Preliminary psychometric validation of the Multidimensional inventory of sport excellence: attention scales and mental energy

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A B S T R A C T

Sport psychologist needs to understand how psychological factors affect athletic performance of an individual, considering individual differences among athletes. Each specific problem in working with athletes must be considered depending on complex factors: the type (specificity) of sport; characteristics of the activity (the training or competition); stages of athletes' sports development; gender and age differences, etc. Although there are numerous psychological instruments, which assess psychological characteristics of athletes, it is important to select instruments adjusted to athletes, working style of sports psychologist, available time and other constraints. Here, we have formulated a preliminary version of our own battery of questionnaires, named Multidimensional Inventory of Sport Excellence (MUSI), selecting the items for following psychological characteristics: energizing, maintaining attention, directing attention, wide internal / external attention and narrow internal / external attention. In this phase of the study, participants were stratified only by gender. Sample of 248 participants was examined, of which 103 male athletes (age 24.52 ± 11.80 years) and 145 female athletes (age 16.61 ± 6.69 years), from the Croatian sports clubs, competing in 16 different sports (archery, football, handball, bocce, bowling, cycling, karate, rowing, tennis, volleyball, basketball, synchronized swimming, triathlon, table tennis, chess, badminton). Data were collected from March to June 2014 in Rijeka, during the trainings in sports clubs. Results of Principal Component Analysis and the reliabilities type internal consistency showed that each of sub-questionnaires from battery MUSI have satisfactory reliability and construct validity, giving positive guidance for future adaptation of the questionnaire to specific subpopulations of athletes.

Key words: diagnosis, practical skills, sports excellence, sport psychologist.

Introduction

In order to achieve sport excellence, athletes should develop attention skills and have enough mental energy to cope with challenges. "Mental energy" is a term with multiple meanings. It can be used to describe specific biological processes involved in the capacity of brain neurons to do physical work, and it can legitimately be used to refer to mood or motivational and cognitive processes. Since there is no valid, objective measure of any mood, self-reported feelings are recognized as the best method for assessing mood (O'Connor, 2006). Attention allows to "filter out" information, sensations and perceptions that are not relevant at the moment. Instead, athletes should focus on the information which is important. Performing in an athletic event requires an athlete to narrowly focus upon the task at hand in order to achieve success. To learn complex movement sequences, athletes break them into their component parts which are, at first, practiced in isolation and afterwards conducted on competition.

Mental energy
The concept of mental energy is still evolving. It is a term with multiple meanings and can be used to describe specific biological processes involved in the capacity of brain neurons to do physical work and/or it can legitimately be used to refer to mood or motivational and cognitive processes. Thus, the feeling of energy can be classified as a specific, positive mood.

Specifically, the mood of energy refers to feelings of having the capacity to complete mental or physical activities. With that said, various researchers try to find out ways of assessing mental energy. Vigilance and choice reaction time seem to have the necessary psychometric properties for assessing mental energy, including construct, predictive content and face validity (Lieberman, 2006). Tests of reaction time and vigilance are correlated with questionnaires that measure mood states corresponding to mental energy. Such mood states include sleepiness, fatigue, and alertness and are of approximately equivalent sensitivity.

Therefore, the studies which suggest using cognitive tests that assess vigilance, ability to sustain attention, and choice reaction time are optimal for assessment of mental energy. On the other hand, O'Connor (2006) suggests three widely used methods that have strong support as a measure of the mood of mental energy: visual analog scales, the vitality scale of the SF-36 Health Survey, and the vigor scale of (Profile of Mood States – hereinafter POMS) (McNair et al., 1971, in press).

Attention (Concentration)
Attention is a concept studied in cognitive psychology that refers to how we actively process specific information present

in our environment. It allows one to "filter out" information, sensations and perceptions that are not relevant at the moment and instead focus on the information that is important (Abernethy et al., 1998). Athletes perform in various levels of arousal and, besides that, few of them are aware of the effect that arousal has on focus and performance that arises. Too much arousal undermines the athlete's ability to narrowly focus attention in a quality manner, while too little arousal may introduce unwanted competition between irrelevant and relevant cues. The problem emerges when high levels of arousal lead to the phenomenon of distractibility. Distractibility has the effect of decreasing the athlete's ability to discriminate relevant and irrelevant cues, and to focus upon relevant cues. The athlete who is suffering from distractibility tends to experience sudden and significant decrements in performance.

Performing in an athletic event requires an athlete to narrowly focus upon the task at hand in order to realize success. According to that statement, sport psychologist usually teaches athletes how to narrow their focus in order to reach adequate attention in order to get into „the zone". Athlete has to practice attention to the point that performance can occur at an automatic level. Given that level of development has been reached, the athlete must then reduce the amount of conscious internal processing of information as much as possible. Anything that forces concentration to become controlled will pull the athlete out of the zone because the conscious control of concentration requires an internal shift. It is important to classify stimuli that require conscious or controlled attention as either task relevant, or task irrelevant.

