

Psychometric Properties of the Sport Motivation Scale: An Evaluation With College Varsity Athletes From the U.S.

Matthew P. Martens and S. Nicole Webber
University of Missouri–Columbia

Motivation, particularly different types of motivation (i.e., intrinsic, extrinsic, and amotivation), is a topic that has been of interest to both psychologists and sport psychologists. One area of interest in sport psychology is the assessment of different types of motivation. The Sport Motivation Scale (SMS) (Pelletier et al., 1995) was created to assess an athlete's intrinsic motivation, extrinsic motivation, and amotivation toward sport participation. The psychometric properties of the SMS, however, have not been tested on a sample of college athletes in the U.S., which is an important component if researchers and applied sport psychologists are to use the SMS with this population. A total of 270 U.S. college athletes participated in this study. Results provided some evidence for the reliability and validity of the SMS for this population, although a confirmatory factor analysis yielded relatively poor fit indices, indicating problems with model specification. A "piecewise" model testing approach, in which different components of the model were tested separately, indicated that the biggest problems with model specification may involve the extrinsic and amotivation components of the measure.

Key Words: intrinsic, measurement, assessment

Two aspects of motivation that have received attention from sport and exercise psychologists over the years are the constructs of intrinsic and extrinsic motivation. The idea of intrinsic motivation has its roots in the work of White (1959), who described a concept called effectance motivation. Briefly, White argued that traditional motivation theories such as Hull's drive theory and Freud's psychoanalytic theory did not fully explain an individual's motivation. According to White, individuals are inherently motivated to achieve competence over their environment, resulting in feelings of self-efficacy. Hence he termed this phenomenon effectance motivation. Effectance motivation is similar to what is now described as intrinsic motivation, or engaging in an activity purely for the pleasure and satisfaction derived from that activity (Deci & Ryan, 1985). White believed that organisms have an intrinsic need to gain competence over their environments.

A second important step in the development of theory related to intrinsic and extrinsic motivation is the work of Harter (1978). While supporting White's main

M.P. Martens is now in the Dept. of Education & Counseling Psychology, SUNY–Albany, Albany, NY 12222; S.N. Webber is with the Dept. of Education & Counseling Psychology, Univ. of Missouri–Columbia, Columbia, MO 65201.

ideas regarding effectance motivation, Harter considered the theory somewhat incomplete. She proposed a comprehensive extension of White's ideas, rooted in a developmental perspective. A few aspects of that model that are relevant to the present study will be discussed further. First, Harter recognized that effectance motivation might consist of several components, indicating that the construct should not be viewed as a global entity. Second, while White's work only addressed effectance or intrinsic motivation, Harter believed it was important to assess both intrinsic and extrinsic motivation. Third, Harter stated that it was important to recognize the importance of certain correlates of intrinsic and extrinsic motivation, specifically perceived competence and perception of control. Thus, while still supporting the core of White's original ideas, Harter provided a comprehensive extension to theory related to intrinsic and extrinsic motivation.

The ideas of White and Harter were further developed by Deci and Ryan (1985) when they formed a theory called cognitive evaluation theory (CET), which they conceptualized as a subtheory under the larger construct of self-determination theory (SDT) (Ryan & Deci, 2000). Their ideas regarding CET were formulated from results of laboratory experiments and have been tested in field studies in a variety of settings. Briefly, according to CET, an individual's intrinsic motivation toward an activity will parallel the perceived autonomy over that activity, and that perceived ability will also influence intrinsic motivation (Deci & Ryan, 1985; Ryan & Deci, 2000). In other words, more personal control and higher levels of competence toward an activity will result in higher levels of intrinsic motivation. This state of high perceived competence and high autonomy does not necessarily cause intrinsic motivation; rather, it elicits such motivation toward an activity.

Both CET and SDT also address the construct of extrinsic motivation, which is defined as performing an activity in order to obtain a separate outcome (Deci & Ryan, 1985; Ryan & Deci, 2000). Thus, the core of extrinsic motivation contrasts with that of intrinsic motivation, as the individual engages in an activity for some purpose (e.g., a reward) rather than for the inherent satisfaction of the activity itself. Extrinsic motivation according to SDT, however, is conceptualized somewhat differently than intrinsic motivation, as extrinsic motivation contains levels that vary in terms of personal autonomy. At the low end (less autonomy) of the extrinsic continuum is the construct of external regulation, which involves motivation for compliance or reward/punishment purposes. At the high end (more autonomy) are the constructs of identified and integrated regulation, which involve motivation out of feelings of personal importance or synthesis with self.

These types of motivation are still considered extrinsic because they do not involve inherent interest in the activity itself, but involve more autonomy than other forms of extrinsic motivation (Deci & Ryan, 1985; Ryan & Deci, 2000). Deci and Ryan have also conceptualized the idea of amotivation, which has been described as a situation in which the individual sees no contingency between his or her actions and the outcome of those actions (Fortier, Vallerand, Briere, & Provencher, 1995). Thus, amotivated individuals often experience incompetence and a lack of control toward the specified activity (Ryan & Deci, 2000).

In summary, the work of Harter (1978) and Deci and Ryan (1985) has been built upon White's (1959) original ideas regarding effectance motivation. Harter further refined the original theory by extending the model to include different components of effectance motivation, correlates of effectance motivation, and a recognition of the importance of extrinsic motivation. Deci and Ryan have furthered the

thinking in this area by developing comprehensive models that explain the relationship of perceived competence and autonomy to intrinsic and extrinsic motivation. Given the theoretical foundation in this area, we now turn our attention to understanding why it might be important for sport psychologists to differentiate between intrinsic and extrinsic motivation.

