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Pertanika J. Soc. Sci. & Hum. 25 (2): 589 - 600 (2017)

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Confirmatory Factor Analysis of the Malay Version of the Recreational Exercise Motivation Measure

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ABSTRACT

The purpose of the present study was to validate the Malay language version of the Recreational Exercise Motivation Measure (REMM-M) using a confirmatory approach. A total of 506 (females=373, males=133) university students with a mean age of 20 (*SD*=1.7) years old, participate in this study. Participants completed the REMM-M to measure their motives for doing recreational exercise. The REMM-M consisted of eight subscales, with 73 items measuring motives of respondents related to recreational exercise. The confirmatory factor analysis was tested on the REMM-M using the Mplus 7.3 software. We developed eight hypothesised measurement models of REMM-M based on each subscale. Therefore, there were eight measurement models with eight latent variables and the number of observed variables for each measurement model ranged from seven to 11. All the eight hypothesised measurement models were found not in good fit based on several fit indices. Therefore, several modifications were made iteratively, with theoretical support, to improve the measurement models. These modifications included deleting 22 low-loading items (< 0.50). The final measurement models were combined as one complete measurement model of REMM-M and the CFA results indicated fit based on several fit indices (SRMR=0.064 and RMSEA=0.049 (90% CI: 0.046 to 0.051), Clfit=0.832). The motive constructs' reliability of the final measurement model were acceptable, ranging from 0.683 to 0.867. The final measurement model comprised 51 items and eight subscales. Overall, 70% of the items were retained from the original English version of REMM.

ARTICLE INFO

Article history:
Received: 07 April 2016
Accepted: 18 August 2016

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ISSN: 0128-7702

Keywords: Confirmatory factor analysis, construct validity, exercise, motivation, recreational

INTRODUCTION

Physical activity is well known as a behaviour that can provide benefit across a wide range of health outcomes. Physical activity has been defined as ‘‘any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level’’ (US Department of Health and Human Services, 2008). Physical activity can be in many forms in our daily life, such as doing household activities, labour activities in the workplace that require some physical movement or recreational physical activity (Caspersen, Powell, & Christenson, 1985). Exercise is a subset of physical activity that is planned and structured and has a repetitive element with the aim of improving or maintaining an individual's physical ability (Caspersen et al., 1985). Recreational physical activity can consist of exercise done within leisure time; the activities chosen are driven by satisfaction and pleasure, and are relatively unorganised activities that require physical exertion (Kraus, 1978; Smith & Theberge, 1987). Rogers (2000) described recreational exercise as a participation in any physical activity during leisure time that does not involve formal competition or monetary payment. Recreational exercises can include common physical activities, such as swimming, running, walking, jogging, cycling and aerobics, when they are performed informally. Therefore, most people participate in a variety of forms of recreational exercise. Researchers have reported that people who participated in physical activity regularly were more likely to maintain a higher level of mental health, and that such activities reduced the risk of chronic disease, such as heart disease, stroke and type 2 diabetes (Hamer, Stamatakis, & Steptoe, 2009; Warburton, Nicol, & Bredin, 2006).

Motivation plays an important role in participation in physical activities. It is one of the essential components in the psychological process of individuals in deciding their participation in physical activities. Rogers and Morris (2003) created an instrument that measures individual's motives for participation in recreational exercise based on a qualitative study. Rogers, Morris and Moore (2008) interviewed recreational exercisers. Through inductive content analysis of the verbatim interview content they identified 13 main themes in terms of motives for participation in exercise. Based on their findings, Rogers et al. developed an instrument named the Recreational Exercise Motivation Measure (REMM), which included 73 items. The REMM was validated in 750 recreational exercisers using exploratory factor analysis (Rogers et al., 2008). The results revealed that the REMM had an eight-factor structure. The factors were identified as mastery, enjoyment, psychological condition, physical condition, appearance, others' expectations, affiliation and competition/ego. A second-order factor analysis was conducted on the factor loadings for the eight factors because there were noteworthy correlations between various pairs of factors. In this process Rogers et al. identified two broad constructs into which the eight factors were classified. The motives of mastery and enjoyment were grouped into an intrinsic motivation dimension, whereas the other six motives were grouped into an extrinsic motives second-order factor. Thus, the instrument framework produced by Rogers et al. fit into the framework of self-determination theory (Deci & Ryan, 1985, 1991, 2000), which is commonly employed by researchers in investigating the motivation of people for participation in physical activity. Based on the EFA results, the REMM covered a breadth of motives for participation in physical activity that were not covered by many other physical activity motivation scales, such as the Motivation for Physical Activity Measure – Revised (MPAM-R; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997) or the Participation Motivation Questionnaire (PMQ; Gill, Gross, & Huddleston, 1983).

