



## A CONFIRMATORY FACTOR ANALYSIS OF THE OTTAWA MENTAL SKILL ASSESSMENT TOOL (OMSAT-3\*) – ROMANIAN VERSION<sup>1</sup>

doi: 10.2478/v10038-011-0014-x

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### ABSTRACT

**Purpose.** The goal of this study was to assess the factorial validity of the Romanian version of the Ottawa Mental Skills Assessment Tool – 3\* – OMSAT-3\*. **Basic procedures.** Cross-sectional with self-reported questionnaire. The sample included 212 athletes (98 women, 114 men; age = 24.3) competing at international and national levels in different sports. **Main findings.** Confirmatory factor analysis of the Romanian version of the OMSAT-3\* replicated the factor structure of the original instrument displaying an adequate level of goodness-of-fit. **Conclusions.** This study provided support for the factor structure of the Romanian version of the OMSAT-3\*. This version expands the possibility of assessing the psychological resources of athletes in order to increase their performance and awareness of towards mental skills.

**Key words:** confirmatory factor analysis, mental skills, goodness-of-fit indices, factorial validity, performance

### Introduction

The high level of modern sport performance increasingly takes on a psychological dimension. Often athletes attributed their failures or their successes to various psychological aspects of performance. Applied sport psychology consultants are interested in developing the psychological resources of athletes via mental skills training interventions. Educational interventions via psychological skills training (PST) are offered more and more often in modern sport preparation. These PST programs are generally aimed at helping athletes acquire and strengthen their psychological skills in order to improve their sport performance and generate a positive approach to competition [1]. Numerous studies have reported favorable effects of mental training programs on competitive performance and for specific psychological/mental skills, such as states of somatic and cognitive anxiety, self-confidence, imagery ability or team cohesion.

Many inventories have been developed to evaluate a single psychological skill, for example, attention, imagery and leadership. In terms of attention, the Test of Attentional and Interpersonal Style – TAIS [2] is the most utilized and cited in literature. For the evaluation of

imagery, there is The Imagery Use Questionnaire [3], while leadership could be assessed with the Leadership Scale for Sport [4].

To monitor the effects of educational intervention, experience gained from psychological skill development has created a need for broad-based tools that measure a range of mental skills and to conduct research on athletes and coaches. Usually, researchers utilized a couple of inventories that assess mental skills in sport. Two of these are: the Test of Performance Strategies – TOPS, [5] and Athletic Coping Skills Inventory – ACSI-28 presented by Smith et al. [6]. The Athletic Coping Skills Inventory (ACSI-28) was adapted to Romanian norms [7]. The authors of these instruments have stated that they have sound psychometric properties, but certain aspects remain questionable and unclear. Some items appear vague and there are conceptual problems with the whole inventories [8]. Researchers have also mentioned problems with reliability and, therefore, some aspects which require further discussion and refinement. The purpose of our study was to assess the factorial validity of the Romanian version of the Ottawa Mental Skills Assessment Tool – 3\* – OMSAT-3\* [9].

### The OMSAT

In order to correct the lack of validity and reliability of the majority of multidimensional psychological tests, researchers have tried to create more advanced instruments. The first step was to determine which mental

<sup>1</sup> A confirmatory factor analysis of the Romanian version of OMSAT-3\* was made in order to replicate the factor structure of the original instrument.

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skills were important to perform well in sport at a high level. For example, in comparison to athletes competing at a lower level, top competitors were more confident, better focused before and during competition, less anxious, they had better imagery abilities and were more committed to excel in sport [10]. The OMSAT was originally developed by Salmela [11] after an extensive literature review. Bota [12], after conducting analysis with the first and second versions of OMSAT suggested that the instrument must be revised and tested. The initial version of the OMSAT consisted of 14 mental scales and 114 items. The imperfections of this first attempt led Bota [12] to construct a new version of OMSAT (OMSAT-2) with 12 mental skill scales and 71 items. Durand-Bush et al. [9] developed a new inventory assessing a range of mental skills that are used in the sport realm. The Ottawa Mental Skills Assessment Tool (OMSAT-3\*) measures three conceptual components; each encompassing several mental skills. The Romanian version was produced through a translation-retroversion methodology that led to sound exploratory analysis results [13].

