Psychometric Properties of the Chinese version of Situational Motivational Scale for Physical Education Students of Sports department

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Abstract

This study assessed the psychometric features of the Chinese version of the Situational Motivational Scale (SMS) from a cross-cultural perspective. 758 Chinese PE university students of the sports department (boy 52.6%, n = 357; female 52.9%, n = 401) completed the forward-backward translation-based SMS Chinese version. Using confirmatory factor analysis, the psychometric features of the 16-item SMS were examined (CFA). GFI = 0.96, CFI = 0.98, TLI = 0.97, RMSEA = 0.04) after incorporating two residual covariance for items loaded on the same factor and internal consistency. The alphas of the scales, according to Cronbach, were between 0.83 and 0.95. The composite reliability (CR) was between 0.87 and 0.95, and the AVE ranged from 0.69 to 0.77 for the subscales. The results give empirical evidence that the Chinese version of the SMS has sufficient psychometric characteristics for gauging motivation among Chinese PE university students in the sports department.

Keywords: psychometric; motivation; confirmatory; China; PE university students; Sports department

1. Introduction

Motivation is concerned with all aspects of activation and intention, including energy, direction, perseverance, and equifinality (Ryan & Deci, 2000). It is a major concern for educators in all subject areas (Perlman & Goc Karp, 2007). Perhaps more importantly, motivation is truly valued in the actual world because of its outcomes: motivation produces (Ryan & Deci, 2000). Motivation, which is often described as the drive that drives the intensity of one's training and devotion to sports and physical activity, is extremely important in developing a sport's training and competition process (Chin et al., 2021). Motivation has also been a reliable predictor of sports performance and learning for decades (Margolis & McCabe, 2006). Furthermore, many studies have linked present motivation to psychological outcomes such as positive affect, vitality (Sheldon et al., 1996), and mental health (Kotera & Ting, 2021). As a result, situational motivation provides a valuable comprehension of a person's present self-regulatory mechanisms when measured at a specific point in time (Guay et al., 2000).

On the other hand, motivation is a subjective, hidden attribute that is difficult to define (Chin et al., 2021). Deci and Ryan (2008) emphasized that, according to the theoretical foundations of self-determination theory, different self-regulation can be generically defined as intrinsic motivation, extrinsic motivation, and motivation to be better understood. Self Determination Theory (SDT), one of the most well-established motivation theories, contrasts intrinsic motivation with an extrinsic incentive (Deci & Ryan, 1985). According to SDT, everyone has a natural desire to channel their psychological energies toward self-actualization and social integration. Intrinsic motivation is related to favorable outcomes such as enhanced performance and well-being (Kotera & Ting, 2021). On the other hand, extrinsic motivation is related to undesirable results such as burnout and depression (Kotera & Ting, 2021).

China is a growing nation where physical inactivity, overweight, and obesity are on the rise (Klepac Pogrmilovic et al., 2018; Reynolds et al., 2007). Additionally, around one-third of Chinese university students are physically inactive (Ho et al., 2015). Environments, modern technology, and excessive social media use all influence the level of physical activity among college students (Bilgrami et al., 2017). In recent decades, social-cognitive theories, such as Achievement Goal Theory (AGT) and Self-determination Theory, have been utilized frequently in research on children, sports, behavior, and motivation (Spray et al., 2006). SDT explains that motivation is a continuum: from motivation (non-motivation) to extrinsic motivated (managed) to intrinsic motivation (self-determined) (Deci & Ryan, 2008). In addition, it aims to explain how the level of autonomous forms of motivation (self-determined) influences a variety of other variables, including physical and sports activities (Mayorga-Vega & Viciana, 2014; Ntoumanis, 2001). Consequently, we believe that SDT provides a solid and comprehensive framework in multidimensional

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dimensions in sports, physical activities, physical education, and exercise (Chin et al., 2021), which is more appropriate for a country with deeply traditional culture, such as China, where physical education is required for university students.

