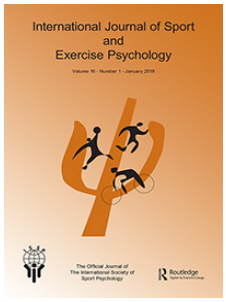

International Journal of Sport and Exercise Psychology

ISSN: 1612-197X (Print) 1557-251X (Online) Journal homepage: www.tandfonline.com/journals/rijs20

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To cite this article: Chunxiao Li, Masato Kawabata & Liancheng Zhang (2018) Validity and reliability of the Sport Motivation Scale-II for Chinese athletes, International Journal of Sport and Exercise Psychology, 16:1, 51-64, DOI: 10.1080/1612197X.2016.1153130

To link to this article: https://doi.org/10.1080/1612197X.2016.1153130

International Journal of Sport and Exercise Psychology, 2018
Vol. 16, No. 1, 51–64, https://doi.org/10.1080/1612197X.2016.1153130

Validity and reliability of the Sport Motivation Scale-II for Chinese athletes

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(*Received 5 November 2015; accepted 31 January 2016*)

Self-determination theory (SDT) has been widely used for studying athlete motivation. The Sport Motivation Scale-II (SMS-II), a SDT-based multidimensional scale, was recently developed to assess athlete motivation. The present research consisting of three studies aimed to develop the Chinese version of the SMS-II (CSMS-II). In Study 1, the SMS-II was translated into Chinese and then administered to university athletes ($N = 267$). The factorial structure of the CSMS-II was tested with confirmatory factor analysis and it was generally supported. In Study 2, the factorial and external validity of the CSMS-II were evidenced with another independent sample of athletes ($N = 259$). In Study 3, the test–retest reliability of the CSMS-II responses was supported. In conclusion, the CSMS-II is considered reliable and valid in general for the use with the Chinese university athletes.

Keywords: motivation; scale validation; behavioural regulation; Chinese version

It is well documented that sport participation brings a few negative health behaviours (e.g. alcohol use and violence) and numerous positive outcomes (e.g. emotional well-being, healthy eating, self-esteem, and vitality; Bouchard, Blair, & Haskell, 2007; Pate, Trost, Levin, & Dowda, 2000). Despite the benefits, many athletes discontinue their sport participation (Petlichkoff, 1996). One key variable related to sport dropout is sport motivation (Sallis, Prochaska, & Taylor, 2000). There are different motivational theories available for understanding sport motivation, such as achievement goal theory (e.g. Elliot & McGregor, 2001), competence motivation theory (e.g. Harter, 1978), and self-determination theory (SDT; e.g. Deci & Ryan, 1985). SDT has become one of the most popular motivational theories in sport and exercise psychology. Compared with other motivational theories, SDT is a macro-theory of human motivation that is unique in acknowledging spontaneous and intrinsically motivated activities. According to SDT (Deci & Ryan, 1985, 2000), athletes are motivated by different reasons for sports participation. These different reasons or types of motivation varied in terms of the level of self-determination and they are considered located along a conceptual continuum (Deci & Ryan, 2000).

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Types of motivation

On the self-determination continuum, its lower end is called *amotivation* in which individuals are literary without motivation for the activity (e.g. lack of intention to sports participation). Next to amotivation, there are different types of extrinsic motivation, ranging from those which are controlled externally to those which are self-endorsed (Deci & Ryan, 1985). *External regulation* describes those activities performed to satisfy external contingencies (e.g. participating in sport for getting money). In *introjected regulation*, individuals control themselves with internal contingencies of reward and punishment (e.g. participating in sport for avoiding guilty or reaching ego-enhancement). Individuals with *identified regulation* recognise and accept personal importance or value of the activity (e.g. sports participation is valued as an important way for career development). When individuals are motivated out of *integrated regulation*, they have integrated or assimilated values or needs to the self (e.g. sports participation becomes an integral part of one's life). Finally, the most autonomous form of motivation on the self-determination continuum is *intrinsic motivation*, which means doing the activity for its own sake (e.g. participating in sport to enjoy the activity itself; Deci & Ryan, 1985, 2000).

