Sport motivation scale-6 (SMS-6): A revised six-factor sport motivation scale

Clifford Malletta*, Masato Kawabataa, Peter Newcombec, Andrés Otero-Foreroa, Susan Jacksona

aSchool of Human Movement Studies, The University of Queensland, St. Lucia, Qld. 4072, Australia
bSchool of Social Work and Applied Human Sciences, The University of Queensland, St. Lucia, Qld. 4072, Australia

Received 4 June 2006; received in revised form 7 December 2006; accepted 8 December 2006
Available online 23 January 2007

Abstract

Background and Purpose: The sport motivation scale (SMS; [Pelletier, L. G., Fortier, M. S., Vallerand, R. J., Tuson, K. M., Brière, N. M., & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The sport motivation scale (SMS). Journal of Sport and Exercise Psychology, 17, 35–53]) was developed to measure an athlete’s motivation toward sport participation. However, the SMS does not measure the most autonomous form of extrinsic motivation, integrated regulation, which is inconsistent with self-determination theory (SDT; [Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behaviour. New York: Plenum Press]) upon which the instrument is based. Moreover, several studies (e.g., [Martens, M. P., & Webber, S. N. (2002). Psychometric properties of the sport motivation scale: An evaluation with college varsity athletes from the U.S. Journal of Sport and Exercise Psychology, 24, 254–270]) have questioned the factorial validity of the SMS. Hence, the purpose of this study was to develop a revised version of the SMS, including integrated regulation.

Method: In Stage 1, the factorial validity of the SMS was examined using confirmatory factor analysis (CFA) on data collected from 614 Australians (elite athletes and university students). In Stage 2, the scale was revised by including integrated regulation items and replacing problematic items through an iterative process using CFA for data collected from 557 Australian university students. Concurrent validity of the revised scale was examined by evaluating correlations with the dispositional flow scale-2 (DFS-2) [Jackson,

**Results**: The revision led to development of a six-factor 24-item scale (SMS-6) that indicated a more parsimonious and improved fitting model consistent with SDT. Correlations between the SMS-6 and DFS-2 factors support the concurrent validity of the revised scale.

**Conclusion**: From statistical and theoretical viewpoints, the revised SMS-6 was preferable to the original SMS, except for the discriminant validity issue of identification regulation. Further examination of the instrument is necessary by cross-validating the findings from this study.

© 2007 Published by Elsevier Ltd.

**Keywords**: Measurement; Multidimensional motivation; Integrated regulation

---

**Introduction**

Why we do what we do is a perennial question that intrigues psychologists and others who are empowered to influence others (e.g., teachers and coaches). Encouraging others to act, think and behave a certain way is the responsibility of many people, however, motivating others can be quite challenging. Thus, understanding motivational processes is pivotal to positively influencing others. More recent social-cognitive theories of motivation, such as self-determination theory (SDT; Deci & Ryan, 1985), provide a comprehensive understanding of motivational processes, for which there is considerable support in the literature (see Deci & Ryan, 2002).

The basic assumption of SDT is that people are innately and proactively motivated to master their social environment. The main thrust of SDT is not so much what causes intrinsic motivation, but the conditions (e.g., coach’s behaviour) that enhance and maintain this innate propensity to interact with the environment so as to undertake challenges and immerse oneself in the doing of an activity (Ryan & Deci, 2000).

SDT proposes that different types of motivation represent different manifestations of the tendency to differentiate, integrate and actualize oneself within his/her environment. Vallerand (1997) supports Deci and Ryan (1985) that motivation is multidimensional and argued that the varying types of motivation could explain much of human behaviour and therefore must be included in a comprehensive analysis of motivation. Assessing intrinsic and extrinsic motivation in sports is important because different types of motivation have been associated with varying outcomes. For example, research has shown that self-determined forms of motivation, including self-determined extrinsic motivation (SDEM), are linked to several important outcomes associated with sport participation. For example, people with higher levels of self-determined motivation perform better (e.g., Amiot, Gaudreau, & Blanchard, 2004), persist longer (e.g., Pelletier, Fortier, Vallerand, & Brière, 2001), use positive coping strategies in stressful situations (Amiot et al., 2004) and invest more effort in activities (e.g., Pelletier et al., 1995).

**Sport motivation scale (SMS)**

Within the framework of SDT, various scales have been developed to assess varying motivational orientations. Among these, a sport-context motivation measure, SMS, has been...
developed and shown to have satisfactory psychometric properties (Li & Harmer, 1996; Pelletier et al., 1995). The SMS was translated from the original French version, the l’Échelle de motivation dans les sports EMS (Brière, Vallerand, Blais, & Pelletier, 1995), which was adapted from the academic motivation scale (AMS; Vallerand et al., 1992).