Currently, there is no published instrument that measures the motives for participation in recreational exercise in the Malay language. It is important to understand the motives that influence the Malaysian community to participate in recreational exercise. Therefore, the aim of this study was to translate the REMM into the Malay language and to examine its reliability and validity using confirmatory factor analysis.

METHODOLOGY

Participants

A total of 506 university undergraduate students in Universiti Sains Malaysia participated in this study. The majority were female students (73.7%), with a smaller proportion of male students (26.3%). The mean age of the participants was 20 years (*SD*=1.7). The participants consisted of 76.3% Malay, 19.0% Chinese and 4.7% other ethnic background. All the participants were undergraduate students enrolled in health-related degrees. The participants reported that they were involved in one or two sport activities, including jogging, badminton, netball, taekwondo and tennis. Most of the participants reported exercise twice a week (28.3%) followed by once a week (27.1%) and three times a week (23.3%). Only a minority of the participants (4.5%) reported that they exercised seven times a week.

Measures

Demographic and recreational exercise activity questions were administered that included age, gender, ethnicity, exercise and recreational activities, and the hours per week of pursuing the activities.

Recreational Exercise Motivation Measure – Malay language (REMM-M) is the translated version of REMM (Rogers & Morris, 2003), consisting of 73 items that measure motives for participation in recreational exercise. There are eight subscales or factors, namely mastery, enjoyment, psychological condition, physical condition, appearance, others' expectations, affiliation and competition/ego, each of which represents a motive for participation. Each item is measured on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Thus, higher scores reflect that participants rate that as a stronger motive for participating in recreational exercise.

The internal consistency (Cronbach's Alpha) for each subcale in the original REMM was reported to be high in validation research, with 0.88 for mastery, 0.88 for enjoyment, 0.85 for psychological condition, 0.80 for physical condition, 0.83 for appearance, 0.77 for others' expectation, 0.90 for affiliation and 0.92 for competition/ego. The REMM has been validated among 750 recreational exercisers in Australia and found to be suitable for measuring motives for participation in recreational exercise among that community sample (Rogers & Morris, 2003; RoyChowdhury, 2012).

Procedure

Prior to data collection, approval was obtained from the institution's Human Research Ethics Committee. Participants were provided with the research information sheet prior to commencing the study. Implied consent was obtained when the participants volunteered to complete and return the REMM-M questionnaire to the researchers.

Because the main language spoken among students in Malaysia is Malay, we translated the REMM from the original English version to Malay and named this version the REMM-M. The second author forward-translated the English version into Malay language and then another local Malay who was bilingual back-translated the Malay version to English. The forward and backward translation process was based on the principle of retaining meaning, rather than on literal word-to-word translation. Then, any deviations between the two translated versions were noted and the preliminary version of REMM-M was constructed. We invited five panel members with expertise in the areas of sport sciences, sport psychology and psychometrics to review the content of the preliminary REMM-M version to make sure that the questions were culturally appropriate to the Malaysian population. Then, the final version of REMM-M was pre-tested among 10 undergraduate students for comprehension and understanding.