The Importance of Intrinsic and Extrinsic Motivation

Assessing intrinsic and extrinsic motivation in sport settings is important because different types of motivation have been associated with different experiential outcomes. For example, high intrinsic motivation has been associated with increased enjoyment of an activity (Brustad, 1988; Scanlan & Lewthwaite, 1984), a desire to pursue challenges (Wong & Bridges, 1995), better sportsmanship (Vallerand & Losier, 1994), and decreased dropout from sport (Gill, Gross, & Huddleston, 1983). In contrast, high extrinsic motivation has been associated with increased state anxiety in young athletes (Scanlan & Lewthwaite, 1984), a tendency to attribute participation in sport to rewards gained instead of the sport itself (Watson, 1984), and increased dropout from sport (Lindner, Johns, & Butcher, 1991).

Thus it would be useful for sport psychologists to have an understanding of the levels of intrinsic and extrinsic motivation in athletes, because these constructs seem to be directly related to intensity of participation and persistence of effort. In turn, intensity and persistence of effort should influence the quality of an athlete's performance. By helping athletes develop greater self-awareness in regard to their levels of intrinsic and extrinsic motivation, it would be possible to help them understand, for example, why they no longer enjoy their sport like they used to. Further, given that intrinsic motivation is related to perceived competence and control, athletes could be taught how to enhance intrinsic motivation toward their sport.

Measuring Intrinsic and Extrinsic Motivation

Given the relationships in the sport setting between intrinsic and extrinsic motivation and various outcomes, it is important for researchers in sport psychology to be able to assess intrinsic and extrinsic motivation. The topic of motivation has been well studied in sport and exercise psychology, with at least 37 published scales devoted to exercise motivation and at least 20 devoted to sport motivation (Ostrow, 1996). Several scales focus on intrinsic and extrinsic motivation, including the Motivation for Physical Activity Measure (Frederick & Ryan, 1993; Ryan, Frederick, Lipes, Rubio, & Sheldon, 1997), the Exercise Motivation Scale (Li, 1999), and the Sport Motivation Scale (SMS) (Pelletier, Tuson, Fortier, et al., 1995). It is the SMS that is the focus of this study.

Originally created in French, the SMS was translated into English and validated by Pelletier et al. (1995). The SMS is designed to represent the self-determination continuum (SDC) of Deci and Ryan (1985) and Ryan and Deci (2000), and consists of seven subscales: amotivation, external regulation, introjection, identification, intrinsic motivation to know, intrinsic motivation to accomplish, and intrinsic motivation to experience stimulation. Amotivation is considered to be at the low-autonomy end of the SDC, followed by external regulation (engaging in a behavior for the purpose of an external reward), introjection (a former extrinsic

source of motivation is internalized), and identification (engaging in a behavior out of choice, e.g., because it is part of a growth process, but for extrinsic reasons), with the three intrinsic subscales simultaneously occupying the high-autonomy end of the continuum.

Notably, this scale deviates slightly from the hypothesized SDC. The SDC contains the construct of integrated regulation, which is not specifically included on the SMS, and the SDC does not specify different types of intrinsic motivation (Ryan & Deci, 2000). The SMS, however, is theoretically consistent with the SDC, as individuals with the lowest amount of competence and personal control toward an activity would experience amotivation, those with the highest amounts would experience intrinsic motivation, and those in-between would experience one of the extrinsic subscales.

Pelletier et al. (1995) used a confirmatory factor analysis (CFA) to assess the psychometric properties of the translated SMS. They concluded there was a good fit for the hypothesized model on a sample of 593 Canadian university athletes. Using the chi-square test, the hypothesized model was significant, $\chi^2(329, N = 593) = 637.49, p < .001$, indicating a poor fit. Based on the large sample size, however, a significant chi-square may be expected. Pelletier et al. concluded that other indices revealed an acceptable fit: Goodness-of-fit index (GFI) = .94, adjusted goodness-of-fit index (AGFI) = .92, NFI (normed fit index) (Bentler & Bonett, 1980) = .92, root mean square residual (RMR) (Jöreskog & Sorbom, 1989) = .05. Values on the GFI, AGFI, and NFI that are .90 or above have generally been considered indicative of an acceptable fit, as are values on the RMR that are .05 or less.¹

Pelletier et al. also reported adequate internal consistency, with alpha scores on six of the seven subscales ranging from .74 to .80, with the internal consistency score of the identification subscale slightly lower (.63). Finally, they supported the existence of the SDC by finding that subscales closer to each other on the continuum (e.g., amotivation/external regulation) were correlated more highly in a positive direction than those farther apart on the continuum (e.g., external regulation/intrinsic motivation to know). Such a pattern is known as a simplex pattern. Intrinsic motivation subscales were more highly correlated in a positive direction with other intrinsic subscales than extrinsic subscales, and vice-versa.

Li and Harmer (1996) also assessed the psychometric properties of the SMS, using a sample of 857 college students enrolled in activity classes. They conducted an initial CFA of the seven-factor SMS and reported adequate psychometric properties: Tucker-Lewis index (TLI) (Bentler & Bonett, 1980) = .90; comparative fit index (CFI) (Bentler, 1990) = .91; root mean square error of approximation (RMSEA) = .08. Values on the TLI and CFI that are .90 or above have generally been considered indicative of a good model fit, although recent evidence from simulation studies supports a cutoff value of .95 (Hu & Bentler, 1999).

Hu and Bentler (1999) also supported a .06 cutoff value on the RMSEA, while others have suggested .08 as a cutoff for adequate model fit (Browne & Cudeck, 1993). Hu and Bentler also combined the three intrinsic subscales into one subscale and tested the simplex pattern of the SMS using structural equation modeling. Results indicated that the simplex pattern emerged for this sample of

¹See Hu and Bentler (1999) for more recent evidence regarding indices that indicate an acceptable model fit.

college students, as analyses yielded a well-fitting model for both males and females: TLI = .94–.95, CFI = .98–.99, RMSEA = .08. Thus, results of this analysis support the hypothesized SDC (Deci & Ryan, 1985; Ryan & Deci, 2000) of the SMS.