## Material and methods

### Participants

The surveys were collected from 212 athletes (99 elite athletes competing in Division I of the Romanian championship and 113 athletes were juniors competing in youth Division) in different sports: soccer, judo, water polo, basketball, handball, rugby, volleyball, track and fields. The majority of participants were selected from the Cluj sport club “Universitatea”. The first author of this paper is a sport psychology consultant at this sport club. To be considered elite athletes, participants must compete for at least three years in international or national championships. The elite group included 99 athletes, 45 women and 54 men, aged between 20 and 37 years, with a mean age of 24.6 years. The junior group included 113 athletes, aged between 14 and 19 years (50 women and 63 men), with a mean age of 16.8 years.

### Measures

The present version of the inventory – *the Ottawa Mental Skills Assessment Tool -3 (OMSAT-3\*)* – includes 48 items and 12 mental skills groups (4 items per group), under three main conceptual components. The authors obtained permission to adapt this inventory from the Mindeval company who hold the rights for this instrument. Foundation skills represent an athlete’s

fundamental mental skills. These skills are fundamental and essential for consistent high levels of performance in sport and they are the building blocks for other mental skills [14]. Goal Setting is the process of establishing objectives or goals which provide a sense of direction and motivation. A sample item for goal setting is: “I set daily goals.” Self-Confidence is the feeling or belief in one’s abilities and goals. An example: “I act confidently even in difficult sport situations. I believe.” Commitment displays an individual’s intensity and dedication to goals. An example item for commitment is: “I am determined to never give up in my sport.” Psychosomatic skills involve mental skills that include control of variations in physiological arousal. Stress reactions are bodily responses to the demands that are placed upon it. A sample item for stress reactions is: “My body tightens unnecessarily in competition.” Fear control is the individual’s capacity to cope with situations that induce fear or apprehension. An example item for fear control is: “There are a number of things in my sport that are potentially dangerous and make me afraid.” Activation is the process where physiological and mental states are increased in situations that require heightened senses. A sample item for activation is: “I can increase my energy level when I am tired in training.” Relaxation is the process where physiological arousal, muscle tension, heart rate, and anxiety are decreased, helping to control attention. A sample item for relaxation is: “I can relax effectively during critical moments in a competition.” Cognitive skills are dependent on cognitive processes and activities. Imagery is the process where images and sensations are used to experience different situations. An example item of imagery is: “I have clear mental images.” Mental practice is a process where physical skills, plays, or parts of a performance are mentally rehearsed without physical movement. A sample item of mental practice is: “I mentally practice my sport on a daily basis.” Focusing is the ability of an individual to direct and maintain attention on certain cues. A sample item of focusing is: “I lose my focus during important competitions.” Refocusing is the ability to recover concentration on task when distractions suddenly appear. An example of refocusing is: “Mistakes often lead to other mistakes when I compete.” Competition planning is the reflection and development of plans that will guide thoughts, emotions, and actions before, during, and after competition. A sample item of competition planning is: “I plan a regular set of things to do before a competition.”

A 7-point Likert scale is used, where options range from *strongly agree* to *strongly disagree* with an available neutral choice.

Procedures

Athletes were recruited by coaches and through other informal contacts from several sport clubs from the city of Cluj-Napoca. The participants were informed of their participant rights during the study and explained that all answers and information were anonymous. The modified OMSAT-3\* was administered in a classroom type environment. Researchers gained approval of the study from their club managers.

Results

Confirmatory Factor Analyses of Scales

Confirmatory factor analysis (CFA) of the proposed 12 dimensional factor structure of the original scale was conducted using the Robust Maximum Likelihood method. The software used was the LISREL 8.8. All goodness-of-fit indices reached acceptable values (see Tab. 1). Due to the controversy regarding the evaluation of model fit, we decided to report multiple indices. Data on criteria to determine the adequacy of model fit are shown in Table 1.

Table 1. Confirmatory factor analysis (CFA) of the OMSAT-3\* Romanian Version

Fit index	First order CFA	Second order CFA	Criterion for good fit
$\chi^2$	1823,45	1856,23	
df	1046	1042	
CFI (The Comparative Fit Index; [15])	.94	.96	Above .90
TLI (The Tucker-Lewis Index; [16])	.87	.88	Above .90
GFI (The Goodness of Fit Index; [17])	.81	.82	Above .90
PCFI (The Parsimony Comparative Fit Index)	.78	.76	Above .50
RMSEA (the Root Mean Square Error of Approximation; [18])	.05	.05	Below .05

All  $\chi^2$  values are significant at  $p < .01$ .