Task irrelevant stimuli are commonly referred to as distractions (flash from a camera as a football player is about to shoot a penalty, or internal distractions (negative thoughts or feelings). When the athlete is confident, the negative impact of the distraction is short lived and the athlete quickly refocuses attention on task relevant external cues, becoming once again immersed in the situation. To remain in the zone, distractions whether they are task relevant, or irrelevant, need to be kept to a minimum, and recovery from those that do occur needs to be almost instantaneous. Indeed, it is the ability to recover quickly which is probably the single most important factor separating successful athletes from unsuccessful ones (Orlick & Partington, 1990).

Most performance in sport is demanding, requiring athletes to combine very complex motor sequences (e.g., to run, dribble and shoot while reacting to the movements of other football players). To learn such complex sequences, athletes break them into their component parts which are practiced in isolation. After the individual pieces are developed, athlete begins to put them together until he or she is able to execute the entire sequence without mistake. With practice, the athlete learns to combine perceptual information (e.g., information about the location of the goal, other players, etc.) with internal information (e.g., feedback from the body about its position in space), to create patterns that the brain can recognize at a preconscious level (Norman, 1968).

To understand exactly how a person is going to behave, the best sources of data are assessment instruments (questionnaires). Nideffer (1976) developed the Theory of Attentional and Interpersonal Style (TAIS) in his work with elite athletes at the professional and Olympic level. TAIS has been applied extensively in military settings with Navy SEALS and Army Special Forces. The goal was to create an inventory that would be useful in predicting performance and in providing feedback about concentration skills to individuals involved in a wide variety of performance areas. The theory brings together performance

relevant constructs in such a way as to accurately predict how people will perform in wide variety of situations. Nideffer (1976) considers concentration along two dimensions: 1) breadth: at any given moment, attention could be either Broad (focused on multiple things simultaneously) or Narrow (focused on one thing); and 2) direction: focus could be either External (focused outside your head) or Internal (focused inside your head).

The purpose of these instruments is to help sport psychologists to predict and understand exactly how an individual will perform under a variety of circumstances. This information is of course very useful for their practical work with the athletes. Therefore, the goal of this research was to determine construct validity (factor structure) and reliability type internal consistence for each of the questionnaires included in this part of the Multidimensional Questionnaire of Sport Excellence. Moreover, the second goal was to determine the correlations among the dimensions in all measuring instruments (questionnaires) in this research.

Methods

Participants

In total 248 athletes, 103 males (mean age 24.52±11.80) and 145 females (mean age 16.61±6.69) were involved in the study. They were recruited from different sport clubs in Croatia. Mean age of sport experience (participation in sport) of the participants was 8.62±6.97 years. The athletes from 16 different sports were included in research: archery (N=1), football (N=17), handball (N=47), bocce (N=2), bowling (N=2), cycling (N=7), karate (N=1), rowing (N=27), tennis (N=3), volleyball (N=57), basketball (N=32), synchronized swimming (N=19), triathlon (N=3), table tennis (N=2), chess (N=1), badminton (N=2). According to sport age category, 99 (39.9%) of them were cadets, 60 (24.2% were juniors), 77 (31.0%) were seniors, while 12 (4.8%) were veterans. According to the level of sport excellence, 37 (14.9%) of them were top Croatian athletes (e.g. national selection), 80 (32.3%) were semi-professionals (they work regularly out of sport, but they are engaged in regular training and national competitions), while 131 (52.8%) are amateurs, engaged in lower levels of competitive sport, or only in recreational sports.

Procedure

Data was collected between March 2014 and July 2014 in the city of Rijeka, Croatia. Participants always filled out the questionnaire anonymously in the presence of a research assistant, or during or during the training, in their respective sports clubs.

Measures

Initial versions of all questionnaires have started from theoretical frameworks and belonging measuring instruments (Profile of Mood States – hereinafter POMS and The Attentional and Interpersonal Style - hereinafter TAIS), but with significant modifications, according to previously mentioned needs, influenced by specific style of work of certain sport psychologists. For the purpose of measuring mental energy, we have formulated the items of Mental Energy Scale according to the vigor scale of POMS (McNair et al., 1971). Mental Energy Scale consists of 14 items based on the self-evaluation of the level of „mental energy". The subjects have to estimate their own behavior on Likert 5-point scale ranging from strongly disagree (1) to strongly agree (5). The results are defined as a simple

linear combination of the estimations for the items. Higher estimation means higher emphasis on certain dimensions of mental energy. Internal consistency for the Profile of Mood States was reported at 0.63 to 0.96 Cronbach alpha rating (McNair et al, in press). For the brief version, POMS-SF, the internal consistency rating was 0.76 to 0.95. The correlation between the sub-scales and the total score in POMS and POMS-SF was 0.84 (McNair et al., in press). In addition, the POMS was correlated with the Functional Assessment of Cancer Therapy scale and the Psychological Well-Being scale, with calculated -0.68 ratings (McNair et al, in press).