Outcomes of behavioural regulation

According to SDT (Deci & Ryan, 1985, 2000), external regulation and introjected regulation are the two controlled types of motivation (i.e. non-self-determined regulations). Identified regulation, integrated regulation, and intrinsic regulation are the three autonomous types of motivation (i.e. self-determined regulations). A number of studies have found that amotivation and controlled motivation are associated with negative outcomes such as athlete burnout (e.g. Li, Wang, Pyun, & Kee, 2013; Lonsdale, Hodge, & Rose, 2009), negative moral behaviours (e.g. Vansteenkiste, Mouratidis, & Lens, 2010), and dropout (Calvo, Cervelló, Jiménez, Iglesias, & Murcia, 2010). On the other hand, athletes who are autonomously motivated are more likely to experience task involvement over ego involvement, approach orientations, vitality, positive affect, mental health, and life satisfaction (see Ng et al., 2012; Pelletir, Rocchi, Vallerand, Deci, & Ryan, 2013). These findings suggest the importance to evaluate or monitor athlete motivation from a SDT perspective.

Measuring sport motivation

Based on SDT, a measurement instrument entitled the Sport Motivation Scale (SMS) was developed in Canada to assess five types of behavioural regulations except integrated regulation (Pelletier et al., 1995). The SMS has been widely used and made a considerable impact on the measurement and understanding of sport motivation (Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013; Pelletier & Sarrazin, 2007; Pelletier, Vallerand, & Sarrazin, 2007). In recent years, however, the SMS has been questioned regarding its psychometric properties. For example, the SMS did not provide enough evidence to support the proposed factorial structure (Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson, 2007). Other researchers (e.g. Cresswell & Eklund, 2005; Gould, Udry, Tuffey, & Loehr, 1996) also reported that some factors of the SMS were not internally consistent (see Mallett, Kawabata, Newcombe, Otero-Forero et al., 2007; Pelletier et al., 2007, 2013 for further details of the strengths and limitations of the SMS).

A few studies have been conducted to address the limitations of the SMS. Mallett, Kawabata, Newcombe, Otero-Forero et al. (2007) developed the SMS-6 by revising the original items from the SMS and integrating a new subscale for measuring integrated regulation. However, the following limitations were observed with the SMS-6: (a) the revised items did not fit the sport

context very well; (b) sufficient information about new subscale items were not provided; and (c) items added for measuring integrated regulation overlapped with the items assessing identified and intrinsic regulations (Pelletier et al., 2007, 2013). Lonsdale, Hodge, and Rose (2008) developed a new measure entitled the Behavioral Regulation in Sport Questionnaire (BRSQ) as an alternative measure to the SMS and SMS-6. Although the proposed BRSQ advanced the measurement of sport motivation as conceptualised by SDT, the scale also has its limitations. For instance, the BRSQ also failed to clearly establish discriminant validity between the self-determined subscales (i.e. intrinsic motivation, integrated regulation, and identified regulation; Pelletier et al., 2013).

Consequently, Pelletier et al. (2013) revised the SMS (renamed as the SMS-II) to address the limitations of the SMS (e.g. some items did not fit the SDT constructs and lack of an integration subscale). They examined the psychometric properties of the SMS-II among Canadian athletes through multiple-studies, and found that the six-factor SMS-II (i.e. amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation) has adequate internal reliability and construct validity. Pelletier et al. (2013) argued that the SMS-II is more theoretically aligned with its item content, overall briefer and more efficient to administer than the original SMS, and therefore encouraged researchers or practitioners to use the SMS-II as an alternative to the SMS. They also suggested future research to further examine or confirm the reliability and validity of the SMS-II for diverse athletes from different countries and sports. Psychometric properties of the SMS-II have been examined in Swedish (Stenling, Ivarsson, Johnson, & Lindwall, 2015) and Brazilian athletes (Nascimento Junior et al., 2014). Although the translated SMS-II showed adequate fit to their hypothesised model, discriminant validity issues were observed in the studies. Specifically, the latent factor correlation between introjected regulation and external regulation was .83 with Swedish athletes (Stenling et al., 2015). The latent factor correlations among intrinsic motivation, integrated regulation, and identified regulation ranged from .81 to .87 among the Brazilian players (Nascimento Junior et al., 2014). These results imply the need to further examine the factor structure of the SMS-II with different culture and language groups.

The present research

To date, no research has systematically examined the psychometric properties of the SMS-II with Chinese athletes. To respond to the call by Pelletier et al. (2013), this multi-study research was therefore conducted to investigate the reliability and validity of the Chinese version of the SMS-II (CSMS-II) for the use with Chinese athletes. In Study 1, the factor structure of the CSMS-II was examined with a sample. In Study 2, the factor structure of the CSMS-II was cross-validated with another independent sample, and measurement invariance among groups (i.e. gender and age) and external validity of the CSMS-II were also examined. Finally, the test–retest reliability of the CSMS-II was examined in Study 3.

