CURRENT ISSUES IN PERSONALITY PSYCHOLOGY · VOLUME 2(2), 2014
DOI: 10.5114/CIPP.2014.44303

ORIGINAL ARTICLE

The Imagination in Sport Questionnaire – reliability and validity characteristics

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BACKGROUND
Imagery is an effective performance enhancement technique. Imagery has been described previously in a range of psychological domains. Measuring imagery is critical in research and practice in sport. Self-report questionnaires are the most regularly used method. The aim of the present study was to examine reliability and validity characteristics of the Imagination in Sport Questionnaire (Kwestionariusz Wyobraźni w Sporcie – KWS).

PARTICIPANTS AND PROCEDURE
Five and hundred eight (N = 326 – study I; N = 182 – study II) Polish athletes completed questionnaires (169 male, 156 female – study I; 139 male, 43 female – study II), aged between 12 and 57 years (M = 22.08, SD = 8.18 – study I; age 19-24, M = 20.46, SD = 1.1 – study II), at different competitive levels and recruited from various sports disciplines.

RESULTS
Results indicated the maintained good stability and internal consistency over a 3-week period. Results of confirmatory factor analysis suggested that the 7-factor structure of the KWS resulted in acceptable model fit indices (NC = 2416.63, df = 1203, GFI = 0.944, AGFI = 0.944, CFI = 0.786, RMSEA = 0.056, p (RMSEA < 0.05) = 0.002 – first study; NC = 2234.39, df = 1203, GFI = 0.673, AGFI = = 0.640, CFI = 0.691, RMSEA = 0.069, p (RMSEA < 0.05) = = 0.000 – second study). Concurrent validity was supported by examination of the relationships between the KWS subscales and the SIAM (Sport Imagery Ability Measure) in Polish adaptation. In addition, differences in athletes' imagery ability were examined across competitive levels, and in relation to both gender and age.

CONCLUSIONS
Overall, the results supported the reliability and construct validity of the KWS.

KEY WORDS
imagery; Imagination in Sport Questionnaire; athletes

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Authors' contribution — A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection

To cite this article — Budnik-Przybylska, D. (2014). The Imagination in Sport Questionnaire – reliability and validity characteristics. *Current Issues in Personality Psychology*, *2*(2), 68-80.

BACKGROUND

The skill of visualisation is a technique frequently employed in many areas of life, for example, in sport psychology in order to improve results and as a means of dealing with stress. Visualisation activates sensory and emotional experience through suggestion (Kłodecka-Różalska, 1996; Morris & Summers, 1998; Williams, 2006; Cox, 2007). It allows one to act out the 'set position' based on the dominant imagery style e.g. visual, kinaesthetic, aural and to perform an 'akinetic' move in the imagination, making one accustomed to a given move at the same time (Paul-Cavallier, 1992). Gawain (2001) stated that creative visualisation has been a method of employing imagination in order to shape a given reality according to our wishes. "The relationship between the reactions of the body and mental movement imagery has long been observed in sport. The study of this process, initiated over 40 years ago, has revealed that (see: Eysenck, 1965) muscle stimulation observed through an EMG test and present during the act of imagining movement is almost identical to that present during genuine movement" (Nowicki, 2004, p. 135, Orlick, 2008).

Imagery has been described previously in a range of psychological domains. An important definition applicable to the sport context defines imagery as the: "creation or re-creation of an experience generated from memorial information, involving quasi-sensorial, quasi-perceptual, and quasi-affective characteristics, that is under the volitional control of the imager, and which may occur in the absence of the real stimulus antecedents normally associated with the actual experience" (Morris, Spittle & Watt, 2005, p. 19).

Imagery is an effective performance enhancement technique. Research and applied work have also shown that imagery processing in relation to sport can be improved through training (Morris *et al*., 2005). Paivio (1986) suggested that individual differences in the capacity to use imagery was a product of genetic variability interacting with experience. That means that imagery use is most effective for people with greater imagery ability (Martin, Moritz & Hall, 1999).

Measuring imagery is critical in research and practice in sport. Self-report questionnaires are the most regularly used method.