For the purpose of measuring attention (concentration) we have developed Maintaining Attention Scale according to TAIS (Nideffer, 1976). Maintaining Attention Scale consists of 12 items based on the self-evaluation of the level of 'adequate concentration'. Extensive Internal Attention Scale consists of 9 items, while Extensive External Attention Scale, as well as Narrow Internal Attention Scale and Narrow External Attention Scale, and consists of 7 items, each. The subjects have to estimate their own behavior on Likert 5-point scale ranging from strongly disagree (1) to strongly agree (5). The results are defined as a simple linear combination of the estimations for the items, which define certain dimension of the attention. Higher estimation means higher attention skills, except in case of Extensive internal attention (lower score means higher developed skills). The group of researchers validated TAIS attention scales using factor analysis, which showed adequate construct validity, while the internal consistency or reliability coefficients found by these investigators for the six attention scales were ranged from .57 to .72 (Van Schoyck & Grasha, 1981; Landers, 1982; Vallerand, 1983; Summers & Ford, 1990; Abernethy et al., 1998).

Statistical Analyses

In the statistical analyses of the data, the software package SPSS 20.0 was used. In the process of determining the main metric properties of the questionnaires, for determining the construct validity of the questionnaires, the method of Principal Component Analysis (PCA) is used (with or without Varimax rotation). Several criteria are combined to obtain final component (factor) solutions: saturation higher than 0.300; Scree Plot; Guttman-Kaiser criterion (eigenvalue higher than 1.00) and interpretability criterion. The results in extracted principal components (factors) in certain questionnaires are expressed as simple linear combinations, and then used in further analysis (correlations). The reliability type internal consistency for all components (factors) revealed was determined using Cronbach's alpha coefficient. The correlation analyses were performed using Spearman rank-correlation coefficients. The significance of differences commented on the probability level $p < 0.05$.

Results

Kaiser-Meyer-Olkin's measures of the data matrix's convenience for the factorization and Bartlett's sphericity test showed that the intercorrelation matrix is suitable for factorization, in all questionnaires (Tables 1-6).

For the first measuring instrument (Mental Energy Scale), applied on Croatian sample(s) of athletes, the application of PCA (Table 1), as well as the scree plot, indicate a steep drop of eigenvalues, that revealed one-component structure. In males (M±SD for the entire scale was 3.86±0.71), only principal component accounts about 44%, while in females (3.79±0.74), only principal component accounts about 51% of the total variance

explained. Basic descriptives (means and standard deviations) and communalities are presented in the Table 1, where it is obvious that all means have values above theoretical average (3.00). Reliability type internal consistency (Cronbach's alpha) of this scale is very high and thus very satisfactory. Variance is explained by somewhat higher values in females than in males. For the second measuring instrument (Maintaining Attention Scale), applied on Croatian sample(s) of athletes, the application of PCA with Varimax rotation (Table 2), as well as the scree plot, indicate a steep drop of eigenvalues, that revealed two-component structure (for males and females), with factors named: Maintaining attention skill (3.53±0.59 for males and 3.67±0.79 for females) and Awareness about the state of attention (3.65±0.65 for males and 3.53±0.63 for females). For males, two components explained about 45% of the total variance (44% for females). Insight into descriptives and communalities (Table 2) shows that all means have values above theoretical average (3.00). Reliability type internal consistency (Cronbach's alpha) of two dimensions of this scale are very low (Maintaining attention skill) and low (Awareness about the state of attention), but still satisfactory. One item saturated only second factor for males (I know why my concentration falls during performance). For the third measuring instrument (Extensive Internal Attention Scale), applied on Croatian sample(s) of athletes (2.60±0.88 for males and 2.58±0.81 for females), application of PCA (Table 3), as well as the scree plot, indicate a steep drop of eigenvalues that revealed one-component structure. Only principal component accounts about 48% of the total variance explained for males, and 40% for females. Insight into descriptives and communalities (Table 3) shows that all means have values bellow theoretical average (3.00). Reliability type internal consistency (Cronbach's alpha) of this scale (in males and females) is medium high and thus satisfactory. One item saturated principal component only for females (I have a feeling that I am analyzing too much different aspects of performance). For the fourth measuring instrument (Extensive External Attention Scale), applied on Croatian sample(s) of athletes (3.66±0.59 for males and 3.71±0.70 for females), application of PCA (Table 4), as well as the scree plot, indicate a steep drop of eigenvalues that revealed one-component structure. Only principal component in males accounts about 48% of the total variance explained, the same as for females. Insight into descriptives and communalities, offers the information that all means except one have values above theoretical average (3.00). Reliability type internal consistency (Cronbach's alpha) of this scale is low, but still satisfactory. Two items more saturated single principal component only for males (Table 4). For the fifth measuring instrument (Narrow Internal Attention Scale), applied on Croatian sample(s) of athletes, application of PCA with Varimax rotation (Table 5), as well as the scree plot, indicate a steep drop of eigenvalues that revealed two-component structure, with factors named: Awareness about the attention during performance (3.80±0.78 for males and 3.76±0.78 for females) and Internal speech (3.36±0.93 for males and 3.32±0.84 for females). All two components accounted about 55% of the total variance explained (males) and 51% for females. Insight into descriptives and communalities, offers the information that all means, except last one, have values above theoretical average (3.00). Reliability type internal consistencies (Cronbach's alpha) of both dimensions of this scale (for males and females) are very low, but still satisfactory. One item saturated second component only for females (In some situations I have to take into account the position of the body during the performance). For the sixth measuring instrument (Narrow External Attention Scale), applied on Croatian sample(s) of