We employed a cross-sectional study design in this study. First, participants read the information statement, then they were further briefed by the researchers about the purpose of the study and they were allowed to ask the researchers any relevant questions, which the researchers answered. Participants' who volunteered to participate in the study completed the demographic and physical activity survey and the REMM-M and returned it to the researcher. We distributed a total of 600 questionnaires to the students; 545 were returned to the researcher, with a response rate of 90.8%. However, after excluding 39 questionnaires with incomplete answers, there were only 506 usable questionnaires with complete answers for further data analysis.

Data Analysis

Data were entered and screened using SPSS 22. Confirmatory factor analysis (CFA) was conducted using Mplus 7.3. Data were checked for missing data, outliers and multivariate normality prior to the CFA. If the data are severely non-normal, the common method of CFA that uses a maximum likelihood (ML) estimator is not suitable to be used in the CFA analysis (Kline, 2011). Therefore, an alternative estimator, a MLM, also known as the Satorra-Bentler chi-square was used. The MLM estimator is robust to non-normality and is commonly used when the assumption of multivariate normality is not met. In the present data analysis, the Mardia multivariate skewedness and a kurtosis test in Mplus were used to test the assumption of multivariate normality.

The hypotheses measurement model for REMM-M consisted of eight latent variables and 73 items. In CFA analysis, items with factor loading below 0.50 were treated as problematic items. The meaning of the item and the importance of the item in the measure were examined by the researchers to decide whether the item should be retained or removed. The problematic items were removed iteratively, examining the fit indices every time an item was deleted. Modification indices in CFA were used as a guide to introduce additional correlation among the error items. However, as a precaution, only meaningful correlations between error terms were introduced in the model. The models were evaluated based on the number-of-fit indices with the recommended fit values: the root mean square error of approximation (RMSEA), with the desired value of less than 0.07 and Close fit (Clfit) of more than 0.05, the standardised root mean square (SRMR), with the desired value of less than 0.08, the comparative-fit index (CFI) and Tucker and Lewis index (TLI), with desired values of more than 0.95 (Hair, Black, Babin, & Anderson, 2010; Kline, 2011).

The best-fit measurement model based on the fit indices was evaluated for construct validity. Examining construct validity includes examining convergent validity and discriminant validity. Convergent validity examines whether the items within a latent variable shares a high proportion of variance in common (Hair et al., 2010). This can be done by assessing the construct validity (CR) and average variance extracted (AVE; Fornell & Larcker, 1981). The recommended range for CR is 0.60 and above (Tseng, Dornyei, & Schmitt, 2006) and the AVE is 0.50 and above (Fornell & Larcker, 1981). Raykov's method in calculating the CR was applied when there was a covariance between the error terms (Raykov & Marcoulides, 2015). For discriminant validity, Kline (2011) suggested that if the correlations between latent variables are less than 0.85, discriminant validity can be established.

RESULTS

Measurement Models of REMM-M

There are eight subscales in the REMM-M. The number of items within each subscale ranges from seven to 11 items. In order to achieve the most parsimonious model, we developed eight measurement models, each reflecting the items and latent variables of the eight subscales. Data screening was carried out before the CFA analysis. There was no missing data in the data set and there was no extreme outliers observed by inspecting the squared Mahalanobis distance value computed in SPSS. In the measurement models, the assumption of multivariate normality was not met based on a *p*-value less than 0.05 in the Mardia multivariate skewedness and kurtosis test. Thus, the MLM estimator was used in the subsequent CFA analyses.

Table 1 presents the fit indices of the initial or the hypothesised measurement models for all eight subscales of the REMM-M. Problematic items were identified from each measurement model by inspecting the item factor loading. Then the fit indices of each problematic item was deleted and examined and presented in Table 1. A total of 22 problematic items were identified. After evaluating the meaning and the role of these items in the measure, we decided to omit the items from the measure. This is because omitting those problematic items would not affect the theoretical framework of the measure. In addition, covariance was added to the items' error 44 and 47. This is reasonable as both items were within the same latent variable and measuring the motive of affiliation.