Study 1

Method

Participants

A sample of 267 Chinese university athletes (male = 197, female = 67, unidentified = 3) was recruited. These athletes had a mean age of 20.8 (SD = 1.39) years. They participated in a variety of sports (e.g. basketball, judo, karate, and volleyball) and trained about five (SD = 2.66) times per week. Each training session lasted for about 1.9 (SD = 0.55) hours.

Measure and procedure

The 18-item SMS-II developed by Pelletier et al. (2013) was translated and used for measuring Chinese athletes' sport motivation. The original SMS-II was translated to Chinese by the first author who is bilingual in Chinese and English, and back translated by another bilingual investigator in sport psychology (Brislin, 1980). Two bilingual investigators from the sport psychology field verified the translation and examined the content validity of the scale. A pilot was conducted with 20 student athletes to check if the translated statements were clearly understood without any difficulties. As no issue was reported about the item statements, no further changes were made to the translated scale (CSMS-II). Consistent with the SMS-II, the CSMS-II consists of six subscales measuring amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation (see Appendix). Each subscale has three items. Participants were asked to respond to all the items on a 7-point Likert scale ranging from 1 (*not true at all*) to 7 (*very true*).

Ethical clearance and informed consent were obtained from the first author's institution before data collection. The head coaches of sport teams at four universities were contacted to obtain the permission to approach their athletes. After getting the permission, athletes were invited to participate in this study without external incentives (e.g. money) via emails. Upon obtaining their informed consent, the questionnaires (i.e. the CSMS-II and a series of items measuring participants' demographic information) were then distributed to participants in quite classrooms under supervisions of researchers. These researchers had rich experiences in conducting survey studies and thus were able to ensure the quality of data collection. Participants were encouraged to respond to the questionnaires honestly. They were informed that there were no correct or wrong answers for the survey. Participants took approximately six minutes to complete the survey.

Data analysis

The missing value (<1.9%) was imputed using Expectation–Maximization algorithm (Little, 1988). Confirmatory factor analysis (CFA) was used to examine the factorial validity of the CSMS-II. All the CFAs were conducted with Mplus 7.0 (Muthén & Muthén, 1998–2012). The robust maximum likelihood estimation procedure was employed to estimate the six-factor structure as the data were not multivariate normally distributed (skewness = −0.38to 1.12, kurtosis = −0.92 to 0.60, Mardia's normalised estimate obtained from EQS 6.1 = 19.18; Bentler & Wu, 2005). To assess the global model fit, the scaled chi-squared test (MLMχ^2), comparative fit index (CFI), Tucker–Lewis index (TLI), root mean squared error of approximation (RMSEA), and standardized root mean squared residual (SRMR) were used. Regarding the values of CFA and TLI, an index value of over .90 indicated adequate fit and an index value of over .95 represented excellent fit (Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004). With regard to RMSEA and SRMR, values smaller than .08 and.05 were considered to indicate adequate and good fit, respectively (Hu & Bentler, 1999; Marsh et al., 2004). The discriminant validity of the scale was evaluated by examining the 95% confidence intervals (CI) of the latent factor correlations. The 95% CI of the factor correlations should not include 1.00 to provide robust evidence of discriminant validity (Anderson & Gerbing, 1988). The latent factor correlations were also used to evaluate the fit of a simplex-like pattern (i.e. adjacent factors on the self-determination continuum have stronger correlations than factors that are further away; Ryan & Connell, 1989). Finally, Cronbach's alpha coefficients and Raykov's composite reliability (CR; Raykov, 1997) were calculated for each subscale.

Results

The CFA result indicated that the six-factor measurement model fit the data adequately: MLMχ^2 (120, $N = 276$) = 214.56, $p < .001$, CFI = 0.93, TLI = 0.91, RMSEA = 0.05, RMSEA 90%

CI = 0.04–0.07, SRMR = 0.07. Factor loadings of items ranged from .47 to .84 (M = .69). The 95% CIs of most latent factor correlations was found less than 1.00; however, the 95% CI of the latent correlation between integrated regulation and identified regulation factors exceeded 1.00 (0.87, 1.01). This means that the two factors were not empirically distinguishable.