Although these two studies provide good support regarding the psychometric properties of the SMS, the measure has yet to be validated on a sample of college athletes from the United States. Validating the psychometric properties of the SMS on a sample of college athletes would serve two main purposes. One purpose involves the issue of replication, or validating a theoretical model across several populations. According to Bollen (1989), “replication is an important check on whether an association is a sampling fluke. Although in theory the importance of replication is widely recognized, in practice replicative studies appear far too infrequently” (p. 60). Thus, should this study indicate good psychometric properties of the SMS, one would have two replication studies, in addition to the original study, supporting its use.

Further, Schutz, Eom, Smoll, and Smith (1994) have recommended that re-examining the factor structure of a multidimensional construct (like intrinsic and extrinsic motivation as hypothesized by the SDC) is an important component of scientific inquiry, especially when analyzing the construct across different populations. For example, researchers reexamining the factor structure of two commonly used sport psychology instruments via CFA have raised questions about the robustness and generalizability of these instruments.

Lane, Sewell, Terry, Bartram, and Nesti (1999), testing a sample of over 1,200 athletes from a host of sports, reported a poor fit (GFI = .83, CFI = .82) for the hypothesized factor structure of the Competitive State Anxiety Inventory-2 (Martens, Vealey, Burton, Bump, & Smith, 1990). Similarly, Schutz et al. (1994), using a sample of over 700 high school athletes, reported that a CFA on the hypothesized factor structure of the Group Environment Questionnaire (Carron, Widmeyer, & Brawley, 1985) failed to provide a good fit to the data. In a more recent study from a different field, Manne and Schnoll (2001) reported that the hypothesized factor structure of a commonly used mental health instrument failed to hold in a large sample ($N = 433$) of cancer patients.

The results of these studies highlight the need for replication when studying the factor structure of a particular instrument, especially when the psychometric properties of the instrument have yet to be tested with a certain population. Given that the SMS has yet to be validated on a sample of college students from the United States, such an examination seems warranted if researchers wish to use the instrument with such a population.

The second purpose of validating the factor structure of the SMS relates to the applied use of the instrument with the population of college student-athletes from the U.S. Why should researchers and/or applied sport psychologists be interested in measuring intrinsic and extrinsic motivation among such a population? Some have argued that college athletes in the U.S. represent a unique population that is faced with special challenges (Ferrante, Etzel, & Lantz, 1996; Parham, 1993). Given the competitiveness, prestige, and potential financial benefits (e.g., scholarships, professional possibilities) of college athletics in the U.S., one of these unique challenges may be susceptibility to the influence of extrinsic rewards.

Research clearly indicates that the presence of extrinsic rewards generally undermines intrinsic motivation toward an activity (Deci, Koestner, & Ryan, 1999). Further, a recent study of the performance of major league baseball players pro-

vides preliminary evidence that introducing an extrinsic controlling reward (a long-term contract), which hypothetically decreases intrinsic motivation, is associated with decreased performance (Sturman & Thibodeau, 2001). Given many of the other detriments associated with lower levels of intrinsic motivation and high levels of extrinsic motivation (e.g., less pleasure toward an activity, higher dropout rates), and the benefits associated with high levels of intrinsic motivation (Vallerand & Losier, 1999), it seems important to assess these constructs in U.S. college athletes.

According to CET, one's intrinsic motivation toward an activity can be enhanced via increased autonomy and competence. Thus, by assessing and recognizing low intrinsic motivation in college athletes, one might be able to design interventions that allow them to enhance their intrinsic motivation toward their sport, which may allow them to experience the benefits associated with this type of motivation.

Method

Participants

A total of 270 student-athletes from three midwestern universities were recruited to take part in the study. Of this number, 161 were enrolled at a large public NCAA Division I university, 68 were enrolled at a small NAIA Division I college, and 41 were enrolled at a small NCAA Division III college. All signed an informed consent form prior to participation in the study. The student-athletes represented several sports including softball, basketball, golf, tennis, track, volleyball, cross-country, wrestling, soccer, and football. Their average age 19.77 years ($SD = 1.29$) and included 180 women and 90 men. The participant sample was 88.4% white, 5.6% black, 2.6% Hispanic, 1.1% Asian, and 2.2% other. Approximately 71% of the student-athletes were receiving at least some athletic financial aid.

Procedure

For each university, the researchers contacted the head coaches and a senior athletic administrator for permission to administer the instrument packet to student-athletes. Coaches and administrators were informed of the purpose of the study, and arrangements were made with each coach for the researchers to distribute the instruments to his or her team. At the NCAA Division I institution, one researcher was given time before a regularly scheduled practice to distribute and collect the instruments. At the NAIA institution the instruments were distributed by the coach or researcher either before or after practice, with student-athletes completing the measures either immediately or within a week. Return rate for these participants was 100%.

At the NCAA Division III university the packets were mailed to potential participants, with instructions to return the packets within a week. The return rate for these participants was approximately 50%. Participants were informed that the surveys were anonymous and that the instruments could not be linked to any participant. Participants received both verbal and written instructions and were asked to read the items carefully and respond honestly to each item. Cover letters were attached to each packet explaining informed consent and noting that participation was strictly voluntary.

Instruments

Sport Motivation Scale. The Sport Motivation Scale (SMS; Pelletier et al., 1995) was administered to all participants. The measure was described in detail earlier, thus that information will not be repeated here.