The SMS (Pelletier et al., 1995) measures seven forms of motivation: amotivation, external regulation, introjected regulation, identified regulation and intrinsic motivation to know, to accomplish and to experience stimulation. Integrated regulation was not identified as a unique component of extrinsic motivation in either the development of the SMS or its predecessor for assessing academic motivation (Vallerand et al., 1992). Therefore, the SMS does not measure the most self-determining form of extrinsic motivation, integrated regulated behaviours. There has been no published work found that has attempted to measure integrated regulation in sport. Although limited research has examined integrated regulated behaviours in sport, Mallett and Hanrahan (2004) did find that integrated regulation was a major source of motivation for a small group of elite track and field athletes. Consequently, a key aim of this research was to develop a quantitative measure of integrated regulation.

Furthermore, research examining the psychometric properties of the SMS has not shown full support for the factor structure of the instrument. What does emerge from an analysis of the research on the SMS is that there are consistent problems with (a) the lack of factorial validity (i.e., poor fit of the measurement model at both overall and individual parameter levels) reported by Martens and Webber (2002) and Riemer, Fink, and Fitzgerald (2002), and (b) low reliability (i.e., unacceptable internal consistency) reported by Pelletier et al. (1995), Raedeke and Smith (2001), Martin and Cutler (2002) and Vlachopoulos, Karageorghis, and Terry (2000).

One of the factorial validity issues is that the three intrinsic motivation factors are not empirically distinguishable and another is that there are items either cross-loading or not loading well onto hypothesized factors (e.g., Martens & Webber, 2002). Motivation measurement problems within sport might be attributable to the difficulties inherent in finding the correct words to capture the essence of the various forms of motivation (e.g., four forms of extrinsic motivation). This problem may be especially salient for the SMS, as translation from the original French version (EMS) may have contributed to a loss of meaning. A review of the content of the problematic items suggests that some of the wording might be confusing or lack content validity. For example, Item 16 (“Because people around me think it is important to be in shape”) might be perceived as being associated with a sense of embarrassment (introjected regulation) if they do not stay in shape; while others may associate the content with coercion (external regulation). Furthermore, some people might interpret some words too literally. For example, in Item 9 (“Because it is absolutely necessary to do sports if one wants to be in shape”), the use of the word “absolutely” may be too restrictive. It is possible that for many people other forms of exercise might be just as useful as sports for staying in shape.

Thus, this study was conducted to improve the SMS and undertaken in two stages. Because the factorial validity and reliability of the SMS has not been evaluated with Australians, they were reexamined with an Australian sample in the first stage. In the second stage, the SMS was improved by including an integrated regulation subscale and subsequently resolving the problems found in the first stage.
Method

Participants

Sample 1: A total of 614 respondents provided data. Of these, 501 were first-year university students (human movement studies or psychology majors) who were actively engaged in competitive sport at least twice per week. The remaining 113 were athletes who were currently competing and had represented Australia internationally, in either track and field or swimming in the past 2 years. Four levels of sport participation were reported: club or recreational level (43%), state (23%), national (15%) and international (19%) providing a sample representative of all competitive sport performance levels. The most common sports reported were track and field (n = 94), swimming (n = 74), netball (n = 67) and soccer (n = 36). The participants in this study ranged in age from 16 to 51 years (M = 20.1, SD = 3.7) and they had a mean competitive experience of 4.3 years (SD = 3.2) at their highest performance level.

Sample 2: A total of 557 university students (44.2% men) who ranged in age from 16 to 43 years (M = 20.0, SD = 3.5) agreed to participate in this study. Part of the data for this sample was drawn from a larger project (Jackson, 2006). To be eligible for the study, participants had to take part in any sport or physical activity twice weekly. Overall, participants were involved in 49 different physical activities ranging from highly competitive sports such as soccer to exercise activities such as weight training. The most common physical activities reported were soccer (n = 57), netball (n = 48), running (n = 48), rugby (n = 41) and touch football (n = 39). A wide range of highest participation levels was reported, including international (7.1%), national (15.4%), state (39.7%), club or school (20.0%) and recreational (16.5%).

Measures

SMS: The SMS (Pelletier et al., 1995) is a measure of contextual motivation that is intended to identify the perceived reasons for participating in sport. As previously stated, the SMS measures seven forms of motivation reflecting varying degrees of self-determination along a motivation continuum (Deci & Ryan, 1985). Participants are asked to respond to the question, “Why do you practice your sport?” with such items as, “for the pleasure I feel in living exciting experiences”. Participants respond using a seven-point Likert-type scale ranging from 1 = does not correspond at all to 7 = corresponds exactly.