Table 1 shows the correlation matrices of the CSMS-II. In general, the simplex-like pattern was observed. However, there were a few exceptions. For example, introjected regulation correlated stronger with integrated regulation (ϕ = .33) than with identified regulation (ϕ = .21). In addition, the effect sizes for the relations between external regulation and autonomous forms of regulation (i.e. identified regulation, integrated regulation, and intrinsic motivation) were about the same. Finally, the internal reliability and CR of the scale were supported (α = .70–.76, CR = .71–.78).

Discussion

The purpose of Study 1 was to examine the validity and reliability of the CSMS-II. The CFA result revealed acceptable model fit for the hypothesised six-factor structure. Although the discriminant validity of the scale was generally sufficient, identified regulation and integrated regulation were empirically indistinguishable for the current sample. As such, the six distinct factor structure proposed by SDT was not tenable with the current sample. Furthermore, the simplex-like pattern was not fully supported as a few exceptions were found. Because this finding might be specific to the sample, the issue requires further examination with another independent sample.

Study 2

Study 2 aimed to re-examine the hypothesised factor structure of the 18-item CSMS-II with another independent sample. Consistent with Pelletier et al.'s (2013) study, group invariances of the CSMS-II across gender and age groups were investigated to see whether the group members interpret the scale items in the same way (Kline, 2005). Finally, the external validity of the scale was investigated by evaluating the relations between the six subscales of the

Table 1. Descriptive statistics of the CSMS-II in study 1 (N = 276).

Subscale	AM	EXT	INTR	IDEN	INTE	IM
AM	*.70*	.36**	.12*	−.34**	−.34**	−.29**
EXT	.41**	*.76*	.43**	.02	.05	.03
INTR	.20**	.53**	*.73*	.18**	.26**	.25**
IDEN	−.49**	−.04	.21**	*.70*	.68**	.61**
INTE	−.49**	−.05	.33**	.94**	*.70*	.66**
IM	−.40**	−.03	.28**	.85**	.91**	*.75*
M	3.00	2.53	3.51	4.98	4.54	4.88
SD	1.20	1.20	1.36	1.07	1.13	1.13
A	.70	.76	.73	.70	.70	.75
CR	.72	.78	.73	.71	.71	.75

Note: AM = Amotivation, EXT = External regulation, INTR = Introjected regulation, IDEN = Identified regulation, INTE = Integrated regulation, IM = Intrinsic motivation, CR = Composite reliability. Zero-order correlations are displayed above the diagonal. Latent factor correlations are displayed below the diagonal. Underlined correlation estimates encompass 1. Cronbach's alpha coefficients are displayed in italics on diagonal.
*p < .05.
**p < .01.

CSMS-II and its related outcomes (i.e. life satisfaction, subjective vitality, and burnout). These outcomes have been used in early studies to examine the external validity of SMS-II and BRSQ (Lonsdale et al., 2008; Pelletier et al., 2013).

Method

Participants

A sample of 259 (male = 169, female = 89, unidentified = 1) Chinese university athletes participated in this study. Participants had a mean age of 20.5 (SD = 1.38) years. They represented a wide range of team and individual sports (e.g. boxing, soccer, gymnastics, tennis, taekwondo, and wrestling), and were actively involved in sports training for about five times per week (M = 4.98, SD = 2.37). Each training session lasted for 2.0 (SD = 0.54) hours.

Measures and procedure

The similar data collection procedure used in Study 1 was followed. Besides the CSMS-II and some demographic items (e.g. gender, age, and sport), the following three questionnaires were completed by 228 of 259 participants.

Life satisfaction. The 5-item Chinese version of the Satisfaction with Life Scale was utilised to evaluate athletes' life satisfaction (Wang, Yuen, & Slaney, 2009). Participants responded on a 7-point Likert scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale had adequate factorial validity with the current sample: MLMχ^2 (5, N = 228) = 11.15, p = .05, CFI = 0.98, TLI = 0.97, RMSEA = 0.07, RMSEA 90% CI = 0.01–0.13, SRMR = 0.03. The scale also had adequate internal reliability with our sample (α = .76, CR = .84).

Vitality. The 7-item Chinese version of the Subjective Vitality Scale was employed for assessing athletes' subjective vitality (Wong, Li, Sun, & Xu, 2014). Participants answered the items on a 7-point Likert scale that ranged from 1 (*not at all true*) to 7 (*very true*). The factorial validity of the scale with the current sample was good: MLMχ^2 (120, N = 228) = 7.96, p = .81, CFI = 1.00, TLI = 1.00, RMSEA = 0.00, RMSEA 90% CI = 0.00–0.03, SRMR = 0.03. The sample also provided reliable responses to the scale (α = .82, CR = .78).