'The Situational Motivational Scale for Physical Education (Guay et al., 2000) measures the attitudes and perceptions regarding various aspects of engagement in PA. The scale showed an acceptable internal consistency between 0.70 to 0.92 (Østerlie et al., 2019). Furthermore, the SMS showed good validity in predicted directions between further intentions of participation in PE and the four SMS factors [$\chi 2$ (71) = 152.004; p <0.00001, $\chi 2$/df = 2.14, and RMSEA = 0.066, p < 0.037, SRMR = 0.045, CFI = 0.96 and TLI = 0.95] (Østerlie et al., 2019). The SMS scale reliability has since been tested as part of experimental studies in several countries, including Canada (Guay et al., 2000), America (Standage et al., 2003), Spanish (Martín-Albo et al., 2009), Brazilian (Bara Filho et al., 2011) and Norway (Østerlie et al., 2019). These previous studies have provided empirical support for the SMS scale's reliability and validity. This study aimed to determine the reliability and construct validity of the translated Chinese version of the Situational Motivational Scale for Physical Education (SMS) for Chinese PE university students.

2. Materials and Methods

2.1 Participants

The participants comprised 758 university students (boy 52.6%, n = 357, girl 52.9%, n = 401) in undergraduate and postgraduate from ten universities in China, age range 18-26 years (21.15±2.33). The participants are students who enrolled in a PE program in the local universities who are Chinese nationality. They are bilingual in Chinese and English or either of these two languages. They are major in PE, male or female. They were allowed to ask questions if they needed more information about the study.

2.2 Measures

2.2.1 Demographic characteristics.

The first part of our survey consists of key demographic variables, including gender, age, date of birth, height, weight, race, grade, major, university address and country.

2.2.2 Instrument

The Situational Motivational Scale (SMS) is a 16-items scale that is comprised of 4 subscales that measure intrinsic motivation (4 items) (e.g., 'Because this activity is fun'), identified regulation (4 items) (e.g. 'Because I feel that I have to do it), external regulation (4 items) (e.g., 'Because I am supposed to do it) and motivation (4 items) (e.g., 'I do this activity but I am not sure if it is worth it). The items were rated on a 7-point Likert scale ranging from 1 (corresponds not at all) to 7 (corresponds exactly).

2.3 Questionnaire Translation

According to Brislin's back-translation procedure, the original English version of the SMS (Østerlie et al., 2019) scale was translated to the Chinese language (Brislin, 1970).

Firstly, the English version will be translated to the Chinese language by 2 independent bilingual translators in both languages after considering the al appropriateness and content meaning of all the items and writing their names and signatures. Secondly, the translated Chinese version will be translated back to English by two independent translators who are also bilingual in both languages. The translators have sufficient content knowledge on PE. Then compare this English rendition to the original English to determine the extent of the discrepancies. The translation is READY if there are little discrepancies between both English versions. If disparities exceed 15 to 20 percent, repeat Step 1 until the translations are as similar as feasible. After this step, the final draft was drafted. Thirdly, a panel of specialists (composed of the sports psychologist, PE specialist, language specialist, and cultural specialist) will review the final document, debate any ambiguities and discrepancies, and establish a consensus to generate a reconciled version of the translated questionnaires. The final Chinese version was shaped by the panel of experts' comments on the translation's adequacy, based on their knowledge of physical education, the Chinese language, and psychology.

The final Chinese version was then evaluated by a sample of 50 PE university students for clarity, intelligibility, and understanding. The input from the PE university students was similar and required no adjustments.

2.4 Date Collection

The University of Malaya Research Ethics Committee approved this study (Reference Number: UM. TNC2/UMREC_1290) and was conducted following the International Declaration of Helsinki guidelines. The study was a cross-sectional design implemented between December 2020 and May 2021. The participants who volunteered were invited to participate in the study, agreed, provided their informed consent form, and were informed that they could withdraw at any time.

They were assured that their participation in the study was

confidential. To assess the test-retest reliability of the questionnaire (Yang, Lee, Kim & Hyun, 2005), 200 participants again completed and returned the questionnaires twice within 14 days (first time 12.12.2020, second time 26.12. 2021).

2.5 Statistical Analysis

The Statistical Package for Social Science (SPSS) Version 23.0 will be utilized to analyze and summarise the data, such as the socio-demographic characteristics of the participants in the study. In addition, the AMOS 23.0 will be utilized to conduct the Confirmatory Factor Analysis (CFA) and composite reliability on each scale to assess an appropriate fit of the data to the identified model factors (Andrew & Barnes, 2004). This study used maximum likelihood estimation and the covariance matrix as input for the data analysis (Bara Filho et al., 2011).