athletes (3.93±0.88 for males and 3.84±0.63 for females), application of PCA (Table 6), as well as the scree plot, indicate a steep drop of eigenvalues that revealed one-component structure. Only principal component accounts about 30% of the total variance explained (males) and 39% for females. Insight into descriptives and communalities offers the information that all means have values above theoretical average (3.00). Reliability type internal consistency (Cronbach's alpha) of this scale is very low, but still satisfactory (for males and females). One item saturated principal component only for males (The best outcome is usually when you do not think much).

Correlations between the dimensions

In the following two analyses we have used obtained latent dimensions, expressed in simple linear combinations, to calculate the correlations among these latent dimensions of psychological characteristics (Table 7), as well as to establish their correlations with three independent variables: age and sport experience. Out of 28 correlations between variables of MUSI, included in this study, 21 were statistically significant (four negative-directed, while the others were positive), just equally for males and females. All significant correlations were low to medium sized, both in males and females. In males and females, Mental energy, Maintaining attention skill, Awareness about attention during performance and Extensive external attention negatively and significantly correlated with Extensive internal attention.

There were no statistically significant correlations between certain psychological characteristics and athletes' age and time spent in training certain type of sports (both in males and females).

Discussion

Basic psychometric properties, construct validity and reliability are examined in six questionnaires, which are used for the first time, separately for male and female athletes. Eight latent dimensions are revealed after application of factor (in fact, PCA) analysis, named leading by the dominant content of the items which saturate each dimension: Mental Energy, Maintaining Attention Skill, Awareness about State of Attention, Extensive Internal Attention, Extensive External Attention, Awareness about Attention during Performance, Internal Speech and Narrow External Attention. All the questionnaires showed satisfactory validity and reliability, while factor structures are very similar for males and females. This finding can lead us to a presumption that the same versions of the questionnaires could be used in males and females, especially after this preliminary application. Namely, when The insight into correlations provide the conclusion that all dimensions revealed in this study are not associated with age of athletes or their time spent in sport (experience). Moreover, intercorrelations between these dimensions of attention and mental energy show that all dimensions are mostly positively (low to medium sized) correlated, except the Extensive internal attention (which is in fact positively related to other characteristics, because lower score in this scale means higher Extensive internal attention). Distractibility scores for male athletes suggest that the pattern of their concentration errors is fairly consistent. More often than not, their mistakes occur because they think too much, become distracted by their own thoughts. Females on the other hand, are just as likely to become distracted by external events (e.g. what their opponent is doing), as they are by their own thoughts. Previous studies show that scores in similar concentration scales indicate

that concentration skills are improving with age (Nideffer & Bond, 2012), while males have in general somewhat higher means in attention features, as compared with females (Nideffer, 1976; Nideffer et al., 2012; Nideffer & Bond, 2012). Although in our research, because of separate factoring, we can't have clear conclusions about gender differences, we can estimate that differences between means in certain attention aspects in males and females are minimal. Moreover, the age differences are not obvious, too. These findings can arise from heterogeneous samples of athletes in our study: for example, the group of older triathletes shows a significantly higher level of concentration of attention than younger (Kovářová & Kovář, 2010). However, second explanation could be the fact that we have developed specific measuring instruments, included in MUSI.

The advantage of this research is the application of these (new) questionnaires for the first time, with the preliminary insight in their main psychometric properties. On the other hand, these instruments have a purpose to be adjusted to the working style of sports psychologists, but taking into account available time (all these instruments need short time to administering). The main shortcoming of the research is the fact that initial validation of the questionnaires was stratified only by gender, among all relevant factors mentioned before: type (specificity) of sport; characteristics of the activity (the training or competition); level of sport excellence; stages of athletes' sports development; age differences, etc. The number of participants was not representative: it is disproportional, according to different types of sports, especially when additionally considering age groups that athletes belong to, levels of sport excellence, etc. However, we have emphasized that this is only preliminary validation of certain measuring instruments, which have to be improved and adjusted, according to all abovementioned criteria, for example: male senior elite basketball players or female junior semi-professional volleyball players, etc. Applying these questionnaires from MUSI on such stratified samples is one of the main directions in future research. Practical implication of this study could be focused on using this orientation standards (average values, such as means and standard deviations), arising from this initial application of the questionnaires, to estimate attention and mental energy in certain group of athletes. This could be useful information for sport coaches, as well as for sport psychologists, as the start point to develop individualized training programs to improve these skills, especially in elite training centers around the world (Nideffer & Bond, 2012).