Burnout. To assess athlete burnout, the 15-item Chinese version of the Athlete Burnout Questionnaire (ABQ; Chen & Zhou, 2007) was used. The ABQ assesses three burnout symptoms, namely reduced sense of accomplishment, sport devaluation, and emotional and physical exhaustion. Each subscale had five items. Athletes were asked to respond in terms of the degree of burnout experience over the last month through a 5-point Likert scale ranging from 1 (*almost never*) to 5 (*almost always*). The overall burnout score (mean score of the three subscales) was computed for further analysis. The CFA results with the current sample supported the factorial validity of the ABQ: MLMχ^2 (87, N = 228) = 146.83, p < .001, CFI = .92, TLI = .90, RMSEA = 0.06, RMSEA 90% CI = 0.04–0.07, SRMR = 0.07. Its internal reliability was also supported in the sample (α = .84, CR = .87).

Data analysis

A CFA with the robust maximum likelihood estimation (skewness = −0.61 to 1.13, kurtosis = −1.08 to 0.52, Mardia's normalised estimate = 18.30) was conducted to re-examine the hypothesised

factor structure of the CSMS-II with an independent sample for the cross-validation purpose. The discriminant validity of the CSMS-II was evaluated with the 95% CI of the latent factor correlations between the six factors (Anderson & Gerbing, 1988). Following the CFA, samples of Studies 1 and 2 were combined to test the measurement invariance of the scale across gender (male = 366, female = 156) and age (junior [16–20 years] = 246, senior [21–25 years] = 273). The samples of Studies 1 and 2 were combined to ensure that there were adequate sample sizes for conducting the group invariance tests. The difference between two multi-sample models was determined based on the difference of CFI value (ΔCFI). A value of ΔCFI smaller than .01 indicated tenability of equality constraints (Cheung & Rensvold, 2002). Finally, Zero-order correlations with expected outcomes (i.e. subscale scores based on averaged items) were calculated to examine the external validity of the CSMS-II responses. Cronbach's alpha coefficients and CR scores were computed to assess the internal consistency of the six subscale responses.

Results

Confirmatory factor analysis

The hypothesised six-factor measurement model fit to the data satisfactorily: MLMχ^2 (120, N = 259) = 201.15, p < .001, CFI = 0.93, TLI = 0.91, RMSEA = 0.05, RMSEA 90% CI = 0.04–0.06, SRMR = 0.06. Factor loadings of items ranged from .55 to .82 (M = .68). The latent factor correlations ranged from −.59 to .92 (Table 2). Discriminant validity of the scale was supported as none of the 95% CI of the correlation estimates exceeded 1.00. Furthermore, all the six subscales were considered internally consistent (α = .69–.76; CR = .69–.77). However, the simplex-like pattern was only partially confirmed. For example, intrinsic motivation correlated more strongly with identified regulation (ϕ = .92) than with integrated regulation (ϕ = .87).

Measurement invariance

The multi-group baseline CFA model for gender (i.e. the configural invariance model that without constraints placed on the parameters) showed adequate fit to the data: MLMχ^2 (240, N = 522) = 440.86, p < .001, CFI = 0.92, TLI = 0.90, RMSEA = 0.06, RMSEA 90% CI = 0.05–0.07, SRMR = 0.06. The result implies that the two groups conceptualised the six constructs in the same way (Cheung & Rensvold, 2002). Next, the factor loadings were constrained to be equal across groups to determine the metric invariance of the scale. The results indicated that the constrained model fit the data adequately and the constrained model differed no difference in the global model fit from the baseline model: (MLMχ^2 [252, N = 522] = 451.54, p < .001, CFI = 0.92, TLI = 0.91, RMSEA = 0.06, RMSEA 90% CI = 0.05–0.06, SRMR = 0.07; ΔCFI < .01). Thus, it was considered that male and female athletes interpreted the scale items in the same way.