Dispositional flow scale-2 (DFS-2): Data collected from the DFS-2 was used as an external standard (criterion) measure for evaluation of concurrent validity of the SMS. The DFS-2 is designed as a dispositional assessment of flow experience in physical activity settings (Jackson & Eklund, 2004). The factor structure of the DFS-2 corresponds to nine flow dimensions, including challenge–skill balance, sense of control and autotelic experience. Respondents are directed to think about how often they generally experience the characteristics represented by the flow items within a particular activity (e.g., “I have a feeling of total control”) and to rate their responses on a five-point Likert scale, ranging from 1 (never) to 5 (always). Confirmatory factor analyses (CFAs) of the DFS-2 have demonstrated support for the nine-factor model and reliability has also been demonstrated to be satisfactory (Jackson & Eklund, 2004).
Procedures

In the first stage (examination of the factor structure of the SMS), participants were briefed about the procedure of the study and then voluntarily completed the original SMS prior to tutorial classes. Track and field and swimming participants were briefed about the procedure between regular training sessions during the competitive phase of training. In the second stage (development of a revised SMS), participants completed a questionnaire package that included (a) the SMS, (b) additional items measuring integrated regulation (five items) and potential replacement items (seven items) for the identified problematic items of the SMS and (c) the DFS-2, prior to lectures. Participants in both stages completed the questionnaires after informed consent was obtained.

Development of integrated regulation items: The development of items measuring integrated regulations was based initially on two-way discussions with Pelletier (personal communications, 6th and 9th February 2001) and subsequently refined through consensual agreement between four other experienced researchers in sport motivation. The five items developed for subsequent analysis were:

(a) “Because it is an extension of me”.
(b) “Because participation in my sport is consistent with my deepest principles”.
(c) “Because participation in my sport is an integral part of my life”.
(d) “Because through my sport, I feel that I can now take responsibilities for changes in my life”.
(e) “Because it is part of the way in which I’ve chosen to live my life”.

Development of replacement items for the SMS: Four experienced researchers in sport motivation developed potential replacement items for the original SMS in two separate discussions producing seven additional mutually agreed measurement items:

(a) “I don’t seem to be enjoying my sport as much as I previously did” (amotivation).
(b) “I don’t know anymore if I want to continue to invest my time and effort as much in my sport anymore” (amotivation).
(c) “For the socio-economic benefits of being an athlete” (external regulation).
(d) “Because I don’t want to disappoint others if I do not play my sport” (introjected regulation).
(e) “Because training hard will improve my performance” (identified regulation).
(f) “Because it is good way to socialize” (identified regulation).
(g) “For the adrenaline that I experience” (IM-stimulation).

Statistical analyses

Stage 1: CFAs were conducted by using a robust maximum likelihood method with EQS 6.1 (Bentler, 2006). CFA tests the hypothesized, underlying model and is considered a robust test of factorial validity. Little missing data were found for the responses to the SMS from both samples (0.15% and 0.08% for Samples 1 and 2, respectively) and were treated by the Expectation Maximization Algorithm. To identify the scale of a measurement model, one of the factor
loadings was fixed to 1.0. No cross-loading of items were postulated and all factors were allowed to correlate freely.

Overall fit of the models with the data was evaluated by using multiple fit indices, such as the comparative fit index (CFI; Bentler, 1990), the Bentler–Bonett non-normed fit index (NNFI; Bentler & Bonett, 1980), the standardized root mean residual (SRMR; Hu & Bentler, 1998) and the root mean square error of approximation (RMSEA; Steiger, 1990). In addition, Akaike information criterion (AIC; Akaike, 1987) was used to facilitate model comparisons, especially for non-nested models. Values on the CFI and NNFI that are greater than 0.90 and 0.95 are generally taken to reflect acceptable and excellent fits to the data, respectively. For the RMSEA, values of 0.05 or less indicate a close fit, and 0.08 or less indicate an adequate fit (Browne & Cudeck, 1993). For completeness, the 90% confidence interval is also provided for RMSEA. Values on the SRMR that are less than 0.08 indicate an adequate fit (Hu & Bentler, 1999). In a well-fitting model, this value should be less than 0.05 and close to zero (Bollen, 1989; Byrne, 2006). Although there are no criterion values for the AIC, the model that produces the minimum AIC may be considered to be a potentially useful model because AIC favours parsimonious models (Bentler, 2006). To evaluate individual fit, items were carefully examined based on (a) standardized factor loadings, (b) standardized residuals and (c) Lagrange Multiplier (LM) test. Following Kline (2005), items associated with several standardized residuals greater than 0.10 were considered statistically problematic.

Items loading adequately on to their hypothesized factors were indicators of convergent validity. Discriminant validity was investigated through inspection of the inter-factor correlations corrected for attenuation. This method (as highlighted by Bagozzi & Kimmel, 1995) assumes discrimination when the attenuated correlation (i.e., the correlation plus 1.96 times its standard error) is less than 1.