The best-fit measurement models from Table 1 were combined as one

Table 1
Fit indices for eight individual measurement models in REMM-M

Model	CFI	TLI	SRMR	RMSEA (90%CI)	Clfit
Mastery					
Model 1 (Initial model)	0.876	0.840	0.055	0.100 (0.087, 0.113)	<0.001
Model 2 (Item 2 deleted)	0.968	0.958	0.033	0.051 (0.035, 0.068)	0.422
Enjoyment:					
Model 1 (Initial model)	0.949	0.929	0.041	0.077 (0.060, 0.095)	0.005
Model 2 (Item 55 deleted)	0.976	0.964	0.031	0.055 (0.032, 0.077)	0.339
Psychology condition:					
Model 1 (Initial model)	0.927	0.906	0.046	0.075 (0.062, 0.089)	0.001
Model 2 (Item 6 deleted)	0.949	0.931	0.041	0.068 (0.052, 0.083)	0.030
Model 3 (Item 6,21 deleted)	0.962	0.947	0.036	0.064 (0.046, 0.082)	0.099
Model 4 (Item 6, 21, 24 deleted)	0.980	0.969	0.030	0.052 (0.029, 0.075)	0.417
Physical condition:					
Model 1 (Initial model)	0.939	0.923	0.044	0.061 (0.049, 0.074)	0.063
Model 2 (Item 72 deleted)	0.948	0.933	0.040	0.061 (0.047, 0.075)	0.088
Model 3 (Item 72, 62 deleted)	0.950	0.933	0.039	0.065 (0.050, 0.081)	0.049
Model 4 (Item 72, 62,19 deleted)	0.965	0.951	0.033	0.058 (0.040, 0.077)	0.214

Table 1 *(continue)*

Model	CFI	TLI	SRMR	RMSEA (90%CI)	Clfit
Appearance:					
Model 1 (Initial model)	0.979	0.969	0.030	0.055 (0.033, 0.078)	0.318
Model 2 (Item 43 deleted)	0.980	0.967	0.030	0.065 (0.038, 0.092)	0.165
Model 3 (Item 43, 15 deleted)	0.990	0.980	0.023	0.058 (0.022, 0.096)	0.309
Others' expectations:					
Model 1 (Initial model)	0.807	0.742	0.064	0.103 (0.089, 0.118)	<0.001
Model 2 (Item 54 deleted)	0.806	0.728	0.066	0.115 (0.098, 0.132)	<0.001
Model 3 (Item 54, 38 deleted)	0.808	0.712	0.068	0.125 (0.106, 0.146)	<0.001
Model 4 (Item 54, 38, 46 deleted)	0.913	0.856	0.045	0.090 (0.066, 0.117)	0.005
Model 5 (Item 54, 38, 46, 60 deleted)	0.935	0.870	0.041	0.093 (0.061, 0.129)	0.017
Model 6 (Item 54, 38, 46, 60, 29 deleted)	0.984	0.952	0.023	0.066 (.012, .127)	0.245
Affiliation:					
Model 1 (Initial model)	0.859	0.789	0.062	0.143 (0.123, 0.163)	<0.001
Model 2 (Item 7 deleted)	0.993	0.988	0.022	0.033 (0.000, 0.065)	0.773
Competition/ego					
Model 1 (Initial model)	0.814	0.768	0.075	0.114 (0.103, 0.126)	<0.001
Model 2 (Item 8 deleted)	0.822	0.772	0.077	0.121 (0.108, 0.134)	<0.001
Model 3 (Item 8, 64 deleted)	0.898	0.864	0.057	0.095 (0.080, 0.110)	<0.001
Model 4 (Item 8, 64, 63 deleted)	0.921	0.890	0.050	0.093 (0.076, 0.110)	<0.001
Model 5 (Item 8, 64, 63, 36 deleted)	0.924	0.886	0.050	0.105 (0.085, 0.126)	<0.001
Model 6 (Item 8, 64, 63, 36, 61 deleted)	0.960	0.933	0.036	0.086 (0.061, 0.112)	0.011
Model 7 (Item 8, 64, 63, 36, 61, 35 deleted)	0.970	0.939	0.031	0.091 (0.059, 0.127)	0.020
Model 8 (Item 8, 64, 63, 36, 61, 35 deleted and covariance on items' errors: 44 and 47)	0.998	0.994	0.014	0.029 (0.000, 0.078)	0.703