Motivation for Physical Activities Measure-Revised (MPAM-R). The social and competence subscales of the MPAM-R (Ryan et al., 1997) were administered to all participants. The social subscale contains five items and the competence contains seven items, each of which is scored on a five-point Likert scale. The competence subscale is conceptualized as a measure of intrinsic motivation, as it addresses a desire to engage in challenges or enhance skills. Conversely, the social subscale is conceptualized as an extrinsic measure, as it assesses the degree to which someone participates in physical activity for social interaction. Adequate reliability and validity have been reported for both subscales. An exploratory factor analysis revealed that the 12 items all loaded above .62 on their hypothesized factors, and alpha scores of .83 for the social subscale and .88 for the competence subscale were reported (Ryan et al., 1997).

Demographics Questionnaire. A demographics questionnaire was created to obtain demographic information from the participants. This questionnaire assessed factors such as gender, type of sport played, and level of competition (e.g., NCAA, NAIA).

Results

Data Screening

Scores on each subscale were screened for normality using histograms and the skewness/kurtosis statistic. Results indicated that all subscales were normally distributed, with the exception of the amotivation subscale. The amotivation subscale was positively skewed, so we transformed it using log to base 10 procedures. This transformation improved normality, so we used the transformed scores for further analyses.

Alpha Scores

Alpha scores were calculated for each subscale of the SMS. Scores ranged from .70 (introjection) to .82 (intrinsic motivation to know), with a mean value of .75. These scores are comparable to the original study conducted by Pelletier et al. (1995). Thus, adequate internal consistency was displayed in this sample.

Confirmatory Factor Analysis

To assess the factor structure of the SMS, we conducted a CFA using the AMOS™ version 4.0 program. We postulated seven factors that corresponded to the seven subscales, with each factor consisting of each subscale's four corresponding items. No cross-loadings were postulated, and all factors were allowed to correlate freely (see Figure 1). The variance of the seven hypothesized SMS factors was fixed to one, so that each latent factor was standardized. All factor loadings corresponding to each factor were freely estimated. Also, for identification purposes the paths between each error term and its underlying latent factor was fixed to one, allowing the variance of the error terms to be freely estimated.

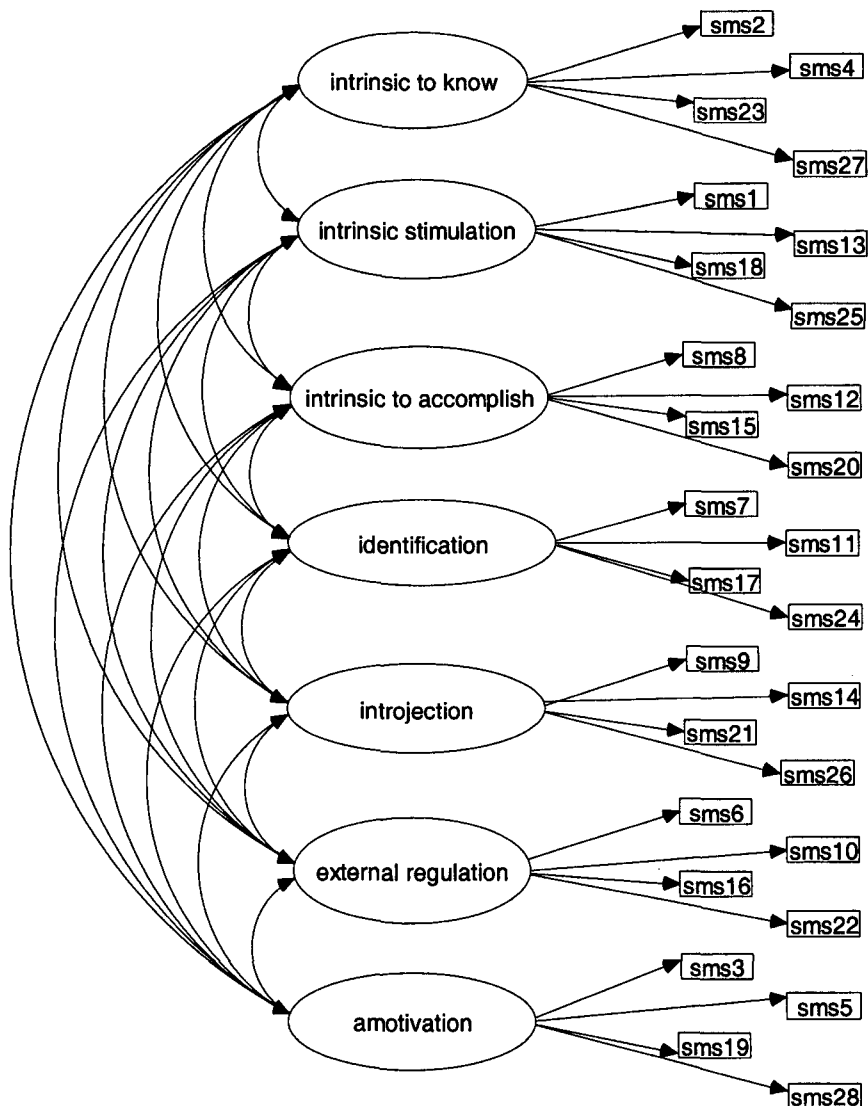


Figure 1 — Proposed factor structure of the SMS (Pelletier et al., 1995). Note that for appearance purposes the error terms were not included in this figure.

When conducting a CFA of an instrument, it is often useful to assess the factor structure of the measure across demographic variables of interest. In this case, it would be useful to test the factor structure of the SMS for both genders, as well as for individuals competing at the NCAA Division I level vs. lower competitive levels. Unfortunately, given a relatively small sample size of 270, a multisample approach is somewhat problematic. Thus, to assess the relationship of gender and competitive level with the seven latent factors of the SMS, we analyzed a model whereby the observed gender and competitive level variables were allowed to freely

correlate with the SMS factors. Small correlations would indicate little relationship between the demographic variables and the factors, whereas large correlations would indicate gender and/or competitive level differences on the factor(s).