Stage 2: First, the factorial validity of the original SMS was tested again, using CFA, with another independent sample. Confirmation of a poor solution supported the development of a revised SMS, with several potential replacement items. The replacement of problematic items for a revised SMS was conducted through an iterative process using CFA. To allow the performance of each potential item to be evaluated based on the three criteria described above, a single item was introduced into an eight-factor measurement model (i.e., original seven factors with integrated regulation developed in this stage). This process was repeated until a conceptually and empirically optimal 32-item solution was identified for the model (Jackson & Eklund, 2002).

In an attempt to resolve the lack of discriminant validity between the IM factors, single first- and higher-order CFAs were conducted on these factors. The first- and higher-order models produced poor solutions, therefore, the decision was made to develop a single IM scale of four optimal items derived from theoretical and statistical considerations. Finally, CFA was conducted for the six-factor model and its solution was compared with those of the original seven- and revised eight-factor models.

Pearson correlations between the best fitting model of the SMS and the DFS-2 were calculated to assess concurrent validity. This assessment is also important from a practical perspective (Byrne, Stewart, & Lee, 2004) as practitioners in sport and exercise psychology might be interested in knowing how motivation relates to optimal experience in sport.
Results

Stage 1: CFA of the SMS

Overall, the hypothesized seven-factor model provided poor fit to the data (see Model 1a in Table 1). Although values for the RMSEA and SRMR were acceptable, values on the CFI and NNFI were below minimum acceptable levels. All factor loadings were statistically significant, ranging from 0.49 to 0.83 ($M = 0.68$) providing evidence that all items loaded onto their proposed factors. However, there were seven items that were associated with several standardized residuals greater than 0.10 (Items 1, 2, 6, 7, 9, 16 and 24) and they were deemed to be responsible for model misspecification. LM test indicated that the model fit could be improved if error terms between Items 7 and 24 were correlated and Item 16 (external regulation) also loaded on introjected regulation. One possible cause of correlated errors is substantial overlap in item content (Byrne, 2006), as shown in the content of Items 7 and 24.

Inter-factor correlations were calculated to examine discriminant validity. The strongest correlations were between the three intrinsic motivation factors. IM-accomplishment strongly

<table>
<thead>
<tr>
<th>Model</th>
<th>$S-B \chi^2$</th>
<th>df</th>
<th>CFI</th>
<th>NNFI</th>
<th>SRMR</th>
<th>RMSEA (90% CI)</th>
<th>AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: ($n = 614$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1a Original (7)</td>
<td>1107.112</td>
<td>329</td>
<td>0.857</td>
<td>0.836</td>
<td>0.061</td>
<td>0.062 (0.058–0.066)</td>
<td>449.112</td>
</tr>
<tr>
<td>Stage 2: ($n = 557$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1b Original (7)</td>
<td>1066.991</td>
<td>329</td>
<td>0.878</td>
<td>0.860</td>
<td>0.062</td>
<td>0.062 (0.059–0.068)</td>
<td>408.991</td>
</tr>
<tr>
<td>M2 Revised (8)</td>
<td>997.395</td>
<td>436</td>
<td>0.925</td>
<td>0.914</td>
<td>0.046</td>
<td>0.048 (0.044–0.052)</td>
<td>125.395</td>
</tr>
<tr>
<td>M3 Revised (6)</td>
<td>560.713</td>
<td>237</td>
<td>0.934</td>
<td>0.923</td>
<td>0.044</td>
<td>0.050 (0.044–0.055)</td>
<td>86.713</td>
</tr>
</tbody>
</table>

Note: CFI = comparative fit index; NNFI = non-normed fit index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval for the RMSEA point estimate; AIC = Akaike information criteria. Values in parentheses represent the number of factors in a model.

Table 2

Inter-factor correlations (lower diagonal), attenuated correlations (upper diagonal) and internal consistencies (diagonal) for the 24-item SMS-6