Note. The numbers in brackets indicate the items in REMM-M

measurement model of the eight-motive model of REMM-M. The fit indices for the combined measurement model were: CFI=0.856, TLI=0.847, SRMR=0.064 and RMSEA=0.049 (90% CI: 0.046 to 0.051), Clfit=0.832. A sequence of modifications of the model that included adding correlation on the items' error and deleting cross-loading items based on their modification index was carried out in an attempt to improve fit. None of the modifications produced substantial improvement in the fit indices. Therefore, the measurement model of REMM-M with eight latent variables and 51 items was considered to represent an adequate fit based on the fit indices of SRMR and RMSEA. All factor loadings of the combined measurement model were above the recommended value (>0.50) and they ranged from 0.500 to 0.830 (see Table 2).

Table 2
Standardised factor loadings (λ), composite reliability and average variance extracted

Construct and Items	Standardised Factor Loading, (λ)[a]	Standardised Factor Loading, (λ)[b]	Composite Reliability (CR)	Average Variance Extracted (AVE)
Mastery				
QS1	0.653	0.625		
QS3	0.601	0.579		
QS16	0.641	0.631		
QS17	0.686	0.669		
QS18	0.576	0.541	0.862	0.413
QS26	0.513	0.546		
QS41	0.739	0.747		
QS53	0.718	0.725		
QS71	0.636	0.684		
Enjoyment				
QS10	0.600	0.619		
QS20	0.600	0.611		
QS45	0.709	0.695		
QS48	0.669	0.677	0.843	0.435
QS52	0.758	0.738		
QS59	0.672	0.683		
QS68	0.589	0.581		
Psychological condition				
QS11	0.625	0.642		
QS22	0.526	0.551		
QS23	0.715	0.716		
QS30	0.768	0.764	0.862	0.474
QS32	0.616	0.605		
QS33	0.781	0.771		
QS65	0.743	0.738		
Physical condition				
QS12	0.637	0.627		
QS14	0.645	0.668		
QS31	0.692	0.686		
QS34	0.689	0.683	0.867	0.450
QS39	0.599	0.608		
QS42	0.648	0.672		
QS69	0.707	0.699		
QS70	0.740	0.719		

Table 2 *(continue)*

Construct and Items	Standardised Factor Loading, (λ)[a]	Standardised Factor Loading, (λ)[b]	Composite Reliability (CR)	Average Variance Extracted (AVE)
Appearance				
QS13	0.544	0.563		
QS28	0.709	0.716		
QS51	0.823	0.830	0.853	0.542
QS56	0.826	0.813		
QS58	0.738	0.728		
Others' expectations				
QS4	0.515	0.500		
QS9	0.756	0.611	0.683	0.355
QS27	0.583	0.730		
QS66	0.531	0.515		
Affiliation				
QS5	0.530	0.543		
QS25	0.543	0.569		
QS37	0.707	0.709	0.824	0.442
QS40	0.699	0.709		
QS57	0.815	0.775		
QS67	0.644	0.656		
Competition/Ego				
QS44	0.632	0.651		
QS47	0.612	0.603		
QS49	0.831	0.808	0.793*	0.465
QS50	0.724	0.727		
QS73	0.570	0.595		

Note. a=Standardised factor loading for individual final measurement model, b=Standardised factor loading for combined measurement model, *CR using Raykov's method