The multi-group baseline CFA model for age also fit the data satisfactorily: MLMχ^2 (240, N = 519) = 414.19, p < .001, CFI = 0.93, TLI = 0.91, RMSEA = 0.05, RMSEA 90% CI = 0.04–0.06, SRMR = 0.06. The model that constrained invariant at the factor loading level also fit the data adequately and showed no difference in the global model fit from the baseline model: MLMχ^2 (252, N = 522) = 436.03, p < .001, CFI = 0.93, TLI = 0.91, RMSEA = 0.05, RMSEA 90% CI = 0.05–0.06, SRMR = 0.07; ΔCFI < .01. These results indicated that junior and senior age groups interpreted the scale items in the same way.

External validity

With regards to the external validity, amotivation was negatively related to life satisfaction (r = −.15) and vitality (r = −.21), as well as positively associated with burnout (r = .48; see Table 2).

Table 2. Descriptive statistics of the CSMS-II in study 2 ($N = 259$; of whom 228 reported LS, vitality, and burnout scores).

	AM	EXT	INTR	IDEN	INTE	IM	LS	Vitality	Burnout
AM	–	.27**	.13*	−.41**	−.40**	−.40**	−.15*	−.21**	.48**
EXT	.39**	–	.31**	−.09	−.04	−.09	.06	.00	.17**
INTR	.17**	.37**	–	.21**	.23**	.24**	.20**	.12	−.08
IDEN	−.55**	−.16*	.29**	–	.64**	.65**	.20**	.30**	−.28**
INTE	−.57**	−.11	.31**	.91**	–	.61**	.23**	.27**	−.29**
IM	−.59**	−.17*	.32**	.92**	.87**	–	.22**	.29**	−.33**
M	3.00	2.59	3.52	5.13	4.64	5.04	4.09	4.72	2.64
SD	1.24	1.29	1.37	1.09	1.19	1.10	1.19	0.84	0.54
α	.73	.76	.69	.74	.70	.69	.76	.82	.84
CR	.73	.77	.69	.74	.70	.69	.84	.78	.87

Note: AM = Amotivation, EXT = External regulation, INTR = Introjected regulation, IDEN = Identified regulation, INTE = Integrated regulation, IM = Intrinsic motivation, CR = Composite reliability, LS = Life satisfaction. Zero-order correlations are displayed above the diagonal. Latent factor correlations are displayed below the diagonal.
*$p < .05$.
**$p < .01$.

Controlled forms of motivation (i.e. external regulation and introjected regulation) were weakly associated with life satisfaction, subjective vitality, and burnout ($r = -.08$ to .20). Autonomous forms of motivation (i.e. identified regulation, integrated regulation, and intrinsic motivation) were positively associated with life satisfaction and subjective vitality with weak to moderate effect sizes ($r = .20$–$.30$). Autonomous forms of motivation were negatively related to burnout with moderate effect sizes ($r = -.28$ to $-.33$). These results supported the external validity of the CSMS-II.

Discussion

The primary purpose of Study 2 was to re-examine the hypothesised factorial validity and reliability of the CSMS-II which were found in Study 1 with another independent sample. The hypothesised six-factor structure was replicated in Study 2. The discriminant validity issue found in Study 1 was not observed in Study 2. This means that the two subscales (identified regulation and integrated regulation) are distinct for the independent sample in Study 2. The factor structure was also shown to be invariant at the factor loading level (i.e. metric invariance) across gender/age groups, which means that composite variables can be safely created for these two groups of athletes for correlation analyses (Pelletier et al., 2013).

When assessing the quality for the simplex-like pattern, the CSMS-II subscales generally fit into the expected simplex pattern. Similar to Study 1, a notable exception is that external regulation correlated about equally with autonomous forms of regulation. Given that the exception was also observed in Study 1, the deviation from the expected simplex pattern is unlikely to be caused by the sampling issue. When the CSMS-II subscales were correlated with the outcome measures (i.e. life satisfaction, subjective vitality, and burnout), expected associations were observed (Li et al., 2013; Pelletier et al., 2013). In particular, the relations between burnout and the six subscales were in order, providing support for the self-determination continuum. These findings thus support the factorial and external validity of the CSMS-II for the independent sample.

Study 3

Study 3 was conducted to examine the test–retest reliability of the CSMS-II over a 1-week interval. A 1-week interval was considered appropriate as trivial changes in behavioural regulation scores were expected across this short period (Lonsdale et al., 2008). Participants ($N = 25$; male = 8, female = 17) were university athletes from a variety of sports (e.g. handball, karate, netball, and triathlon). They had a mean age of 21.8 (SD = 1.88) years. They had participated in their sports for 8.8 (SD = 3.85) years and trained about three (SD = 1.46) times each week.