<table>
<thead>
<tr>
<th>Factor</th>
<th>AM</th>
<th>EXT</th>
<th>ITJ</th>
<th>IDT</th>
<th>ING</th>
<th>IM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amotivation (AM)</td>
<td>(0.86)</td>
<td>0.33</td>
<td>0.29</td>
<td>0.14</td>
<td>−0.26</td>
<td>−0.19</td>
</tr>
<tr>
<td>External regulation (EXT)</td>
<td>0.20</td>
<td>(0.80)</td>
<td>0.79</td>
<td>0.84</td>
<td>0.79</td>
<td>0.66</td>
</tr>
<tr>
<td>Introjected regulation (ITJ)</td>
<td>0.13</td>
<td>0.62</td>
<td>(0.78)</td>
<td>0.82</td>
<td>0.95</td>
<td>0.57</td>
</tr>
<tr>
<td>Identified regulation (IDT)</td>
<td>0.01</td>
<td>0.68</td>
<td>0.63</td>
<td>(0.70)</td>
<td>1.14</td>
<td>1.05</td>
</tr>
<tr>
<td>Integrated regulation (ING)</td>
<td>−0.10</td>
<td>0.62</td>
<td>0.73</td>
<td>0.93</td>
<td>(0.83)</td>
<td>0.91</td>
</tr>
<tr>
<td>Intrinsic motivation (IM)</td>
<td>−0.10</td>
<td>0.54</td>
<td>0.44</td>
<td>0.91</td>
<td>0.75</td>
<td>(0.81)</td>
</tr>
</tbody>
</table>

Note: Absolute correlation values above 0.02 are significant at $p < 0.05$. Attenuated correlation values greater than 1.0 mean that the pair of factors are not empirically distinguishable (Bagozzi & Kimmel, 1995). Coefficient alpha of the SMS-6 subscale scores are presented in parentheses along the diagonal.
correlated with IM-knowledge (0.92) and to a lesser extent with IM-stimulation (0.84) causing some concerns with the discriminant validity of the IM factors. Therefore, inter-factor correlations were corrected for attenuation and it was found that IM-accomplishment and IM-stimulation were empirically distinguishable whereas IM-accomplishment and IM-knowledge were not (Bagozzi & Kimmel, 1995).

Internal consistencies of the SMS: The internal consistency of the factors of the SMS was assessed using Cronbach alpha. The coefficients ranged from 0.73 to 0.82 with a mean of 0.77, which are considered acceptable (Nunnally & Bernstein, 1994). Inconsistent with previous research employing the SMS (e.g., Martin & Cutler, 2002; Raedeke & Smith, 2001; Riemer et al., 2002) acceptable alphas were found for all seven factors.

Stage 2: CFA of the SMS and revised SMS

As presented in Table 1, results of the CFA on the original SMS provided poor fit to the data from Sample 2 (Model 1b). Therefore, problematic items identified in Stage 1 were replaced with potential measurement items based on the item selection process described earlier. As a result, six of seven potential items were selected to replace original problematic items, and four of five items measuring integrated regulation were also chosen. The revised scale consisting of 32 items (four items per factor) is called the SMS-8 hereafter. The measurement model for the SMS-8 provided acceptable fit to the data (Model 2 in Table 1). Because Models 1 and 2 were not nested, the AIC values were compared for the models. The AIC value for Model 2 was far smaller than that for Model 1 indicating a superior fitting model. In addition, all factor loadings were statistically significant, ranging from 0.47 to 0.89 ($M = 0.73$) and no cross-loading was detected with the LM test. However, examination of attenuated correlations (discriminant validity) revealed that four pairs of factors were not statistically distinguishable with this sample: IM-accomplishment from both IM-knowledge and IM-stimulation, identified regulation from IM-accomplishment and integrated regulation.

As the lack of discriminant validity of the IM factors was consistently found in both Stages 1 and 2, it was attempted to resolve this issue. First, referring to previous studies (Li & Harmer, 1996; Riemer et al., 2002), single first- and higher-order models were examined. Although Li and Harmer and Riemer et al. reported goodness-of-fit indices for the higher-order model, the solution was improper here because of the negative variance of IM-accomplishment. In addition, the single first-order factor (i.e., unidimensional) model provided poor fit to the data from Sample 2: $S-B \chi^2$ ($54$) = 389.59, CFI = 0.867, NNFI = 0.837, SRMR = 0.068 and RMSEA = 0.106. These results suggested that both models on all 12 items were not a resolution to the lack of discriminant validity of the IM factors. As a result, an optimal set of four items (see the Appendix) representing the IM as a single scale was chosen from theoretical and statistical considerations. The fit of the four-item model to the data was excellent: $S-B \chi^2$ ($2$) = 8.817, CFI = 0.983, NNFI = 0.950, SRMR = 0.024 and RMSEA = 0.078. All four items significantly loaded onto IM, ranging from 0.67 to 0.77 ($M = 0.73$). (The single first- and higher-order models as well as the four-item model were also examined for Sample 1 and the same results were obtained as reported here for Sample 2.)

Finally, CFA was conducted for the six-factor model (referred to SMS-6 hereafter) and the fit of the model was acceptable (Model 3 in Table 1). For model comparison, the AIC value of this...
model was much smaller than Models 1b and 2. This result suggested that the measurement model for the SMS-6 (see the Appendix) provided the best and most parsimonious fit to the data. In addition, all items loaded onto their hypothesized factors significantly—factor loadings were from 0.47 to 0.84 ($M = 0.71$). However, because the same sample was used as the SMS-8, the issue that identified regulation was not statistically unique from the IM and integrated regulation remained.

