had physical activity less than 5 days/week and less than 60 minutes/time. There were several physical activities but the most common physical activities was walking (n=629; 78.63%). An average score for positive and negative items of the PAES was 3.84 (SD=0.62) and 2.06 (SD=0.64), respectively (Table 2 and 3).

All positive and negative items had significant

Table 2. Positive items of the physical activity enjoyment scale in high school students who participated in (n=800)

Items	Questions	Mean	SD
POS1	1) I enjoy it	4.02	0.78
POS2	2) I find it pleasurable	3.69	0.83
POS3	3) It gives me energy	3.86	0.87
POS4	4) It is very pleasant	3.98	0.82
POS5	5) My body feels good	4.06	0.80
POS6	6) I get something out of it	3.79	0.88
POS7	7) It is very exciting	3.62	0.87
POS8	8) It gives me a strong feeling of success	3.63	0.89
POS9	9) It feels good	3.95	0.81
	Average	3.84	0.62

correlation with others by Pearson correlation analysis (Table 4 and 5). The highest correlation coefficient among positive items was between item 6 and 7: coefficient of 0.65 ($p<0.01$), while correlation between item 2 and 3 for negative items had the highest correlation coefficient at 0.62 ($p<0.01$) as shown in Table 4 and 5.

The model for positive items had significant t score for all nine items with the SMC of six items was over 0.50 (Table 6). The construct reliability was 0.898 with the average variance extracted of 0.499. The model for negative items also had significant t score for all seven items with the

SMC of five items was over 0.50 (Table 7). The construct reliability was 0.866 with the average variance extracted of 0.484. The final model combined both positive and negative items had the t score for positive items of 13.72 ($p<0.01$) with the SMC of 0.33 and for negative items of 19.44 ($p<0.01$) and 0.24, respectively. The construct reliability was 0.936 with the average variance extracted of 0.482. Note that factor loading for positive and negative items in the final model was 0.58 and 0.49, respectively. The goodness of fit indices of the model for positive items, negative items, and final model were met with the criteria (Table 8).

Table 3. Negative items of the physical activity enjoyment scale in high school students who participated in (n=800)

Items	Questions	Mean	SD
NEG1	1) I feel bored	2.27	0.87
NEG 2	2) I dislike it	2.04	0.82
NEG 3	3) It is no fun at all	1.99	0.84
NEG 4	4) It makes me depressed	1.71	0.83
NEG 5	5) It frustrates me	1.90	0.87
NEG 6	6) It is not at all interesting	1.91	0.86
NEG 7	7) I feel as though I would rather be doing something else	2.63	0.96
Average		2.06	0.64

Table 4. Pearson correlation coefficients among positive items of the physical activity enjoyment scale in high school students who participated in (n=800)

Items	Coefficient								
	POS1	POS2	POS3	POS4	POS5	POS6	POS7	POS8	POS9
POS1	1.00								
POS2	0.37**	1.00							
POS3	0.47**	0.33**	1.00						
POS4	0.61**	0.31**	0.50**	1.00					
POS5	0.58**	0.34**	0.53**	0.58**	1.00				
POS6	0.49**	0.32**	0.49**	0.46**	0.62**	1.00			
POS7	0.54**	0.28**	0.47**	0.57**	0.52**	0.65**	1.00		
POS8	0.41**	0.30**	0.48**	0.43**	0.45**	0.52**	0.49**	1.00	
POS9	0.56**	0.38**	0.49**	0.59**	0.57**	0.54**	0.55**	0.60**	1.00

** $p<0.01$

Table 5. Pearson correlation coefficients among negative items of the physical activity enjoyment scale in high school students who participated in (n=800)

Items	Coefficient						
	NEG1	NEG2	NEG3	NEG4	NEG5	NEG6	NEG7
NEG1	1.00						
NEG2	0.59**	1.00					
NEG3	0.50**	0.62**	1.00				
NEG4	0.47**	0.51**	0.54**	1.00			
NEG5	0.48**	0.49**	0.48**	0.61**	1.00		
NEG6	0.48**	0.55**	0.53**	0.52**	0.57**	1.00	
NEG7	0.39**	0.38**	0.35**	0.30**	0.37**	0.36**	1.00

Discussion

The present study found that the Thai version of modified PACES had good reliability and fair validity showed by construct reliability and average variance extracted of 0.936 and 0.482, respectively. Additionally, the final model of the Thai version of modified PACES had passed the goodness of fit indicators (Table 8).