Conclusions

Construct validity and reliability were preliminarily examined in six questionnaires, separately for male and female athletes. Eight latent dimensions are revealed after the application of PCA analysis, named: Mental Energy, Maintaining Attention Skill, Awareness about State of Attention, Extensive Internal Attention, Extensive External Attention, Awareness about Attention during Performance, Internal Speech and Narrow External Attention. All the questionnaires showed satisfactory validity and reliability (in range from minimum to high sized). All revealed factor structures were very similar for males and females, so it could be recommended that in future research the same versions of the questionnaires could be used in males and females. None of the dimensions revealed in this study are not statistically significantly associated with age or sport experience of athletes, while most of correlations between the di-

Table 1. Mental Energy Scale: descriptive characteristics and results of Principal Components Analysis (PCA) with belonging reliability, applied on the sample of male and female athletes

Items	Males				Females			
	r	h²	Mean	Std. Dev.	r	h²	Mean	Std. Dev.
I feel the energy in the body and readiness for competition. / Osjećam energiju u tijelu i spremnost za natjecanje.	.757	.643	4.245	0.838	0.802	.643	4.029	0.943
I feel the energy that makes me brave. / Osjećam energiju koja me čini hrabrim.	.726	.419	3.842	1.027	0.648	.419	3.762	1.144
I feel the energy that makes me tough. / Osjećam energiju koja me čini izdržljivim.	.779	.645	4.040	0.958	0.803	.645	3.775	0.978
Because of the energy in the body do not have a sense of fatigue./ Zbog energije u tijelu nemam osjećaj umora.	.584	.341	3.604	1.167	0.584	.341	3.378	**1.192**
I can manage my energy during the competition./ Mogu upravljati svojom energijom tijekom natjecanja.	.402	.270	3.559	1.068	0.519	.270	3.376	1.125
I enjoy the competition when I feel the energy./ Uživam u natjecanju kad osjetim energiju.	.717	.489	4.392	1.026	0.699	.489	**4.285**	1.075
When I feel the energy in my body, I can easier deal with the pressure./Kad osjetim energiju u tijelu lakše se nosim s pritiskom.	.559	.364	3.971	1.164	0.603	.364	3.759	1.156
When I feel more ready energy / and I accept the challenge./ Kad osjetim energiju spremniji/a sam prihvatiti izazov.	.750	.571	4.099	1.005	0.755	.571	**4.132**	0.977
When I feel the energy, errors less affect on my performance./ Kad osjetim energiju pogreške manje utječu na moje izvođenje.	.609	.528	3.745	1.114	0.727	.528	3.545	1.053
When I feel the energy, I do not fear of mistakes./ Kad osjetim energiju ne bojim se pogreške.	.623	.585	3.755	1.147	0.765	.585	3.535	**1.153**
When I feel the energy, I can easier accept mistakes./ Kad osjetim energiju lakše prihvatim pogreške.	.537	.345	3.559	1.157	0.587	.345	3.563	1.120
When I feel the energy I'm not afraid of negative outcomes. / Kad osjetim energiju ne bojim se negativnog ishoda.	.633	.703	3.941	1.088	0.838	.703	3.566	1.123
When I perform with the energy in the body, I can more easily accept the consequences./ Kad nastupam s energijom u tijelu lakše prihvaćam posljedice.	.775	.545	3.673	1.193	0.738	.545	3.796	1.069
When I feel the energy in the body, I can easier accept the outcome of the competition./ Kad osjećam energiju u tijelu lakše prihvaćam ishode natjecanja.	.716	.700	3.752	1.126	0.836	.700	3.809	1.035
Kaiser-Meyer-Olkin Measure / Bartlett's Test of Sphericity	583.350** (df=91)	.872			1023.837** (df=91)	.920		
Eigenvalue / Variance Explained	44.01%	6.161			51.05%	7.147		
Reliability (Cronbach's alpha)		0.895				0.921		

Legend: r=correlation of the variable with principal component; h²= communalities.

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Table 2. Maintaining Attention Scale: descriptive characteristics and results of Principal Components Analysis (PCA) with Varimax rotation, with belonging reliabilities, applied on the sample of male and female athletes