Acknowledging this issue, following previous studies (Li & Harmer, 1996; Riemer et al., 2002), the simplex pattern of the SMS-6 was examined by constructing an SEM model. As presented in Fig. 1, paths between each pair of the factors were specified only between adjacent levels in the proposed model (i.e., amotivation $\rightarrow$ external regulation $\rightarrow$ introjected regulation $\rightarrow$ identified regulation $\rightarrow$ integrated regulation $\rightarrow$ intrinsic motivation). Indirect effects were estimated as the product of direct effects comprising them (Kline, 2005). For example, the indirect effects between amotivation (AM) and introjected regulation (ITJ) through external regulation (EXT) was statistically estimated as the product of standardized coefficients for the paths AM $\rightarrow$ EXT $\rightarrow$ ITJ (see Fig. 1). As expected, goodness-of-fit indices for the simplex model were worse than those for the corresponding CFA, but they were still acceptable: $S-B \chi^2 (247) = 691.639$, $CFI = 0.909$, $NNFI = 0.898$, $SRMR = 0.070$, $RMSEA = 0.052$ and $AIC = 197.639$. All path coefficients were statistically significant (see Table 3), indicating that each factor was substantively related to the next in a linear sequence (Li & Harmer, 1996).

To evaluate a simplex model appropriately, Marsh (1993) recommended comparing inter-factor correlations between the simplex model and its corresponding measurement models. He argued that if the simplex model fails to reproduce the correlations with reasonable accuracy, then that model should be rejected even if its fit is acceptable. Comparison of the inter-factor correlations produced by the two models revealed that although there were discrepancies in the size of some correlations, the overall correlation patterns were reasonably similar (see Tables 2 and 3). In addition, the LM test statistics were examined for model misspecification. Because a large LM statistic was observed for the path from external regulation to identified regulation, the direct relationship between these two factors was estimated by specifying the path in the simplex model. Although the size of this path obtained from the

Fig. 1. The simplex structure model for the SMS-6. This figure was adapted from Li and Harmer (1996). For clarity, observed variables and error terms are omitted. Solid lines indicate direct effects for the adjacent levels of motivational orientation; whereas, dotted lines indicate indirect effects for the non-adjacent levels of motivational orientation.
Table 3
Standardized parameter estimates of direct and indirect effects for the simplex model of the SMS-6

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct effects</th>
<th>Residual variances</th>
<th>Indirect effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AM</td>
<td>EXT</td>
</tr>
<tr>
<td>Amotivation (AM) → external regulation (EXT)</td>
<td>0.19</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>EXT → introjected regulation (ITJ)</td>
<td>0.68</td>
<td>0.73</td>
<td>ITJ</td>
</tr>
<tr>
<td>ITJ → identified regulation (IDT)</td>
<td>0.74</td>
<td>0.68</td>
<td>IDT</td>
</tr>
<tr>
<td>IDT → integrated regulation (ING)</td>
<td>0.99</td>
<td>0.14</td>
<td>ING</td>
</tr>
<tr>
<td>ING → intrinsic motivation (IM)</td>
<td>0.76</td>
<td>0.66</td>
<td>IM</td>
</tr>
</tbody>
</table>

Note: All direct effects are statistically significant at p<0.05. Standardized residual variances are proportions of the variances unexplained by each of the preceding factors. Indirect effects are estimated as the product of direct effects comprising them (e.g., AM → ITJ = 0.19 × 0.68 = 0.13).

aThese effects are not indirect effects but direct effects specified in the simplex model (Kline, 2005).

non-adjacent pair was moderate (β = 0.37), it was substantively weaker than the one from the adjacent pair of factors (i.e., β = 0.68 between external regulation and introjected regulation). Thus, these results in general confirmed the hypothesized simplex structure underlying the SMS-6 for the present sample.

**Concurrent validity**

Concurrent validity of the revised SMS was evaluated by examining Pearson product–moment correlations between the SMS-6 and the DFS-2. Theoretically, individuals who are intrinsically motivated should be more likely to experience flow because they will be interested in the task at hand (Deci & Ryan, 1985). Hence, it was expected that the intrinsic motivation factor would be positively and substantially correlated with the factor of the DFS-2 whereas the external motivation and amotivation factors would show negative or no significant correlations with the flow factors. Results presented in Table 4 support these hypotheses and further confirm the validity of the SMS-6.

**Internal consistencies of the SMS-6**

The internal consistency of the SMS-6 was assessed using Cronbach alpha. As shown in Table 2, all the coefficients were above 0.70 with a mean of 0.78.