The validation of internal consistency for the components of the scales will be measured by alpha (Cronbach) coefficients (Nunnally, 1994). The recommended alpha value of 0.70 will be utilized to evaluate the internal consistency of the subscale (Taber, 2018). The standardized factor loading of 0.60 or greater was applied as a cut-off to establish sufficient factor loading for all the items employed as a criterion to retain or remove an item (Ford et al., 1986). After removing a problematic item, model fit was assessed again (Bara Filho et al., 2011). Further, modification indices were examined to determine whether to add correlation to the items' residuals.

To evaluate the fit of the models, the goodness of fit indices and cut-off used here are Chi Square/degree of freedom (Chisq/df) < 3, Goodness of Fit Index (GFI) > 0.90 (Balasekaran et al., 2021) Comparative Fit Index (CFI) > 0.90 (Ho et al., 2015), Tucker and Lewis index (TLI) > 0.90 (Hu & Bentler, 1999), Root Mean Square of Error Approximation (RMSEA) < 0.08 (Brown, 2015), P close > than 0.05 (Brown, 2015; Kotera & Ting, 2021; Mayorga-Vega & Viciana, 2014).

After establishing a good model fit, reliability (Cronbach's alpha) was computed for scales. In addition, the composite reliability (CR) based on Raykov's method (Raykov & Marcoulides, 2016) was computed, and a value of at least 0.60 was used as a cut-off for CR and 0.50 for AVE (Tseng et al., 2006; Zhou et al., 2021). Further, a correlation coefficient of less than or equal to 0.85 among the factors in the final measurement model was used as a cut-off for the discriminant validity of the measurement model (Brown, 2015).

3. Results

3.1. Socio-Demographic Characteristics

A total of 758 university students from ten universities in China, age range 18-26 years (M = 21.15, SD = 2.33) (Table 1). As it may be seen in Table 1, 360 (47.5%) were 18-20 years, 256 (33.8%) were 21-23 years, 142 (18.7%) were 24-26 years. 160 (21.1%) of the participants came from North China, 160 (21.1%) of the participants came from Central China, 160 (21.1%) of the participants came from South China, 160 (21.1%) the participants came from western of China, 118 (15.6%) of the participants came from east of China. All the university students who are majoring in PE.

Table 1

The demographic characteristics of Participants (N = 758)

Items	Category	Frequency	Percentage	Min	Max	M	SD
Gender	Male	357	47.1	--	--	--	--
	Female	401	52.9	--	--	--	--
	Total	758	100.0				
Age	18-20	360	47.5	18	26	21.15	2.33
	21-23	256	33.8				
	24-26	142	18.7				
	Total	758	100.0				
Location	Northern	160	21.1				
	Central	160	21.1				
	Southern	160	21.1				
	Western	160	21.1				
	Eastern	118	15.6				
	Total	758	100.0				

Note. M = Mean, SD = Standard Deviation.

3.2 Reliability evidence

The reliability of the translated questionnaires was measured utilizing alpha coefficients to assess the internal consistency (Cronbach's alpha) (Nunnally, 1994). offered a rule of thumb of 0.70 or equal alpha value as good internal consistency. The SMS had good internal consistency determined by Cronbach's alpha. Table 2 shows the reliability test results for each subscale in SMS.

Table 2

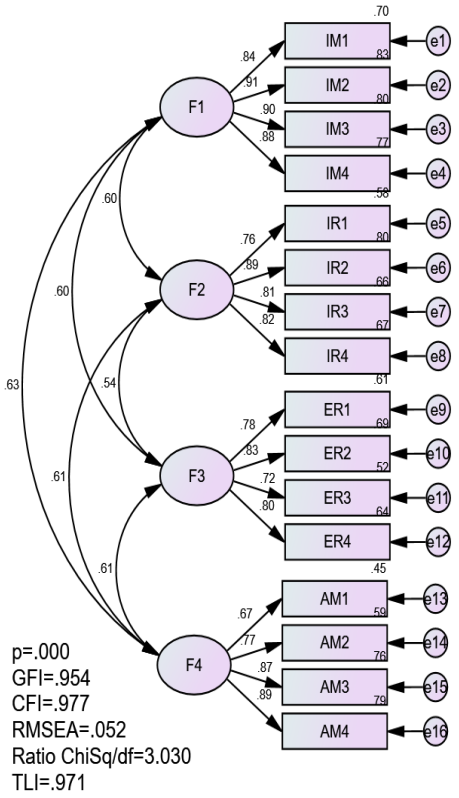
Reliability Test Results of SMS

	Number of Items	Cronbach's Alpha
SMSPE		
Overall	16	0.93
IM	4	0.93
IR	4	0.89
ER	4	0.86
AM	4	0.88