The factorial structure of the Romanian version of OMSAT-3\* is satisfactory. From these fit index, only the Tucker-Lewis Index (TLI) is below the conventional .90 criterion. This attenuation of model fit results from the significant multivariate kurtosis generated when we have a large number of items. All parameters were statistically significant and within an acceptable range.

Standardized factor loadings and error variances for

OMSAT-3\* scores supported for the notion that items load onto their hypothesized subscale (Fig. 1). The strength of an item is indicated by high factor loadings and low standard errors. Comrey and Lee [19] suggested that factor loadings higher than .71 (50% overlapping variance) are excellent, .63 (40% overlapping variance) very good, .55 (30% overlapping variance) good and .45 (20% overlapping variance) fair. In the present analysis, 16 of the 48 items could be considered excellent, and 14 could be considered very good.

As psychometric data have a tendency to not be normally distributed, attention was given to the Mardia coefficient. In the current study, Mardia values showed significant deviation from normality in both samples, which suggests that the data were not multivariate normal (multivariate kurtosis = 612.21;  $Z = 21.65, p < .001$ ).

In Figure 1 we have factor loadings and error uniqueness and the correlations between the latent factors are shown in Table 2. The magnitude of these correlations was small.

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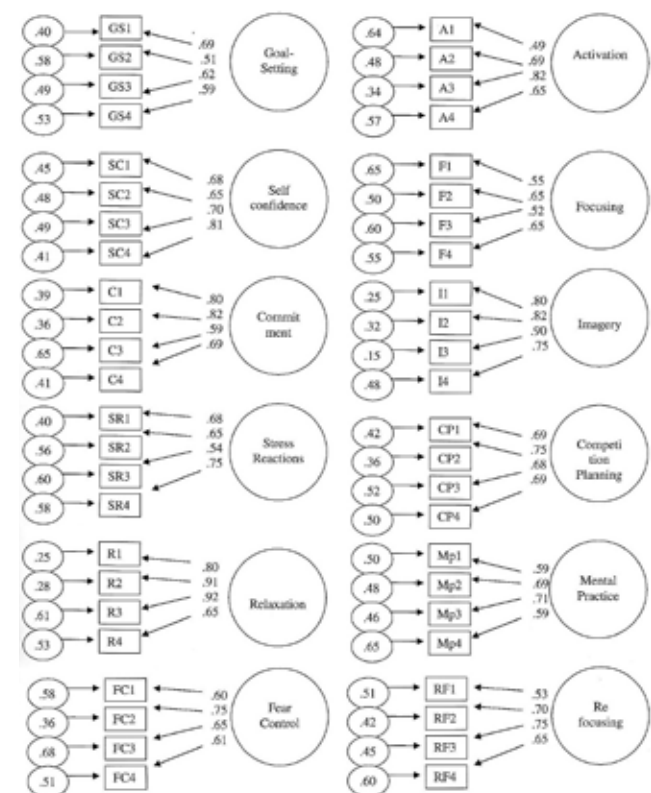


Figure 1. Confirmatory factor analysis of the OMSAT-3 Romanian Version. All parameters are standardized and significant at the .01 level

Table 2. Correlation coefficients between OMSAT-3 subscales

	GS	SC	CO	SR	RX	FC	AV	FO	IM	CP	MP	RF
GS	1.0	.49*	.52*	.10	.20*	.07	.40*	.28*	.25*	.45*	.47*	.09
SC	.40*	1.0	.39*	.30*	.35*	.38*	.13	.40*	.45*	.20*	.40*	.30*
CO	.42*	.39*	1.0	.05	.25*	-.20	.23*	.19*	.13	.21*	.35*	.10
SR	.09	.27*	.09	1.0	.39*	.50*	.23*	.52*	.20*	.11	.12	.50*
RX	.21*	.34*	.30*	.25*	1.0	.14	.32*	.24*	.40*	.19	.30	.32
FC	.02	.04	-.10	.30	.10	1.0	.12	.41	.15	.03	.05	.37
AV	.32*	.39*	.20*	.20*	.34*	.10	1.0	.39*	.29*	.37*	.29*	.13
FO	.23*	.38*	.19*	.39*	.25*	.31*	.27*	1.0	.39*	.09	.35*	.47*
IM	.24*	.19*	.18*	.21*	.47*	.10	.29*	.25*	1.0	.24*	.51*	.23*
CP	.28*	.23*	.20*	.12	.19*	.04	.31*	.05	.20*	1.0	.38*	.02
MP	.30*	.29*	.33*	.10	.25*	.03	.30*	.21*	.34*	.10	1.0	.12
RF	.08	.20*	.09	.38*	.29*	.39*	.10	.29*	.21*	.02	.10	1.0