**Discussion**

The primary aim of this research was to improve the SMS and several outcomes from this research have advanced the measurement of various forms of motivation based on SDT (Deci & Ryan, 1985). Specifically, (a) items measuring integrated regulated extrinsic motivation were
developed and found to possess satisfactory levels of construct validity, (b) the replacement of several problematic items improved the factorial validity of the revised SMS, and (c) a solution to the poor discriminant validity of the IM factors was found.

The reexamination of the 28-item SMS (Pelletier et al., 1995), conducted in Stage 1, revealed that although the subscale responses were found to be internally consistent, the measurement model of the SMS did not fit responses from the present Australian sample. Previous research on the SMS has also reported problems with poor fit of the measurement model at both overall and individual levels (Martens & Webber, 2002; Riemer et al., 2002). Careful examination of standardized residuals and LT test revealed that several items were responsible for the model misspecification. In addition, the lack of discriminant validity between the IM factors was also found in this study. These findings are consistent with Martens and Webber’s (2002) study.

Therefore, a revised SMS was argued on three central issues: (a) the inclusion of items measuring integrated regulation on theoretical grounds (Martens & Webber, 2002), (b) revision of the wording of statistically and theoretically problematic items to improve the factorial validity of the SMS, and (c) a resolution of the lack of discriminant validity of the three IM factors.

Integrated regulation was proposed by Deci and Ryan (1985) in SDT and supported by recent qualitative research on elite athletes (Mallett & Hanrahan, 2004). Items measuring this most self-determining form of extrinsic motivation were found to possess satisfactory levels of construct validity. The four items were found to be internally consistent ($\alpha = 0.83$) and each loaded well onto integrated regulation (all $R_s > 0.70$). Moreover, as expected integrated regulation significantly and positively correlated with various factors of flow (e.g., autotelic experience, sense of control). The ability to quantitatively measure this form of extrinsic motivation is an important development in a revised SMS. The measurement of integrated regulations provides a more complete examination of an important source of extrinsic motivation that has been reported by elite athletes (Mallett & Hanrahan, 2004).

Table 4
Correlations between the factors of the SMS-6 and DFS-2

<table>
<thead>
<tr>
<th>DFS-2 factor</th>
<th>AM</th>
<th>EXT</th>
<th>ITJ</th>
<th>IDT</th>
<th>ING</th>
<th>IM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge–skill</td>
<td>0.83</td>
<td>-0.18</td>
<td>0.28</td>
<td>0.10</td>
<td>0.29</td>
<td>0.34</td>
</tr>
<tr>
<td>Autotelic experience</td>
<td>0.80</td>
<td>-0.31</td>
<td>0.18</td>
<td>0.16</td>
<td>0.29</td>
<td>0.32</td>
</tr>
<tr>
<td>Concentration</td>
<td>0.85</td>
<td>-0.18</td>
<td>0.14</td>
<td>0.09</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>Sense of control</td>
<td>0.84</td>
<td>-0.18</td>
<td>0.17</td>
<td>0.18</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td>Clear goals</td>
<td>0.79</td>
<td>-0.28</td>
<td>0.17</td>
<td>0.14</td>
<td>0.30</td>
<td>0.32</td>
</tr>
<tr>
<td>Action awareness</td>
<td>0.87</td>
<td>-0.06</td>
<td>0.24</td>
<td>0.13</td>
<td>0.18</td>
<td>0.27</td>
</tr>
<tr>
<td>Unambiguous feedback</td>
<td>0.88</td>
<td>-0.11</td>
<td>0.13</td>
<td>0.15</td>
<td>0.18</td>
<td>0.27</td>
</tr>
<tr>
<td>Time transformation</td>
<td>0.87</td>
<td>-0.09</td>
<td>0.06</td>
<td>0.13</td>
<td>0.16</td>
<td>0.20</td>
</tr>
<tr>
<td>Lose self-consciousness</td>
<td>0.87</td>
<td>-0.18</td>
<td>-0.06</td>
<td>0.03</td>
<td>0.07</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Note: AM = amotivation; EXT = external regulation; ITJ = introjected regulation; IDT = identified regulation; ING = integrated regulation; IM = intrinsic motivation. Absolute correlation values of 0.09 and above are significant at $p < 0.05$. 
In addition, several studies identified some consistent problems with the factor structure of the SMS (e.g., Martens & Webber, 2002; Martin & Cutler, 2002; Pelletier et al., 1995; Raedeke & Smith, 2001; Riemer et al., 2002; Vlachopoulos et al., 2000). Through iterative process of CFA, overall, six items were replaced removing some of the items that either cross-loaded or loaded poorly onto hypothesized factors. This replacement produced superior global fit of the measurement model of the revised SMS-8 (i.e., the revised SMS plus integrated regulation). The third key issue centred on the lack of discrimination between the three forms of IM. Replacing one item from the IM-stimulation improved the internal consistency of the factor but did not resolve the lack of discriminant validity between the IM factors with the SMS-8. The inability of a single first- or higher-order model for the IM factors necessitated the identification of an optimal set of four items representing the three forms of IM (accomplishment, knowledge and stimulation) on both conceptual and statistical grounds. In determining the optimal set of four items measuring a single scale IM, the loadings and operational definitions of Deci and Ryan’s (1985) conceptualization of intrinsic motivation were considered. The results supported the single scale of IM, which includes four items measuring all three forms of IM proposed by Vallerand (1997)—accomplishment (two items), knowledge and stimulation.