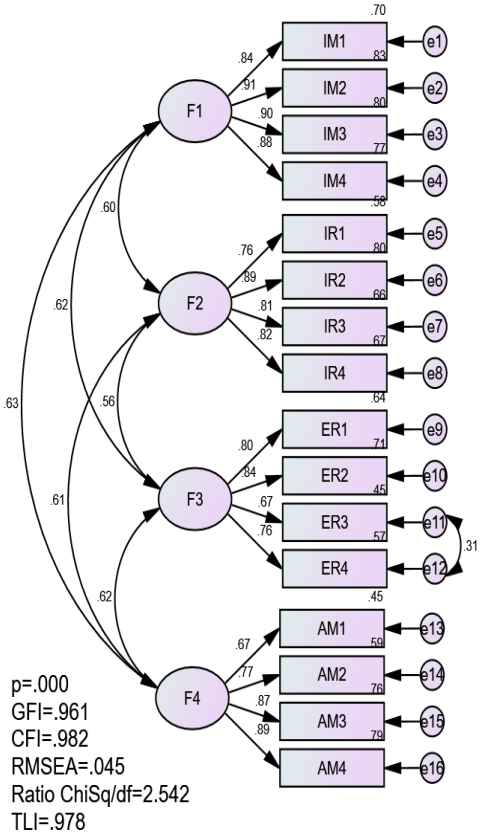
Note. IM = Intrinsic, IR = Identified regulation, ER = External regulation, AM = Amotivation.

3.3 Measurement Model SMS

Model 1



Model 2



Tables 3 and 4 display the results of all the tested measurement models. The SMS measurement model hypothesized with four factors and 16 items (Model 1), the results of the initial hypothesised model of the SMS Chinese version displayed an unacceptable fit with the data (X^2/df = 3.03, GFI = 0.95, CFI = 0.97, TLI = 0.97, RMSEA = 0.05). Subsequent model modifications were made by adding a correlation among the items' residuals within the same factor, which resulted in good fit indices (X^2/df = 2.54, GFI = 0.96, CFI = 0.98, TLI = 0.97, RMSEA = 0.04). The standardized factor loadings of the measurement Model 1 are presented in Table 4.

Table 3

Goodness of fit indices of the tested measurement models

Path Models	X^2/df	GFI	CFI	TLI	RMSEA
Model X	< 3	> 0.90	> 0.90	> 0.90	< 0.08
Model 1	3.03	0.95	0.97	0.97	0.05
Model 2 [a]	2.54	0.96	0.98	0.97	0.04

[a] Measurement model with correlation between items' residuals within same factor e11 with e12; Model X = Recommended values; Chisq/df = Chi Square/degree of freedom; GFI = Goodness of Fit Index; CFI = Comparative Fit Index; TLI = Tucker and Lewis index; RMSEA= Root Mean Square of Error Approximation.

Table 4

Standardized factor loadings for Model 1 and Model 2 of the SMS

Factors and Items	Factor Loadings		Cronbach's Alpha	Composite Reliability	Average Variance Extracted
	Model 1	Model 2/Final Model			
F1 (IM)					
IM1	0.84	0.84			
IM2	0.91	0.91	0.95	0.95	0.71
IM3	0.90	0.90			
IM4	0.88	0.88			
F2 (IR)					
IR1	0.76	0.76			
IR2	0.89	0.89	0.91	0.91	0.72
IR3	0.81	0.81			
IR4	0.82	0.82			
F3 (ER)					
ER1	0.78	0.80			
ER2	0.83	0.84	0.89	0.90	0.69
ER3	0.72	0.67			
ER4	0.80	0.76			
F4 (AM)					
AM1	0.67	0.67			
AM2	0.77	0.77	0.83	0.87	0.77
AM3	0.87	0.87			
AM4	0.89	0.87			

Note. IM = Intrinsic Motivation, IR = Identified regulation, ER = External regulation, AM = Motivation.

Several repeated rounds of CFA model respecification and reanalysis were required for the analysis. Factor loadings and fit indices were assessed at each iteration, and the CFA models were re-specified and re-analyzed (Zhou et al., 2021).

The model modification also included the addition of error residual covariances between factors' components. Adding the residuals' covariance seems fair, given that the items were referenced to the same latent variable (factor) (Zhou et al., 2021). After one round, the CFA model was significantly improved, and the fit indices fell inside the acceptable range, indicating that the fit indices were acceptable.