Results indicated low correlations between both demographic variables and the SMS factors. For gender, correlations ranged from .00 (amotivation) to .16 (introjection), with a mean correlation absolute value of .05. For competitive level, correlations ranged from .01 (amotivation) to -.15 (intrinsic motivation to know), with a mean correlation absolute value of .07. Thus, given the small correlations between these two demographic variables and the SMS factors, we concluded that it would be appropriate to test a single model that collapsed across gender and demographic level.

We next used maximum-likelihood estimation procedures to assess the hypothesized factor structure of the SMS. Results generally indicated a poor fit for the model. The chi-square test was significant, $\chi^2(329, N = 270) = 749.34, p < .001$, and the NFI = .76, indicating a poor fit. Other fit indices indicated a slightly better fit: CFI = .84, TLI = .82, RMSEA = .07 (90% confidence interval [CI] = .06-.08), although the CFI and TLI are well below any accepted cutoff scores for acceptable model fit. Furthermore, 12 items had squared multiple correlations less than .40 (ranging from .20 to .39), indicating a relatively weak association between the item and its latent factor. Taken together, these results indicate that the hypothesized factor structure of the full SMS did not provide a good fit to the data collected from this sample (see Table 1).

Possibly this lack of good fit may have to do with the relationship between sample size and parameter estimates. In general, one desires a relatively high ratio of sample size to parameter estimates, with 10:1 often used as a rule of thumb (Ullman, 1996).² For the present analysis, dividing the sample size of 270 by the 77 parameters to be estimated yields a ratio of 3.5:1, which is considerably smaller than the aforementioned rule of thumb. Further, when analyses indicate a poor fitting model, it can be useful for researchers to analyze components of the overall model to determine the source(s) of model misspecification.

Thus, we chose to use what Bollen (1989) termed a "piecewise approach" to further examine this model. In this approach one breaks up a poorly fitting model into several components and assesses each component separately. For this analysis, it would make conceptual sense to assess the intrinsic component, extrinsic component, and amotivation component of the model separately. Splitting the model in this manner would also yield a more desirable ratio of sample size to parameter estimates (10:1, 10:1, and 33.8:1 for the intrinsic, extrinsic, and amotivation components, respectively).

These analyses further elucidate the misspecification of the SMS model for the sample at hand. Results for the intrinsic component of the model (i.e., the three intrinsic factors only with their hypothesized manifest variables), although not meeting the most stringent cutoff criteria for an acceptable model fit (Hu & Bentler, 1999), provide stronger results than the overall model. The chi-square statistic was still significant, $\chi^2(51) = 142.74, p < .01$, but other indices showed considerable improvement over the overall SMS model: NFI = .89, CFI = .93, TLI = .90, RMSEA = .08 (90% CI = .07-.10). Results from the extrinsic component of the model,

²See MacCallum et al. (1999) and Maxwell (2000) for discussions on problems associated with using a rule of thumb to determine adequate sample size for various analyses.

Table 1 Confirmatory Factor Analysis of the SMS

Subscale and item	Standardized loading	SMC
<i>Intrinsic Motivation to Know</i>		
For the pleasure it gives me to know more about the sport I practice	.63	.40
For the pleasure of discovering new training techniques	.71	.51
For the pleasure I feel while learning training techniques I have never tried before	.82	.68
For the pleasure of discovering new performance strategies	.77	.60
<i>Intrinsic Motivation to Experience Stimulation</i>		
For the pleasure I feel in living exciting experiences	.61	.38
For the excitement I feel when I am really involved in the activity	.70	.49
For the intense emotions I feel while I am doing a sport that I like	.63	.39
Because I like the feeling of being totally immersed in the activity	.62	.38
<i>Intrinsic Motivation to Accomplish</i>		
Because I feel a lot of personal satisfaction while mastering certain difficult training techniques	.63	.39
For the pleasure I feel while improving some of my weak points	.63	.40
For the satisfaction I experience while perfecting my athletic abilities	.77	.59
For the pleasure I feel while executing certain difficult movements	.63	.39
<i>Identification</i>		
Because, in my opinion, it is one of the best ways to meet people	.59	.34
Because it is one of the best ways I have chosen to develop other aspects of myself	.68	.46
Because it is a good way to learn lots of things which could be useful to me in other areas of my life	.57	.32
Because it is one of the best ways to maintain good relationships with my friends	.65	.42
<i>Introjection</i>		
Because it is absolutely necessary to do sports if one wants to be in shape	.45	.20
Because I must do sports to feel good about myself	.69	.48
Because I would feel bad if I was not taking time to do it	.61	.37
Because I must do sports regularly	.70	.49
<i>External Regulation</i>		
Because it allows me to be well regarded by people I know	.70	.49
For the prestige of being an athlete	.71	.51
Because people around me think it is important to be in shape	.59	.35
To show others how good I am at my sport	.64	.41

(cont.)

Table 1 (Continued)

Subscale and item	Standardized loading	SMC
<i>Amotivation</i>		
I used to have good reasons for doing sports, but now I am asking myself if I should continue doing it	.66	.44
I don't know anymore; I have the impression that I am incapable of succeeding at this sport	.67	.44
It is not clear to me anymore; I don't really think my place is in sport	.78	.60
I often ask myself; I can't seem to achieve the goals I set for myself	.63	.35

Note: SMC = squared multiple correlation. $\chi^2(329) = 749.34, p < .01$, NFI = .76, CFI = .84, TLI = .82, RMSEA = .07 (90% CI = .06-.08).

although stronger than the full model, still indicate considerable model misspecification: $\chi^2(51) = 155.92, p < .01$, NFI = .83, CFI = .88, TLI = .84, RMSEA = .09 (90% CI = .07-.10). Finally, fit indices from the amotivation factor provided mixed results, which taken together also indicate model misspecification: $\chi^2(2) = 14.44, p < .01$, NFI = .95, CFI = .95, TLI = .86, RMSEA = .15 (90% CI = .09-.23) (see Table 2). In sum, although fit indices for the separate components of the SMS model were stronger than those for the overall model, there were still problems with model misspecification, especially within the extrinsic and amotivation components of the model.