Items	Males					Females				
	f1	f2	h²	Mean	Std. Dev.	f1	f2	h²	Mean	Std. Dev.
I have a feeling that I can be concentrated long enough during performance./ Imam osjećaj da mogu dovoljno dugo biti koncentriran/a za vrijeme izvođenja.	.762		.594	3.814	1.031	.710		.512	3.704	1.050
There are only few things that we can disrupt concentration./ Malo je stvari koje mi mogu poremetiti koncentraciju.	.798		.637	3.353	1.174	.773		.599	3.345	1.149
I can recognize when my concentration low down./ Mogu prepoznati kada mi padne koncentracija.		.702	.524	3.775	1.098		.598	.382	3.958	1.070
I can easily restore concentration on my performance./ Mogu lako vratiti koncentraciju na izvođenje.	.653		.436	3.647	0.971	.765		.650	3.550	1.075
I am aware on my thinking, feeling and bodily sensations that may disturb my concentration during performance./ Svjestan/na sam vlastitih misli, osjećaja i tjelesnih senzacija koje mogu poremetiti moju koncentraciju za vrijeme izvođenja.		.494	.244	3.608	1.016		.657	.434	3.479	1.128
I am aware on external factors (reaction of spectators, referee decisions, weather conditions, monitoring the results) that can disturb my concentration during performance./ Svjestan/na sam vanjskih faktora (reakcije gledatelja, sudačke odluke, vremenski uvjeti, praćenje rezultata na semaforu) koji mogu poremetiti moju koncentraciju za vrijeme izvođenja.		.660	.445	3.598	1.188		.474		3.333	1.291
At any time, I know what is important for my performance and in what should be focused /U svakom trenutku znam što je bitno za moje izvođenje i na što trebam biti fokusiran/a.	.689		.562	3.608	1.016	.625		.404	3.873	1.078
During most of the performance, I'm oriented on technical and/or tactical aspects of performance./ Veći dio izvođenja usmjeren/a sam na tehničke i/ili taktičke aspekte izvođenja.		.361	.230	3.598	1.188		.625	.395	3.587	0.995
I can easily shift the focus from irrelevant to the essential aspects of performance./ Lako mogu prebaciti fokus s nebitnih na bitne aspekte izvođenja.	.652		.510	3.950	0.942	.607		.371	3.634	1.133
I am aware that the error is result of the worse concentration./ Svjestan sam da je greška rezultat pada koncentracije.		.681	.467	3.657	1.000		.688	.474	3.951	1.047
My fault during the execution does not hinder the focus on the essential./Moje greške tijekom izvođenja ne otežavaju fokus na bitno.	.699		.529	3.851	1.014		.585	.430	2.811	1.283
I know why I my concentration fall during performance./ Znam zbog čega mi pada koncentracija za vrijeme izvođenja.		.571	.380	3.255	1.248	-	-	-	-	-
Kaiser-Meyer-Olkin Measure / Bartlett's Test of Sphericity	.758	306.22** (df=66)				.748	273.39** (df=55)			
Eigenvalue	3.230	2.329				2.819	2.056			
Variance Explained	26.92%	19.40%				25.63%	18.69%			
Reliability (Cronbach's alpha)	0.500	0.627				0.505	0.599			

Legend: r=correlation of the variable with principal component; h²= communalities; f1= Maintaining attention skill; f2= Awareness about the state of attention

Table 3. Extensive Internal Attention Scale: descriptive characteristics and results of Principal Components Analysis (PCA), with belonging reliabilities, applied on the sample of male and female athletes

Items - males	Males				Females			
	r	h²	Mean	Std. Dev.	r	h²	Mean	Std. Dev.
During the the performance I'm thinking about errors./Tijekom izvođenja razmišljam o greškama.	0.540	.292	3.129	1.246	0.505	.255	3.211	1.341
During the performance I feel I am not aware of what is happening./Tijekom izvođenja imam osjećaj da nisam svjestan što se događa.	0.725	.526	2.455	1.382	0.653	.426	2.329	1.373
I have a feeling that during the performance I'm confused in my thoughts./Imam osjećaj da se zapetljam tijekom izvođenja u svojim mislima.	0.753	.566	2.559	1.339	0.738	.545	2.490	1.321
I cannot recognize myself while performing./Ne mogu sam/a sebe prepoznati tijekom izvođenja.	0.769	.592	2.129	1.155	0.586	.344	1.971	1.148
My feelings have occupied me so that I can't focus attention on performance./Moji osjećaji me okupiraju tako da ne mogu usmjeriti pažnju na izvođenje.	0.711	.505	2.297	1.245	0.690	.475	2.090	1.211
My thoughts strayed to something unrelated to performance./Misli mi odlutaju na nešto nevezano za izvođenje.	0.755	.571	2.720	1.364	0.689	.475	2.254	1.302
Some errors cannot be out of my mind during the performance./Pojedine greške ne mogu izbaciti iz glave tijekom izvođenja.	0.521	.271	3.010	1.206	0.572	.328	3.049	1.280
Everyday worries occupy me during performance./Okupiraju me svakodnevne brige tijekom izvođenja.	0.707	.499	2.471	1.460	0.639	.409	2.184	1.366
	-	-	-	-	0.574	.330	3.071	1.215
Kaiser-Meyer-Olkin Measure / Bartlett's Test of Sphericity	.842		256.706** (df=28)		.815		310.186** (df=36)	
Eigenvalue / Variance Explained	3.822		47.78%		3.586		39.85%	
Reliability (Cronbach's alpha)	0,840				0.808			

Legend: r=correlation of the variable with principal component; h²= communalities

Table 4. Extensive External Attention Scale: descriptive characteristics and results of Principal Components Analysis (PCA), with belonging reliabilities, applied on the sample of male and female athletes