GS – Goal-setting, SC – Self-confidence, CO – Commitment, SR – Stress reactions, RX – Relaxation, FC – Fear Control, AV – Activation, FO – Focusing, IM – Imagery, CP – Competition Planning, MP – Mental Practice, RF – Refocusing. \*  $p < .01$

Second-order CFA for Broader Conceptual Components

As we see in Table 1, the low value of TLI represents an underestimation of model fit because of the presence of significant multivariate kurtosis. All hypothesized relationships were significant with acceptable magnitude, except from the path between the cognitive skills factor, the Imagery subscale and Competition planning, and the path between the psychosomatic skills factor and the fear control subscale (Fig. 2).

Inter-correlations between OMSAT subscales were examined to ascertain if excessive multicollinearity ( $r > .80$ ) existed between subscales (Tab. 2). All correlations were below .80 and were in the predicted conceptual direction.

Multivariate analysis of variance

We conducted MANOVA to establish if OMSAT-3\* could differentiate between the scores of elite and junior athletes. Descriptive statistics are presented in Table 3. There is a significant difference between the elite and junior groups regarding dependent variables –  $F(12,211) = 4.43, p < .001$ . Univariate  $F$  – tests revealed that 7 from 12 scales significantly discriminated between the two groups of athletes (commitment, focusing, refocusing, self – confidence, stress reactions, goal – setting, activation have  $p$  values below .01).

Reliability

Means, standard deviations, and alpha reliability coefficients for all variables in the study are presented in Table 3. For the OMSAT-3 subscales, all subscales

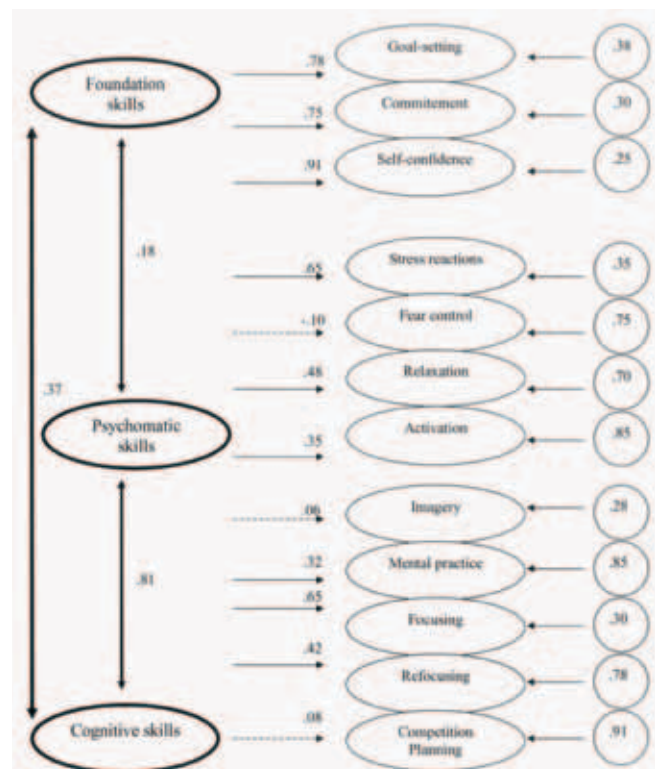


Figure 2. Second-order confirmatory analysis OMSAT-3. With exception of three paths represented by a dashed arrow, all parameters are standardized and significant

met the .70 criterion advocated by Nunnally [20], so we have no lack of reliability.

In Table 3, we have summarized the estimated values of internal consistency and interclass reliability of the OMSAT-3\*. Internal consistency estimates varied from .71 to .83, with a mean value of .78. Interclass reliability scores ranged from .78 to .93 and yielded a mean temporal stability score of .82.