Correlations Among SMS Subscales

To determine whether the self-determination continuum (SDC) emerged for our sample of athletes, we analyzed the correlation matrix of the seven SMS subscales. Note that for this analysis we assessed the correlations among the latent factors, rather than calculating correlations via the raw scores of the items for each subscale. For this continuum to hold, a simplex pattern should emerge in which

Table 2 Comparisons of Fit Indices for Full SMS Model and its Components Separately

Model	NFI	CFI	TLI	RMSEA
Full model	.76	.84	.82	.07
Intrinsic only	.89	.93	.90	.08
Extrinsic only	.83	.88	.84	.09
Amotivation only	.95	.95	.86	.15

Table 3 Correlations Among the Latent SMS Factors

	IM Know	IM Stim	IM Acc	Ident	Intro	Ext Reg	Amot
IM Know	—						
IM Stim	.67**	—					
IM Acc	.81**	.85**	—				
Ident	.53**	.52**	.57**	—			
Intro	.20**	.38**	.28**	.44**	—		
Ext Reg	.28**	.30**	.33**	.59**	.70**	—	
Amot	-.36**	-.54**	-.44**	-.20*	.07	.03	—

Note: IM Know = intrinsic motivation to know; IM Stim = intrinsic motivation to experience stimulation; IM Acc = intrinsic motivation to accomplish; Ident = identification; Intro = introjection, Ext Reg = external regulation; Amot = amotivation. * $p < .05$, ** $p < .01$

adjacent subscales are more highly correlated in a positive direction. Results indicate that in essence this pattern did emerge, with most subscales having higher correlations with adjacent as opposed to distant subscales (see Table 3). For example, amotivation was positively correlated (nonsignificantly) with both the external regulation and introjection subscales, while negatively correlated with the intrinsic motivation subscales. Similarly, introjection was most highly correlated with the subscales next to it on the self-determination continuum, namely external regulation and identification, while all intrinsic motivation subscales were more highly correlated with each other than the extrinsic scales. Taken together, these results support the hypothesized SDC.

Another noteworthy result regarding the correlations among factors was the fact there were high correlations (.67, .81, .85) among the three intrinsic motivation factors. This suggests very strong relationships among the three subscales and raises questions about the distinctness of the three constructs.

Correlations With Other Motivational Assessments

To further assess the validity of the SMS, we correlated the SMS subscales with subscales from another measure that assesses motivation, the Motivation for Physical Activities Measure—Revised (MPAM-R) (Ryan et al., 1997). We used the social and competence subscales from the MPAM-R, hypothesizing that the intrinsic motivation subscales of the SMS would be more highly correlated with the competence subscale and that the extrinsic subscales would be more highly correlated with the social subscale. Results indicated that the average correlation of the intrinsic subscales with competence was .58, while with social the average correlation was .24. For the extrinsic subscales the average correlation with social was .40 and the average correlation with competence was .22 (see Table 4). Thus these results further support the validity of the SMS with this particular sample.

Table 4 Correlations of SMS Subscales With MPAM-R Subscales

	IM Know	IM Stim	IM Acc	Ident	Intro	Ext Reg	Amot
Social	.25**	.30**	.19**	.58**	.28**	.34**	-.07
Competence	.59**	.55**	.59**	.36**	.12*	.17**	-.47**

Note: IM Know = intrinsic motivation to know; IM Stim = intrinsic motivation to experience stimulation; IM Acc = intrinsic motivation to accomplish; Ident = identification; Intro = introjection, Ext Reg = external regulation; Amot = amotivation.

* $p < .05$, ** $p < .01$

Discussion

Results of this study provide some support for the reliability and validity of the SMS with a sample of U.S. college athletes, although there appear to be specification problems with the overall SMS model. Alpha scores for the SMS subscales were adequate, with values similar to those reported in the original validation study of the instrument (Pelletier et al., 1995). Results generally supported the existence of a simplex pattern, with subscales theoretically closer to each other on the SDC having stronger correlations than those theoretically distant. These results also confirmed those reported in previous studies (Li & Harmer, 1996; Pelletier et al., 1995). Further, SMS subscales correlated in a theoretically consistent way with another motivational measure, with intrinsic subscales showing stronger correlations than extrinsic subscales on a measure that assessed motivation to achieve competence, while extrinsic subscales had stronger correlations than intrinsic subscales on a measure that assessed social motivation. Taken together, these results provide evidence for the reliability and validity of the SMS for the present sample.

Interpreting the results of the CFA that we conducted is a bit more complex, as results do not provide a clear conclusion regarding the fit of the hypothesized SMS model. When the entire model was tested, results generally indicated a poor fit for the overall model. A follow-up "piecewise" analysis, which analyzed the intrinsic, extrinsic, and amotivation components of the model separately, was then conducted to specify the source(s) of model misspecification. Results of these analyses generally provided stronger fit indices than the analysis of the overall model, which may be at least partly explained by sample size. When the full model was tested, the ratio of sample size to free parameters estimated was relatively small (3.5:1), which could influence all parameter estimates and fit indices should a specification error exist. Testing the intrinsic, extrinsic, and amotivation components separately involved a more favorable ratio of sample size to free parameter estimation (at least 10:1), which may in part explain the better fit for those analyses.

When tested separately, the intrinsic component of the SMS model yielded stronger fit indices than the extrinsic component, indicating that many of the problems with the SMS model misspecification may be in the extrinsic subscales. Among the reasons why the extrinsic component of the SMS did not fit as well as the

intrinsic component, one is that a few items on the extrinsic subscales had very small squared multiple correlations (SMC). For example, the SMC for "Because it is absolutely necessary to do sports if one wants to be in shape," which is hypothesized to load on the introjection subscale, was only .20. Similarly, the SMC for "Because it is a good way to learn lots of things which could be useful to me in other areas of my life," which is hypothesized to load on the identification subscale, was only .32. These results indicate that the hypothesized SMS factors account for a low amount of variance in these items. Thus, perhaps these items were not particularly salient for this sample.