Items - males	Males				Females			
	r	h²	Mean	Std. Dev.	r	h²	Mean	Std. Dev.
I think I have good spatial orientation bit for my sport./Mislim da imam dobru prostornu orijentaciju bitnu za moj sport.	.681	.464	4.186	0.887	.650	.464	3.896	0.914
During performance, I can notice also the other things around me./Uz izvođenje mogu primijetiti i druge stvari oko mene.	.367	.135	3.725	1.064	-	-	-	-
If necessary, I can simultaneously monitor multiple stimuli which are important for successful performance./Po potrebi mogu istovremeno pratiti više podražaja bitnih za uspješno izvođenje.	.741	.549	3.840	0.896	.688	.135	3.608	1.028
I can well adapt my performance to environmental conditions./Mogu dobro prilagoditi svoje izvođenje uvjetima u okolini.	.697	.486	3.794	1.037	.701	.549	3.771	0.973
I am able to assess all the relevant external factors on my performance./Mogu dobro procijeniti sve bitne vanjske faktore na moje izvođenje.	.718	.516	3.598	0.967	.671	.486	3.461	1.004
I know how to adjust my own performance to external factors in order to be successful./Znam kako prilagoditi vlastito izvođenje vanjskim faktorima da bi ono bilo uspješno.	.846	.716	3.608	1.036	.741	.516	3.514	1.055
Kaiser-Meyer-Olkin Measure / Bartlett's Test of Sphericity	.781		154.379** (df=15)		.751		122.541** (df=10)	
Eigenvalue / Variance Explained	2.866		47.77%		2.386		47.72%	
Reliability (Cronbach's alpha)	0.673				0.624			

Legend: r=correlation of the variable with principal component; h²= communalities

Table 5. Narrow Internal Attention Scale: descriptive characteristics and results of Principal Components Analysis (PCA) with Varimax rotation, with belonging reliabilities, applied on the sample of male and female athletes

Items - males	Males					Females				
	f1	f2	h2	Mean	Std. Dev.	f1	f2	h2	Mean	Std. Dev.
I can follow the course of my thoughts during the competition (performance)./ Mogu pratiti tijek svojih misli tijekom natjecanja (izvođenja).	**.722**		.522	3.812	1.102	**.676**		.465	3.789	1.044
I repeat to myself what to do during the performance./ Ponavljam u sebi što trebam raditi tijekom izvođenja.		**.836**	.699	3.386	1.319		**.819**		3.190	1.378
I notice that I speak negative things to myself during the performance./ Mogu primijetiti da si govorim negativne stvari tijekom nastupa (izvođenja).	-.360	**.553**	.435	2.686	1.421	-.447	**.594**	.552	2.769	1.500
I can recognize my negative feelings during the performance./ Mogu prepoznati svoje negativne osjećaje tijekom izvođenja.	-	-	-	-	-		**.497**	.259	3.350	1.218
In some situations I have to take into account the position of the body during the performance./ U nekim situacijama moram voditi računa o položaju tijela tijekom izvođenja.		**.776**	.635	4.000	1.053		**.667**	.470	3.811	1.261
I can make a brief analysis of my performance./ Mogu napraviti kratku analizu svog izvođenja.	**.735**		.545	3.804	1.081	**.792**		.652	3.783	1.022
I quickly learn from my mistakes./ Brzo učim na greškama.	**.677**		.467	3.792	1.033	**.685**		.491	3.631	1.078
Kaiser-Meyer-Olkin Measure / Bartlett's Test of Sphericity	.497			70.493** (df=15)		.593			124.880** (df=21)	
Eigenvalue	1.683	1.620				1.789	1.770			
Variance Explained	28.05%	26.99%				25.56%	25.29%			
Reliability (Cronbach's alpha)	0.543	0.547				0.547	0.559			

Legend: r=correlation of the variable with principal component; h2= communalities; f1= Awareness about the attention during performance; f2= Internal speech

Table 6. Narrow External Attention Scale: descriptive characteristics and results of Principal Components Analysis (PCA), with belonging reliabilities, applied on the sample of male and female athletes

Items	Males				Females			
	r	h^2	Mean	Std. Dev.	r	h^2	Mean	Std. Dev.
Some things I am doing 'unconsciously', but successful./ Neke stvari odradim „nesvjesno" i na kraju budu uspješne.	.609	.370	3.980	0.921	.734	.539	3.859	1.069
Some acts I perform automatically./ Neke radnje izvodim automatski.	.613	.376	4.265	0.807	.715	.512	4.191	1.007
Some operations I perform instinctively./ Neke radnje izvodim instinktivno.	.427	.182	4.059	0.899	.623	.389	3.826	1.136
I can focus only on one aspect of the action during the performance./ Mogu se fokusirati na jedan aspekt radnje tijekom izvođenja.	.513	.263	3.545	1.145	.667	.446	3.574	1.135
I feel like I'm constantly focused on the essential aspects of performance./ Imam osjećaj da sam stalno fokusiran na bitne aspekte izvođenja.	.523	.273	3.588	1.018	.529	.280	3.348	1.042
At any time, I'm ready to react quickly./ U svakom trenutku spreman sam reagirati brzo.	.636	.404	4.137	1.015	.422	.178	3.958	0.971
The best outcome is usually when you do not think much./ Najbolji ishod obično bude kad ne razmišljam puno.	.480	.231	3.971	1.067	-	-	-	-
Kaiser-Meyer-Olkin Measure / Bartlett's Test of Sphericity	.590		79.654** (df=21)		.726		124.840** (df=15)	
Eigenvalue / Variance Explained	2.099		29.99%		2.343		39.05%	
Reliability (Cronbach's alpha)	0.597				0.637			