After adding correlated residual covariances to the final SMS, the fit indices are satisfactory. The subscales' Cronbach's alpha ranged from 0.83 to 0.95. Based on the CFA's final model, the composite reliability ranged from 0.87 to 0.95. All scale reliabilities on the SMS Questionnaire were greater than 0.60 (Rarujanai et al., 2020), and the AVE for the subscales ranged from 0.69 to 0.77. (Table 4).

The resulting CFA model's standardized factor correlation ranged from 0.22 to 0.83. (Table 5). The correlation coefficients between components were less than 0.85, indicating discriminant validity. In the final model, 16 components were kept, and the original factor structure of the APAS was confirmed.

Table 5

Standardized factor correlation of the final measurement model of the SMS

Variables	IM	IR	ER	AM
IM	1	.567**	.167**	.219**
IR		1	.264**	.218**
ER			1	.829**
AM				1

Note. IM = Intrinsic Motivation, IR = Identified regulation, ER = External regulation, AM = Amotivation

3.4 Face Validity SMS

Fifty randomly selected participants were given the Chinese-translated versions of questionnaires to check face validity. Their comments demonstrated that university students can comprehend the final Chinese version and that no more revisions are necessary.

Fifty undergraduate and graduate university students were asked to evaluate each of the four subscales (Intrinsic motivation, External Regulation, Identified Regulation, Amotivation). SMS thus represents what it was intended to test.

4. Discussion

This study aimed to translate and validate the Situational Motivational Scale for Physical Education into Chinese and then use confirmatory factor analysis to examine the construct validity of the Chinese version (SMS) among Chinese university students majoring in physical education. Cronbach's alpha was used to examine the reliability (internal consistency) of the SMS subscales (Zhou et al., 2021). The current study offered empirical evidence confirming the psychometric features of SMS for use with undergraduate and graduate Chinese physical education students. The components that continue to adequately represent the original variables (Zhou et al., 2021). After including correlated residual covariances, the final SMS fit the data nicely.

'The final SMS verified in this study showed sufficient internal consistency with the Cronbach's alpha ranging between 0.83 and 0.95. A previous study reported that the scale showed an acceptable internal consistency between 0.7 to 0.92 (Østerlie et al., 2019). In addition, all the correlations between the factors of the SMSPE were less than the cut-off value of 0.85. These results revealed that the four factors in the final SMSPE model are unique, and each factor explains a different variance than the other factor (Fornell & Larcker, 1981). These revealed that the SMS has a similar factor structure to the original English version (Guay et al., 2000).

In order to investigate the psychometric properties of the Chinese version of the Situational Motivational Scale for Physical Education, CFA was used to investigate and confirm the measurement model validity of the Situational Motivational Scale's factor models. A four-factor model was specified for the initial model's 16 items (Model 1). This model was re-specified (Model 2) by adding one correlated error residual. The 16-item final SMS model (Model 2) achieved a good fit with the data. In addition, the convergent validity of the models evaluated with CR and AVE was greater than the recommended values of 0.60 (Fornell & Larcker, 1981; Tseng et al., 2006)

Comparing the 16 items and four factors SMS in the present study with the previous SMS. The Canadian version yielded 16 items and four factors with Cronbach's alpha coefficient ranging between 0.75 and 0.93 (Guay et al., 2000). The American version yielded 16 items and four factors, with Cronbach's alpha coefficient ranging between 0.70-0.90 (Standage et al., 2003). Spanish version yielded 16 items and four factors with Cronbach's alpha coefficient ranging between 0.81 to 0.87 (Martín-Albo et al., 2009). Various researchers may have reported the same items and characteristics in different counties because of cultural

variances, which will lead to changes in the interpretation of the items and their cultural fit to that community.

The present investigation has some limitations. First, the study was conducted using a cross-sectional survey, rendering decisive results unattainable. Second, the results of this study were derived from the responses of university students majoring in PE. Third, athletes with a particular level of competition in college sports may differ from those described. Consequently, getting information from many sources might be advantageous for future research.

5. Conclusion

In conclusion, the study's findings demonstrate the validity and dependability of the Chinese SMS version. We believe the SMS is a valuable instrument for studying situational motivation in physical education settings. Researchers, professionals, and politicians can use the data to assess and promote university students' motivation for physical education. Future research could include samples from various sports and exercise-related professions to generalize results to sports communities.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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