As previously reported, the modified PACES had a good reliability and validity after translation⁽¹⁰⁾. The internal consistency of German version of PACES was 0.94 which was comparable to this study (0.936). Regarding factorial validity, the CFI and RMSEA of the German version of

PACES was 0.856 and 0.116, while in the present study had both values of 0.999 and 0.019, respectively. Therefore, the modified PACES version may retain its reliability or validity after translation.

Even though the final model had fair validity with the average variance extracted of 0.482 indicating fair validity, the factor loading of both positive and negative items in the final model were significantly different from zero ($p < 0.01$). As there are several factors associated with enjoyment in physical activity such as commitment or motivation^(11,15), the SMC values may not be reached 1. In the present study, the SMC for positive and negative items were 33% and 24%, respectively.

There are some limitations in the present study. First, the results of the present study may be applied for only high school students in one province. Further studies may be required to confirm the results of the present study in other populations. Second, no predictor was evaluated to be associated with good enjoyment scale⁽¹⁶⁻¹⁹⁾. Finally, future adherence to physical activity was not evaluated. It might be other scale using fewer items such as 7 or 8 items^(20,21).

In conclusion, the Thai version of modified PACES

was feasible to evaluate the enjoyment of physical activity in high school students.

What is already known on this topic?

The modified physical activity enjoyment scale (PACES) is widely used and translated to several languages but not Thai.

What this study adds?

The Thai version of the modified physical activity enjoyment scale (PACES) is feasible.

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Conflicts of interest

The authors declare no conflict of interest.

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Table 6. Factor loading (λ_i), standard error (SE λ_i), t score, and square multiple correlation (SMC) of positive items of the physical activity enjoyment scale in high school students who participated in (n=800)

Items	λ_i	SE λ_i	t score	SMC
POS1	0.74	0.03	23.14**	0.55
POS2	0.45	0.04	12.89**	0.20
POS3	0.67	0.03	20.52**	0.44
POS4	0.76	0.03	24.01**	0.58
POS5	0.77	0.03	24.19**	0.59
POS6	0.73	0.03	21.48**	0.53
POS7	0.72	0.03	22.34**	0.52
POS8	0.70	0.04	20.03**	0.49
POS9	0.76	0.03	24.07**	0.57

Table 7. Factor loading (λ_i), standard error (SE λ_i), t score, and square multiple correlation (SMC) of positive items of the physical activity enjoyment scale in high school students who participated in (n=800)

Items	λ_i	SE λ_i	t score	SMC
NEG1	0.68	0.03	19.92**	0.46
NEG2	0.76	0.04	20.60**	0.58
NEG3	0.74	0.03	21.98**	0.54
NEG4	0.72	0.03	21.04**	0.52
NEG5	0.72	0.04	18.29**	0.51
NEG6	0.72	0.03	21.50**	0.52
NEG7	0.51	0.04	14.12**	0.26

Table 8. Goodness of fit indices and results of the model for the physical activity enjoyment scale in high school students

Indicators	Criteria	Positive items	Negative items	Final model
1) Chi-square: χ^2	-	22.709	6.900	85.779
2) Degree of freedom: df	-	16	6	66.000
3) The p-value	>0.050	0.120	0.330	0.051
4) Relative Chi-square: χ^2/df	<2.000	1.419	1.150	1.300
5) Root Mean Square Error of Approximation (RMSEA)	<0.050	0.023	0.014	0.019
6) Normed Fit Index (NFI)	>0.900	0.970	0.998	0.994
7) Non-Normed Fit Index (NNFI)	>0.900	0.998	0.999	0.997
8) Comparative Fit Index (CFI)	>0.900	0.999	1.000	0.999
9) Root Mean Square Residual (RMR)	<0.050	0.013	0.011	0.028
10) Standardized Root Mean Square Residual (SRMR)	<0.050	0.013	0.011	0.028
11) Goodness of Fit Index (GFI)	>0.900	0.994	0.998	0.987
12) Adjusted Goodness of Fit Index (AGFI)	>0.900	0.982	0.989	0.973

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