There is a range of measures developed within the sport and motor performance domains, such as the Movement Imagery Questionnaire (MIQ; Hall, Pongrac & Buckholz, 1985), Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997), Vividness of Movement Imagery Questionnaire (VMIQ; Isaac, Marks & Russell, 1986) and revised Vividness of Movement Imagery Questionnaire-2 (VMIQ-2; Roberts, Callow, Hardy, Markland & Bringer, 2008). All these questionnaires were constructed for assessing imagery ability associated with general motor movements and they do not examine images related to sport (Bhasavanija, Vongjaturapat, Morris & Muangnapo 2011). These measures assess only an individual's ability to image specific movements (e.g., knee lift) and actions (e.g. jumping of a high wall) (Williams & Cumming, 2011). Hall (1998) explained such a situation by saying: "Just because athletes might be able to easily and vividly imagine themselves performing a skill (e.g. "throwing a ball"), does not mean they can just as easily and vividly imagine receiving a medal or being in control of difficult situations" (p. 171). Furthermore, only a single dimension (vividness), and two sense modalities (visual and kinaesthetic) are measured by those questionnaires.

Measures constructed specifically for sport include the Sport Imagery Questionnaire (SIQ; Martens, 1982), modified versions of the SIQ (Vealey, 1986; Vealey & Walter, 1993; Vealey & Greenleaf, 1998), the Motivational Imagery Ability Measure for Sport (MIAMS; Gregg & Hall, 2006), the Sport Imagery Ability Questionnaire (SIAQ; Williams & Cumming, 2011), and the Sport Imagery Ability Measure (SIAM; Watt, Morris & Andersen, 2004). The SIQ (Martens, 1982) is a self-report measure, which involves description of four sport-oriented scenes. After visualization of each scene athletes rate vividness of visual, kinaesthetic, auditory imagery and mood associated with imagery. The MIAMS (Gregg & Hall, 2006) measures participants' imaging abilities associated with ease and level of emotion experienced following the generation of eight motivational general images, i.e., four MGA (motivational general arousal) and four MGM (motivational general mastery) images. The SIAQ is a questionnaire developed for measuring sport-specific images and at the same time assessing cognitive and motivational imagery ability associated with the five functions of athlete imagery use: skill, strategy, goal, affect, and mastery sport imagery ability (Williams & Cumming, 2011). The Sport Imagery Ability Measure (SIAM) (Watt *et al*., 2004) assesses five imagery dimensions (vividness, control, ease of generation, speed of generation, and duration), six senses (visual, auditory, kinaesthetic, olfactory, gustatory, and tactile sense), and the experience of emotions.

A precise imagery ability measure can assist researchers, coaches, psychologists and athletes to identify whether athletes have high or low imagery ability and then develop or modify imagery programmes to support their performance. Imagery ability is normally assessed from performance on a specific set of mental-ability tasks or from answers to questionnaires that require behavioural or emotive-imagery responses (Sheehan, Ashton & White, 1983). Imagery-use measures typically incorporate a questionnaire format to determine when, where, and how (Hall, 1998) people use imagery during their involvement in a particular performance or experience (Morris *et al*., 2005).

Research has demonstrated that images can serve multiple functions for athletes (Nordin & Cumming,

2008; Short, Monsma & Short, 2004). Two judokas use a variety of sensory modalities visualizing the execution of techniques. One can use the imagination to improve the execution of technique using an external perspective. The second one visualizes feeling his own physiological states just to build confidence during competition.

Therefore, there is a need for a tool combining the advantages of the above-mentioned questionnaires, and exploring a holistic view of visualization – a tool which also will measure the ability of visualization in sport as well as ways of sport athletes' effective visualization.

The aim of the present investigation was to develop a valid, reliable and comprehensive assessment of athletes' imagery ability called the Imagination in Sport Questionnaire (Kwestionariusz Wyobraźni w Sporcie – KWS).

PARTICIPANTS AND PROCEDURE

PARTICIPANTS

Participants involved in the first study were recruited from primary and secondary schools offering specialist sport programmes, Gdansk University of Physical Education and Sport, University of Gdansk, and elite sporting groups (N = 326) (169 male, 156 female, missing data were recorded), aged between 12 and 57 years (M = 22.08, SD = 8.18). This sample was also categorized into two ability levels, novice (n = 84) and elite (n = 186), representing a variety of sports disciplines, including football, sailing, basketball, track and field, volleyball, and swimming. An additional sample of 32 athletes was recruited from Gdansk University and Gdansk University of Physical Education and Sport to test the stability of the KWS over time.

Participants of the second study consisted of 182 students recruited from Gdansk University of Physical Education and Sport (139 male, 43 female), aged between 19 and 24 years (M = 20.46, SD = 1.10) also categorized into two ability levels, novice (n = 55) and elite (n = 81). They also represent a variety of sport disciplines.