Another potential explanation has to do with the theoretical conceptualization of the SMS. The SDC as conceptualized by Deci and Ryan (1985; Ryan & Deci, 2000) contains four types of extrinsic motivation, although the SMS assesses only three types, leaving out integrated regulation. Perhaps including items related to this construct specifically would improve the fit of the extrinsic component of the model.

Finally, perhaps the extrinsic component of the SMS omits certain factors that are salient in influencing extrinsic motivation for U.S. college athletes. For example, comprehensive literature reviews (e.g., Vallerand, Deci, & Ryan, 1987; Vallerand & Losier, 1999) have examined how external rewards and competition can enhance extrinsic motivation toward an activity. College athletics in the U.S. is generally quite competitive and external rewards are often salient. In our sample, for example, 71% of the athletes were receiving financial aid. The SMS does not include items that assess these factors. Incorporating items that assess factors such as these that may be more salient for U.S. college athletes could enhance the validity of the measure with this population.

Results from the amotivation part of the model are somewhat intriguing, as two of the fit indices yielded acceptable results ($NFI = .95$, $CFI = .95$) while the other indices indicated significant model misspecification (significant chi-square, $TLI = .86$, $RMSEA = .15$). Of particular concern is the RMSEA, which is well above any accepted cutoff score (e.g., Browne & Cudeck, 1993). It is possible that the high RMSEA value for this analysis is at least partially explained by the few degrees of freedom in the amotivation part of the model. The RMSEA is sensitive to the number of free parameters in the model, with fewer free parameters (which results in more degrees of freedom) resulting in lower RMSEA values (Loehlin, 1998). Thus, with few degrees of freedom in a model, one may expect higher RMSEA values if the model does not represent a perfect fit to the data. It is also possible of course that the high RMSEA values may reflect serious model misspecification with this component of the SMS model, although such answers await further study.

The fit indices for the intrinsic component of the model, while not meeting some of the stricter criteria for a good model fit (e.g., $CFI \geq .95$ and $RMSEA \leq .06$) may at least be categorized as adequate. One aspect of the intrinsic latent factors, however, raises additional concerns. The correlations among the latent intrinsic factors were high, ranging from .67 to .85. These results indicate a large degree of shared variance among these factors, approximately 45% to 72%, which raises questions as to whether or not they should be interpreted as distinct factors. Perhaps future analyses of the SMS should test models whereby the three intrinsic factors are collapsed into one general factor, and compare this model with one in which the intrinsic factors are separated.

There were a few limitations to our study that should be addressed. Data were collected at three colleges of varying sizes, but all were located in the Midwest. It would be desirable to collect data from a more representative sample of U.S. college athletes. Second, no controls were included to assess the truthfulness of responses; thus, participants could have responded in a socially desirable manner. Finally, due to practical considerations, the method of instrument administration was not consistent across all sites. It is possible that participants responded differently based on type of administration (e.g., a researcher handing out the instruments before practice vs. a coach asking athletes to take the instruments home and fill them out), despite the fact that they were assured anonymity and confidentiality.

There are several possible directions for future studies using the SMS. First, given the problems inherent to this study regarding model specification, more research that further examines the psychometric properties of the instrument is warranted. Such studies should have larger sample sizes, which may resolve the problems noted in this study related to the ratio of subjects to free parameters. Larger sample sizes would also allow researchers to assess the fit of the SMS model across demographic variables of interest (e.g., gender, competitive level). Second, the results of this study raised questions about the distinctness of the hypothesized intrinsic motivation subscales. Perhaps future studies could explore this issue in more detail.

Third, perhaps items that assess the integrated regulation component of the SDC could be developed and incorporated onto the SMS, as currently there are no items on the SMS that explicitly reflect that component of the theory. Fourth, it may be useful to assess the psychometric properties of the SMS at various points in the season (i.e., preseason, midseason, postseason) to determine whether its factor structure remains consistent across varying external factors. Research indicates that levels of intrinsic motivation can vary based on the experiences of factors such as success and failure, competition, and coaching behavior (for a review, see Vallerand & Losier, 1999). Thus it would be useful to assess the properties of the SMS during periods when these factors are either more or less salient.

Finally, it would be useful to obtain more information regarding the relationship between different types of motivation and performance. Both laboratory and field studies have provided us with information about the relationship between different types of motivation and a host of psychological and sport related factors, but the relationship with performance still remains somewhat elusive.

In conclusion, while results of this study provide some support for the reliability and validity of the SMS with a college student-athlete population in the U.S., there appear to be problems with the hypothesized SMS model. This lack of fit for the overall SMS model, as well as its component pieces, indicates that the instrument should be further refined before researchers and applied sport psychologists use it with U.S. college athletes.

References

- Bentler, P.M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238-246.
- Bentler, P.M., & Bonett, D.G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588-606.