The data of Study 3 were collected in a similar way to Studies 1 and 2. In Study 3, however, the participants were required to complete the CSMS-II twice at a 1-week interval. Given the small sample size, normality of the data was examined through the Shapiro–Wilk test (Ghasemi & Zahediasl, 2012). The results indicated that subscale scores of identified regulation at the pre-test as well as amotivation, external regulation, and integrated regulation at the post-test were not normally distributed ($ps < .05$).

Intraclass correlation coefficients of the six subscale scores were computed to examine the test–retest reliability of the CSMS-II. The intraclass correlation coefficients ranged from .70 to .89: amotivation (.89, 95% CI [.76, .95]), external regulation (.73, 95% CI [.38, .88]), introjected regulation (.70, 95% CI [.31, .87]), identified regulation (.79, 95% CI [.52, .91]), integrated regulation (.82, 95% CI [.60, .92]), and intrinsic motivation (.80, 95% CI [.54, .91]). We conducted a *post-hoc* power analysis (i.e. sample size = 27, number of observations = 2, $p = .05$, effect size

= .70) through PASS 11 and found that there was enough statistical power (0.96) for conducting the intraclass correlation tests (Walter, Eliasziw, & Donner, 1998). In summary, the CSMS-II responses were reliably stable for the interval period.

General discussion

The current research aimed to examine the reliability and validity of the SMS-II for the use with Chinese university athletes. To this end, the scale was translated into Chinese (CSMS-II) and its psychometric properties were comprehensively examined through the three studies outlined above. The findings of the present research provide preliminary evidence that the CSMS-II is a psychometrically sound instrument to examine Chinese athletes' motivation from a SDT perspective. The factorial validity of the CSMS-II was generally supported across two independent samples. Although identified regulation and integrated regulation were found empirically indistinguishable for the Chinese athletes who participated in Study 1, this issue was not replicated with another sample in Study 2. Therefore, the issue was considered sample specific. However, it might be also possible that athletes identified and valued their sports in a similar way (Sabiston & Crocker, 2008). Further investigations are warranted to confirm these two possibilities for the issue.

Although the discriminant validity of the six hypothesised factors were established in Study 2, the latent factor correlations among identified regulation, integrated regulation, and intrinsic motivation found in Studies 1 and 2 (ϕ = .85–.94) were much higher than those found in Pelletier et al.'s (2013) study (ϕ = .68–.78). The higher latent factor correlations observed in the present study suggest that self-determined factors (i.e. intrinsic motivation, integrated regulation, and identified regulation) might be less clearly differentiated by Chinese university athletes. In other words, our participants may incline to respond to the self-determined factors in a similar way (Sabiston & Crocker, 2008). This does not mean that the constructs of the self-determined factors do not exist among the Chinese population. Ample evidence has supported the existence of identified regulation and intrinsic motivation in the Chinese context (see Liu, Chung, & Si, 2013). However, empirical support for the existence of integrated regulation for the Chinese population in sport was still lack. Interview studies could be useful for examining whether Chinese athletes' sport participation is regulated by integrated regulation.

The evidence derived from Studies 1 and 2 generally supported the simplex-like pattern. However, a few deviations from the expected simplex pattern were found in each study. Given that some of the deviations were not consistently observed across both studies, they might be sample specific. However, the relation between external regulation and autonomous forms of motivation was deviated from the simplex-like pattern across both studies. Therefore, it was considered that this deviation was not a sample specific issue. One possibility could be due to the cultural difference. For example, for one item "because people around me reward me when I do" from the external regulation subscale, the term *jiangli* (i.e. reward) can be interpreted as either a material incentive (controlled form of regulation) or an encouragement message (autonomous form of regulation) in the Chinese culture. Thus, the cultural difference between China and Western countries may limit the findings regarding simplex-like pattern. It is suggested that future studies should examine the cultural-invariance of the SMS-II responses, especially between Eastern and Western cultures. Measurement invariance of the CSMS-II across gender/age was examined and supported at the factor loading level (i.e. metric invariance). This means the strength of the relationship between each item and its underlying construct was the same for both the gender/age groups (Cheung & Rensvold, 2002). The results are consistent with Pelletier et al.'s (2013) study.