Legend: r=correlation of the variable with principal component; h2= communalities;

Table 7. Correlations (Spearman) among all the components in all questionnaires in male and female athletes

	Males								Females							
	Mental Energy	Maintaining attention skill	Awareness about state of attention	Extensive Internal Attention	Extensive External Attention	Awareness about attention during performance	Internal speech	Narrow External Attention	Mental Energy	Maintaining attention skill	Awareness about state of attention	Extensive Internal Attention	Extensive External Attention	Awareness about attention during performance	Internal speech	Narrow External Attention
Mental Energy	1								1							
Maintaining attention skill	.492**	1							.485**	1						
Awareness about state of attention	.324**	.320**	1						.229**	.058	1					
Extensive Internal Attention	-.275**	-.420**	.119	1					-.246**	-.539**	.385**	1				
Extensive External Attention	.416**	.585**	.529**	-.199**	1				.523**	.780**	.261**	-.362**	1			
Awareness about attention during performance	.373**	.513**	.321**	-.350**	.473**	1			.373**	.558**	.173**	-.316**	.569**	1		
Internal speech	.024	.029	.190**	.497**	.010	-.034	1		.054	-.020	.397**	.519**	-.004	.011	1	
Narrow External Attention	.565**	.500**	.468**	-.095	.567**	.492**	.067	1	.544**	.500**	.376**	-.104	.624**	.543**	.085	1

Legend: * Correlation significant with p<0.05 (two-tailed); ** Correlation significant with p<0.01 (two-tailed)

mensions of attention and mental energy are statistically significantly and mostly positively (low to medium sized) correlated, except with the dimension Extensive internal attention (reverse coded).

R E F E R E N C E S

Abernethy, B., Summers, J.J. & Ford, S. (1998). Issues in the measurement of attention. In, J.L. Duda (Ed.) *Advances in sport and exercise psychology measurement* (pp. 173-193). Morgantown: Fitness Information Technology.

Kovářová, L., Kovář, K. (2010). Concentration of attention as a predisposition of performance in junior categories in endurance sports. *Acta Universitatis Palackianae Olomucensis. Gymnica*, 40 (1), 23-31.

Landers, D.M. (1982). Arousal attention and skilled performance: Further considerations. *Quest*, 33, 271-283.

Lieberman, H.R. (2006). Mental Energy: Assessing the Cognition Dimension. *Nutrition Reviews*, 64 (7), 10-13.

McNair, D.M., Heuchert, J.W.P., & Shillony, E. (in press). *Research with the Profile of Mood States (POMS) 1964-2002: A comprehensive bibliography*. Toronto, Canada: Multi-Health Systems.

McNair, D.M., Lorr, M., & Droppleman, L.F. (1971). *Manual for the Profile of Mood States*. San Diego, CA: Educational and Industrial Testing Services.

Nideffer, R.M. (1976). Test of Attentional and Interpersonal Style. *Journal of Personality and Social Psychology*, 34, 394-404.

Nideffer, R.M., Bond, J. (2012). *A Cross Cultural Examination of the Concentration Skills of Elite Level Athletes*. Retrieved from: http://www.epstais.com/articles/xcult.php (2/1/2015).

Nideffer, R.M., Bond, J. Cei, A. & Manili, U. (2012). *Building A Psychological Profile of Olympic Medalists and World Champions*. Retrieved from: http://www.taisdata.com/ articles/building.php (2/1/2015).

Norman, D.A. (1968). Toward a theory of memory and attention. *Psychological Review*, 75, 522-536.

O'Connor, P.J. (2006). Mental Energy: Assessing the Mood Dimension. *Nutrition Reviews,* 64 (7), 7-9.

Orlick, T. & Partington, J. (1988). Mental links to excellence. *The Sport Psychologist*, 2, 105-130.

Summers, J.J. & Ford, S.K. (1990). The test of attentional and interpersonal style: An evaluation. *International Journal of Sport Psychology*, 21, 102-111.

Van Schoyck, S.R. & Grasha, A.F. (1981). Attentional style variations and athletic ability: The advantage of a sport-specific test. *Journal of Sport Psychology*, 3, 149-165.

Vallerand, R.J. (1983). Attention and decision-making: A test of the predictive validity of the Test of Attentional and Interpersonal Style (TAIS) in a sport setting. *Journal of Sport Psychology,* 5, 449-459.

Weinberg, R.S., Gould, D. (1995). *Foundations of sport and exercise psychology*. Human Kinetics. Champaign, Illinois.

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