Construct Validity

From the combined measurement model of REMM-M, the CR values ranged from 0.683 to 0.867, which indicated a moderate-to-good construct reliability. The AVE for each latent variable ranged from 0.355 to 0.542. Although the majority of the latent variables' AVE were below the recommended value of 0.50, the CR values were above the recommended value of 0.60. On this basis, the convergent validity of the measurement model was considered to still be adequate (Fornell & Larcker, 1981). The discriminant validity was checked based on the correlations among the latent variables. Table 3 presents the Pearson's product-moment correlation value and its significant indication. All correlations were

Table 3
Correlations Between Latent Variables in the Combined Final Model for REMM-M

Variable	Mastery	Enjoyment	Psychological condition	Physical condition	Appearance	Others' expectations	Affiliation	Competition/ Ego
1. Mastery	1	0.707*	0.604*	0.721*	0.364*	0.270*	0.453*	0.471*
2. Enjoyment		1	0.665*	0.653*	0.394*	0.212*	0.413*	0.370*
3. Psychological condition			1	0.690*	0.404*	0.194*	0.331*	0.265*
4. Physical condition				1	0.547*	0.182*	0.313*	0.302*
5. Appearance					1	0.254*	0.227*	0.315*
6. Others' expectations						1	0.556*	0.468*
7. Affiliation							1	0.539*
8. Competition/ Ego								1

Note. * Correlation is significant at the 0.05 level (two-tailed)

below the recommended cut-off point of 0.85, which indicated that the eight-motive latent variables achieved good discriminant validity.

DISCUSSION

The purpose of this study was to identify the best-fit measurement model of REMM-M and to evaluate the construct validity of the best-fit measurement model by assessing the two main components: convergent validity and discriminant validity. Overall, the results indicated that the measurement model for each subscale needed to go through model respecification to improve the model fit. Then, the best-fit measurement models of all eight subscales were combined as the final measurement model of REMM-M. The final model of REMM-M met the cutoff values of SRMR and RMSEA. The construct validity test indicated that the items in each construct (subscale of the REMM-M) were converging and shared a high proportion of variance in common (known as convergent validity), and all the eight individual constructs were unique and distinct from each other (known as discriminant validity).

In the present study the reliability was checked using the CR. The recommended value of CR is 0.70 and above (Hair et al., 2010). All the CR values were above 0.70 except for the subscale others' expectations, which suggests that the majority of subcales had good reliability (Hair et al., 2006). The CR for the subscale others' expectations is still considered reliable if based on the recommendation of Tseng et al. (2006), who suggested a lower cut-off for CR (more than 0.60). For AVE, all the values were below the recommended value of 0.50 except for the subscale appearance. A value of AVE less than 0.50 indicates that the variance due to measurement error is larger than the variance depicted by the factor and the individual items. However, if the value of the CRs is available, then we still can consider that the convergent validity of the

REMM-M is adequate, even though more than 50% of the variance is due to error (Fornell & Larcker, 1981). Therefore, from this study, convergent validity was achieved. In addition, discriminant validity was achieved as the correlations among the latent varibles (subscales) in the measurement model were below the recommended value of 0.85 (Kline, 2011). We can conclude that the eight subscales in REMM-M were distinct from each other and they measured different motives for participation in recreational exercise.

CONCLUSION

In conclusion, the findings showed that the revised 51-item version of the REMM-M was reliable and valid among the 506 undergraduate students who were surveyed in this study. However, improvements are needed for future research using REMM-M to attain more accurate results for different study populations and age groups, such as people with illness and of older age. This study developed the Malay version of the REMM-M, which can be used in future research examining motives for participation in recreational exercise, where the Malay language is the main spoken language among the study participants. The final version of the REMM-M is shorter than the original version, with 51 items and eight factors on motives for participation in recreational exercise. This might be valuable, given that a criticism of the 73-item REMM has been that it might be too long for use with a range of the population, who might get bored or tired while completing a 73-item measure (Morris & Rogers, 2004).

ACKNOWLEDGEMENT

The present study was supported by the first author's short term grant of Universiti Sains Malaysia (304/PPSP/61313082).

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