Table 3. Descriptive statistics of the OMSAT-3\* scales for two groups (elite and junior)

Scale	Elite M (SD)	Junior M (SD)	Internal con- sistency	Inter- class reliability
Goal setting	5.28 (.67)	5.07 (.89)	.81	.86
Self-confidence	5.21 (.79)	4.88 (.91)	.80	.82
Commitment	5.71 (.80)	5.09 (.81)	.81	.90
Stress reactions	4.89 (1.45)	4.22 (1.21)	.78	.82
Relaxation	4.26 (1.31)	3.67 (1.32)	.83	.85
Fear control	5.12 (1.04)	4.98 (1.11)	.72	.80
Activation	5.20 (1.21)	4.75 (1.03)	.78	.82
Focusing	5.02 (1.11)	4.67 (1.20)	.73	.80
Imagery	5.12 (1.42)	4.83 (1.32)	.78	.89
Competition planning	5.03 (1.23)	4.67 (1.31)	.83	.78
Mental practice	4.02 (1.03)	3.96 (1.23)	.71	.78
Refocusing	4.78 (1.12)	4.24 (1.31)	.80	.82

## Discussion

The results indicate that the factorial validity and reliability of the Romanian version of the OMSAT-3\* are acceptable. This version extends the possibility to assess psychological resources of elite athletes in order to increase their performance. OMSAT is a valid inventory intended to evaluate mental resources after mental skills training interventions.

The results of the first-order CFA revealed that OMSAT-3\* scales had a sound factorial structure. The model, composed of 12 mental skill scales, adequately represented the covariance within the study sample. The results of the second-order CFA revealed that the proposed higher-order factors displayed a sound structure, the magnitude of the second order factor loadings was quite similar. There are non-significant loadings between the cognitive skills component and the mental practice scale and between the psychosomatic skills component and the activation scale. All other relationships between first-order factors and second-order ones supported our hypotheses. The second-order model represented the covariance within the sample in a satisfactory manner.

In terms of the known group analysis, the OMSAT-3\* significantly differentiated between elite and junior athletes. This fact suggests that athletes competing at a high level possess more refined mental skills than less skilled athletes do. The studies carried out by Orlick and Partington [8] and Gould et al. [21] showed that the best athletes have better mental abilities than less skilled athletes do.

The commitment scale showed a significant differ-

ence. Indeed, elite athletes are extremely dedicated individuals who will do anything to become the best, even sacrifice other important activities. The self-confidence scale also significantly differentiated between the two groups of athletes, suggesting that elite athletes believe more in themselves and their abilities to achieve their goals than their less skilled colleagues do.

Negative reactions to stress can be detrimental to performance, while positive reactions can lead to enhanced performance [22]. In this view, the significant difference between the elite and junior athletes on stress reaction scale suggests that experienced athletes most likely react to stress in more positive ways.

Another significant difference between the two groups regards their focusing and refocusing scales, indicating that elite athletes in this study were probably able to better focus their attention and regain their focus when faced with distractions than their less skilled counterparts were.

The two groups differ significantly in the activation scale. Indeed, a proper activation leads the athletes to optimum performance and an experienced athlete is more aware of it.

The alpha coefficients indicated that the reliability of each of the 12 subscales was adequate, with internal consistency ranging from 0.71 to 0.83 (Tab. 2). These results, which were consistent with the validation study of Durand-Bush et al. [9], provided evidence for the adequate internal consistency of the 12 subscales of the Romanian OMSAT-3\*.

## Conclusions

The results of our study support the validity and reliability of the OMSAT-3\*, Romanian version. From a practical perspective OMSAT-3\* could be useful for coaches and consultants helping them to assess the mental skills of athletes competing in different sports and their levels of competence. More specifically, filling out the questionnaire takes approximately 15 minutes and consultants gain a better understanding of strengths and weaknesses of athletes. The items are clear and the scores are easily calculated and graphed to provide a summary profile an athlete's mental skills. OMSAT-3\* is appropriate for working with a large group of athletes when it is difficult to meet with all of them individually. However, our findings are affected by some limitations. In spite of our care to recruit participants from a wide variety of sports, the present data are not guaranteed to replicate in other sport disciplines. New studies must be done to determine the usefulness of this instrument in other sport activities.

Moreover, our study had a correlational design. We could expand our information on the psychometric properties of the OMSAT-3\* by studying its predictive validity using a longitudinal design. The inventory could be administered at the beginning and the end of a mental skill training program to investigate empirically its effects regarding some mental skills development. Also, a line for research could be applied to determine the effects of variables such as age, gender, type of sport, etc.

The Romanian version of the OMSAT-3\* offers the possibility of assessing the psychological resources of athletes in order to increase the performance and awareness of mental skills. Our hope is that OMSAT-3\* will help athletes to develop the performance by using their psychological resources more efficiently.

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Paper received by the Editors: September 6, 2009.

Paper accepted for publication: July 9, 2010.

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