- Bollen, K.A. (1989). *Structural equations with latent variables*. New York: Wiley & Sons.
- Browne, M.W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.
- Brustad, R.J. (1988). Affective outcomes in competitive youth sport: The influence of intra-personal and socialization factors. *Journal of Sport & Exercise Psychology*, *10*, 307-321.
- Carron, A.V., Widmeyer, W.N., & Brawley, L.R. (1985). The development of an instrument to assess cohesion in sport teams: The Group Environment Questionnaire. *Journal of Sport Psychology*, *7*, 244-267.
- Deci, E.L., Koestner, R., & Ryan, R.M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627-668.
- Deci, E.L., & Ryan, R.M. (1985). *Intrinsic motivation and self-determinism in human behavior*. New York: Plenum Press.
- Ferrante, A.P., Etzel, E., & Lantz, C. (1996). Counseling college student-athletes: The problem, the need. In E.F. Etzel, A.P. Ferrante, & J.W. Pinkney (Eds.), *Counseling college student-athletes: Issues and interventions* (2nd ed., pp. 3-26). Morgantown, WV: Fitness Information Technology.
- Fortier, M.S., Vallerand, R.J., Briere, N.M., & Provencher, P.J. (1995). Competitive and recreational sport structures and gender: A test of their relationship with sport motivation. *International Journal of Sport Psychology*, *26*, 24-39.
- Frederick, C.M., & Ryan, R.M. (1993). Differences in motivation for sport and exercise and their relationships with participation and mental health. *Journal of Sport Behavior*, *16*, 125-145.
- Gill, D.L., Gross, J.B., & Huddleston, S. (1983). Participation motivation in youth sports. *International Journal of Sport Psychology*, *14*, 1-14.
- Harter, S. (1978). Effectance motivation reconsidered. *Human Development*, *21*, 34-64.
- Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus alternatives. *Structural Equation Modeling*, *6*, 1-55.
- Jöreskog, K.G., & Sorbom, D. (1989). *LISREL 7*. Chicago: National Educational Resources.
- Lane, A.M., Sewell, D.F., Terry, P.C., Bartram, D., & Nesti, M.S. (1999). Confirmatory factor analysis of the Competitive State Anxiety Inventory-2. *Journal of Sport Sciences*, *17*, 505-512.
- Li, F. (1999). The exercise motivation scale: Its multifaceted structure and construct validity. *Journal of Applied Sport Psychology*, *11*, 97-115.
- Li, F., & Harmer, P.H. (1996). Testing the simplex assumption underlying the sport motivation scale: A structural equation modeling analysis. *Research Quarterly for Exercise and Sport*, *67*, 396-405.
- Lindner, K.J., Johns, D.P., & Butcher, J. (1991). Factors in withdrawal from youth sport: A proposed model. *Journal of Sport Behavior*, *14*, 3-18.
- Loehlin, J.C. (1998). *Latent variable models* (3rd ed.). Mahwah, NJ: Erlbaum.
- Manne, S., & Schnoll, R. (2001). Measuring cancer patients' psychological distress and well-being: A factor analytic assessment of the Mental Health Inventory. *Psychological Assessment*, *13*, 99-109.
- MacCallum, R.C., Widaman, K.F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, *4*, 84-99.
- Martens, R., Vealey, R.S., Burton, D., Bump, L., & Smith, D.E. (1990). Development and validation of the Competitive Sports Anxiety Inventory-2. In R. Martens, R.S. Vealey,

- & D. Burton (Eds.), *Competitive anxiety in sport* (pp. 117-178). Champaign, IL: Human Kinetics.
- Maxwell, S.E. (2000). Sample size and multiple regression analysis. *Psychological Methods*, *5*, 434-458.
- Ostrow, A.C. (Ed.) (1996). *Directory of psychological tests in the sport and exercise sciences* (2nd ed.). Morgantown, WV: Fitness Information Technology.
- Parham, W.D. (1993). The intercollegiate athlete: A 1990's profile. *The Counseling Psychologist*, *21*, 411-429.
- Pelletier, L.G., Tuson, D.M., Fortier, M.S., Vallerand, R.J., Briere, N.M., & Blais, M.R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The sport motivation scale. *Journal of Sport & Exercise Psychology*, *17*, 35-53.
- Ryan, R.M., & Deci, E.L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*, 68-78.
- Ryan, R.M., Frederick, C.M., Lepes, D., Rubio, N., & Sheldon, K.M. (1997). Intrinsic motivation and exercise adherence. *International Journal of Sport Psychology*, *28*, 335-354.
- Scanlan, T.K., & Lewthwaite, R. (1984). Social psychological aspects of competition for male youth sport participants: I. Predictors of competitive stress. *Journal of Sport Psychology*, *7*, 25-35.
- Schutz, R.W., Eom, H.J., Smoll, F.L., & Smith, R.E. (1994). Examination of the factorial validity of the group environment questionnaire. *Research Quarterly for Exercise and Sport*, *65*, 226-236.
- Sturman, T.S., & Thibodeau, R. (2001). Performance-undermining effects of baseball free agent contracts. *Journal of Sport & Exercise Psychology*, *23*, 23-36.
- Ullman, J.B. (1996). Structural equation modeling. In B.G. Tabachnick & L.S. Fidell, *Using multivariate statistics* (3rd ed., pp. 709-780). New York: HarperCollins.
- Vallerand, R.J., Deci, E.L., & Ryan, R.M. (1987). Intrinsic motivation in sport. In K.B. Pandolf (Ed.), *Exercise and Sport Sciences Reviews* (pp. 389-425). New York: MacMillan.
- Vallerand, R.J., & Losier, G.F. (1994). Self-determined motivation and sportsmanship orientations: An assessment of their temporal relationship. *Journal of Sport & Exercise Psychology*, *16*, 229-245.
- Vallerand, R.J., & Losier, G.F. (1999). An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Sport Psychology*, *11*, 142-169.
- Watson, G.G. (1984). Competition and intrinsic motivation in children's sport and games: A conceptual analysis. *International Journal of Sport Psychology*, *15*, 205-218.
- White, R.W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, *66*, 297-333.
- Wong, E.H., & Bridges, L.J. (1995). A model of motivational orientation for youth sport: Some preliminary work. *Adolescence*, *30*, 437-452.

Manuscript submitted: July 21, 2000

Revision accepted: January 11, 2002

Copyright of Journal of Sport & Exercise Psychology is the property of Human Kinetics Publishers, Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.