Although a solution for the issue of discriminant validity for the IM factors was found, the issue that the identification factor was not statistically distinguishable from the IM and integrated factors remained. In this study, a problematic item of the identified subscale was replaced through an iterative process using CFA, but this replacement was not enough to resolve the discriminant validity issue of the identified factor. As the SMS-6 was developed through the revision of the original SMS (Pelletier et al., 1995) with an Australian sample, the discriminant validity issue of the identified regulation factor should be examined with different samples in order to know if this problem shown in this study was sample specific. The issue of discriminant validity between identified regulation and other factors in the SMS has not been reported in previous research examining the psychometric properties of the SMS. However, Hagger, Chatzisarantis, and Biddle (2002) reported a problem distinguishing statistically between the IM and identified regulation factors in another self-report instrument based on SDT. Their resolution was to amalgamate the two factors into a single latent factor. In this study, the integrated factor showed better internal consistency than the identified factor and could be distinguished statistically from the IM factor despite it measuring the most self-determining form of extrinsic motivation. Considering this finding, some items of the identified regulation factor should be replaced if the issue of discriminant validity is replicated with other samples. In such a case, potential items of the identified regulation subscale should be developed to make this factor empirically distinguishable from the IM and integrated regulation factors. However, there is also a possibility that the factorial structure between the identified and integrated regulations might be unclear for most sport participants.

Marsh and Jackson (1999) emphasize that construct validation is an ongoing process and cannot be accomplished in one single study and although this research progressed measurement of sport motivation based on Deci and Ryan’s SDT (1985), further examination of the SMS-6 is required. Future research is necessary to cross-validate the results of this study with various samples from Australia as well as other English-speaking communities.
Acknowledgements

The authors acknowledge Prof. Luc Pelletier for his feedback on some of the integrated regulation items and the constructive feedback from the anonymous reviewers.

Appendix. Sport motivation scale-6

Using the scale below, please indicate to what extent each of the following items corresponds to one of the reasons for which you are presently practising your sport.

<table>
<thead>
<tr>
<th>Does not correspond at all</th>
<th>Corresponds a little</th>
<th>Corresponds moderately</th>
<th>Corresponds a lot</th>
<th>Corresponds exactly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Why do you practice your sport?**

1. For the excitement I feel when I am really involved in the activity
2. Because it’s part of the way in which I’ve chosen to live my life
3. Because it is a good way to learn lots of things which could be useful to me in other areas of my life
4. Because it allows me to be well regarded by people that I know
5. I don’t know anymore; I have the impression of being incapable of succeeding in this sport
6. Because I feel a lot of personal satisfaction while mastering certain difficult training techniques
7. Because it is absolutely necessary to do sports if one wants to be in shape
8. Because it is one of the best ways I have chosen to develop other aspects of my life
9. Because it is an extension of me
10. Because I must do sports to feel good about myself
11. For the prestige of being an athlete
12. I don’t know if I want to continue to invest my time and effort as much in my sport anymore
13. Because participation in my sport is consistent with my deepest principles
14. For the satisfaction I experience while I am perfecting my abilities
15. Because it is one of the best ways to maintain good relationships with my friends
16. Because I would feel bad if I was not taking time to do it
17. It is not clear to me anymore; I don’t really think my place is in sport
18. For the pleasure of discovering new performance strategies
19. For the material and/or social benefits of being an athlete
20. Because training hard will improve my performance
21. Because participation in my sport is an integral part of my life
22. I don’t seem to be enjoying my sport as much as I previously did
23. Because I must do sports regularly 1 2 3 4 5 6 7
24. To show others how good I am at my sport 1 2 3 4 5 6 7

Key
Amotivation 5, 12, 17, 22 Identified Regulation 3, 8, 15, 20
External Regulation 4, 11, 19, 24 Integrated Regulation 2, 9, 13, 21
Introjected Regulation 7, 10, 16, 23 Intrinsic Motivation 1, 6, 14, 18

References