To examine the external validity of the CSMS-II, two adaptive outcome variables (i.e. life satisfaction and subjective vitality) and one maladaptive outcome variable (i.e. burnout) were

chosen. The chosen of the three outcomes had a large amount of supportive evidence (e.g. Li et al., 2013; Ryan & Deci, 2000). In general, the current results showed that autonomous forms of motivation were more adaptive than the controlled forms of motives. These results support the tents of SDT (Deci & Ryan, 2000) as well as the external validity of the CSMS-II. Exceptions were that the relationships between autonomous forms of motivation and two outcome variables (i.e. life satisfaction and subjective vitality) did not support the hypothesised self-determination continuum. The issue was also observed in Pelletier et al.'s (2013) study. Despite this limitation, future research is warranted to investigate how the CSMS-II's subscales relate to other important positive and negative constructs in sport (e.g. sportsmanship, dropout, mental health, and life satisfaction).

The internal consistency of the CSMS-II subscales was generally acceptable across Studies 1 and 2 ($\alpha = .69–.76$; CR = .69–.78). These subscale reliability values are comparable to or slightly below than those found in the study by Pelletier et al. (2013). As the test–retest reliability of the SMS-II was not examined in the past studies, one important contribution of the current research is to fill this literature breach. Adequate test–retest reliability of the CSMS-II was found in Study 3.

In summary, this multi-study research generally supports the validity and reliability of the CSMS-II. It is therefore recommended that the CSMS-II can be used for measuring Chinese university athletes' sport motivation. As scale development is an ongoing process (Lonsdale et al., 2009; Lonsdale, Hodge, Hargreaves, & Ng, 2014; Mallett, Kawabata, & Newcombe, 2007), more studies are warranted to examine and advance the SMS-II/CSMS-II. Furthermore, it could be interesting to compare the psychometric properties of the SMS-6, BRSQ, and SMS-II among Chinese athletes in future.

Acknowledgements

We would like to thank all our helpers and participants.

Funding

We would like to thank The Hong Kong Institute of Education for providing financial support to this research [RG 39/2014-15].

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Appendix

Scale items.

	Sport Motivation Scale-II	Chinese Sport Motivation Scale-II
INTR1	Because I would feel bad about myself if I did not take the time to do it.	因为不参加这项运动, 我会觉得自己不好。
AM1	I used to have good reasons for doing sports, but now I am asking myself if I should continue.	我曾经拥有良好的理由参与这项运动, 但现在我不知道为什么要继续参加。
IM1	Because it is very interesting to learn how I can improve.	因为学习提高运动专项的方法很有趣。
INT1	Because practicing sports reflects the essence of whom I am.	因为参与这项运动反映了最真实的自己。
EXT1	Because people I care about would be upset with me if I didn't.	因为不参加这项运动, 身边重要的人会对我发脾气。
IDEN1	Because I found it is a good way to develop aspects of myself that I value.	因为参加这项运动是提高自己所看重的素质的一个好办法。
INTR2	Because I would not feel worthwhile if I did not.	因为不参加这项运动, 我会觉得自己的价值降低。
EXT2	Because I think others would disapprove of me if I did not.	因为不参加这项运动, 身边重要的人会对我表示不满。
IM2	Because I find it enjoyable to discover new performance strategies.	因为发现提高运动专项能力的办法很愉快。
AM2	I don't know anymore; I have the impression that I am incapable of succeeding in this sport.	我觉得我在自己的运动专项上毫无作为, 我不知道为何要继续参加。
INT2	Because participating in sport is an integral part of my life.	因为参加这项运动已成为我生命中不可缺少的一部分。
IDEN2	Because I have chosen this sport as a way to develop myself.	因为参加这项运动是自我提升的一个好方式。
AM3	It is not clear to me anymore; I don't really think my place is in sport.	参加这项运动的原因已不再清晰,我真不觉得我属于这项运动。
INT3	Because through sport, I am living in line with my deepest principles.	因为参与这项运动与我的价值观相符。
EXT3	Because people around me reward me when I do.	因为参加这项运动, 身边重要的人会给我奖励。
INTR3	Because I feel better about myself when I do.	因为参加这项运动, 我对自己感觉会好些。
IM3	Because it gives me pleasure to learn more about my sport.	因为参加这项运动给我带来乐趣。
IDEN3	Because it is one of the best ways I have chosen to develop other aspects of myself.	因为参加这项运动是发展我其他方面能力的一个好途径。

Note: AM = Amotivation, EXT = External regulation, INTR = Introjected regulation, IDEN = Identified regulation, INTE = Integrated regulation, IM = Intrinsic motivation.