PROCEDURE

The study was approved by the University of Gdansk Human Research Ethics Committee. The lead investigator and a research assistant contacted the individuals directly and provided them information indicating the study purpose, voluntary participation, and confidentiality of the results. Written consent was obtained from athletes over 18 years, and a parent or person with care responsibilities in the case of minors. The treatment of athletes was in accordance with APA ethical guidelines. In both studies each participant completed the KWS and provided their demographic information (4 items to source data associated with gender, age, sport/s in which the athlete has had involvement, and competitive level of their participation) in a quiet environment, usually at their education or training facilities. The participants completed the materials individually or in small groups and then returned them to the investigators. Data collection took approximately 20 minutes. The test-retest reliability procedure required the athletes recruited to complete the KWS on two occasions separated by a 3-week interval.

DATA ANALYSIS

Descriptive, reliability, correlational, and inferential analyses were conducted using SPSS version 21. Relationships between subscales, the time stability of the KWS, correlation of the KWS with age and relationships between KWS and SIAM were calculated using Pearson's correlation coefficient. A value of $r > 0.8$ is considered to be the typical value indicative of strong test-retest reliability (Kline, 2000). Internal consistency of each of the 7 KWS sub-scales was examined using Cronbach's α coefficient. Independent samples t-tests were used to examine gender and competitive level differences in imagery ability for each of KWS subscales.

Factor validity hierarchical cluster structure was tested using the Ward method in a linear covariance matrix among scale items scores. The analysis was conducted using Statistica 10.

Confirmatory factor analysis (CFA) was conducted using AMOS 21 for Windows and the maximum likelihood estimation (Arbuckle, 2006). To determine the fit of the model, there were considered different indices of fit that included normed χ^2 (NC), goodness of fit (GFI) index, goodness of fit index adjusted for the number of parameters (AGFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA), the p-value for the null hypothesis that RMSEA is greater than or equal to 0.05. A good model fit is inferred when values of AGFI are higher than 0.80; and CFI and GFI are higher than 0.90; and the RMSEA is close to 0.08 χ^2 and p (RMSEA < 0.05) is not significant, but these indices are very strict and considered as over-conservative (Hooper, Coughlan & Mullen, 2008; Hu & Bentler, 1999).

STEPS OF CREATING THE QUESTIONNAIRE

The aim of the first phase of the questionnaire construction was to create questions that concerned two aspects of visualization: a) whether the person is able to imagine something (ability), b) the ways of the person's visualization (use).

The questionnaire had to be created in such way that the entire study/filling in should not exceed 10-20 minutes. Filling in was to be preceded by a dynamic visualization of a person's behaviour/action in the situation common in sport competition. This situation should be connected with the excitation emotions, with the present threat of failure or assessment.

Preliminary dimensions of the questionnaire were: vividness, modalities, visualization control and flexibility, affirmation – positive self-affirmation, the perspective of visualization (external vs. internal), emotions – feeling emotions during visualization, ease of visualization and general – the use of visualization in general.

The preliminary instruction was constructed in the following way:

Imagine yourself before the first start in the competition of high rank. If you want, you can close your eyes. Try to keep the image as realistic as possible, have as much detail as possible, pay attention to all elements. Imagine what you see, what you hear and what you feel, what you're doing, what others are doing and what is happening around you. Feel the emotions and sensations that this situation induces in you.

Rate specific aspects of your image on a scale from 1 to 5 by entering the appropriate number next to where 1 means "at all" and 5 "completely".

TESTING INSTRUCTIONS AND THE QUESTIONNAIRE

Preliminary analysis was undertaken on 64 questions. Students participating in sport mental training classes (N = 30), having different sports experience read the instructions and questionnaire. Participants were asked to imagine the situation after reading the instructions and then answered if everything was clear and if they understood the way of filling in the questionnaire. If the questions according to them were unclear, students were asked to write their comments. From the pool of those questions there were selected 58 which were included in the first study. After students' comments the instruction was modified as follows:

Imagine yourself before the start of the high-level competitions. Spend on this task about 60 seconds. If you want, you can close your eyes. Try to keep the image as realistic as possible, have as much detail, pay attention to all the elements. Imagine what you see, what you hear and what you feel, what you're doing, what others are doing and what is happening around you. Feel the emotions and sensations that this situation has on you.

Then rate the different aspects of your image on a scale of 1 to 5 next to each statement by entering the appropriate number, where 1 means "not at all" and 5 "completely so".

RESULTS

TESTING THE RELIABILITY AND VALIDITY OF THE METHOD

To analyse factor validity, hierarchical cluster structure was tested using the Ward method in a linear covariance matrix among scale items scores (Figure 1).

There were extracted six clusters of questions representing 6 groups/types of sensations associated with visualization – physiological sensations, sensory modalities, ease/control, perspective, affirmations, vision and general – that allow the variance of the distance between the positions of the questionnaire to be reduced by about 60%.

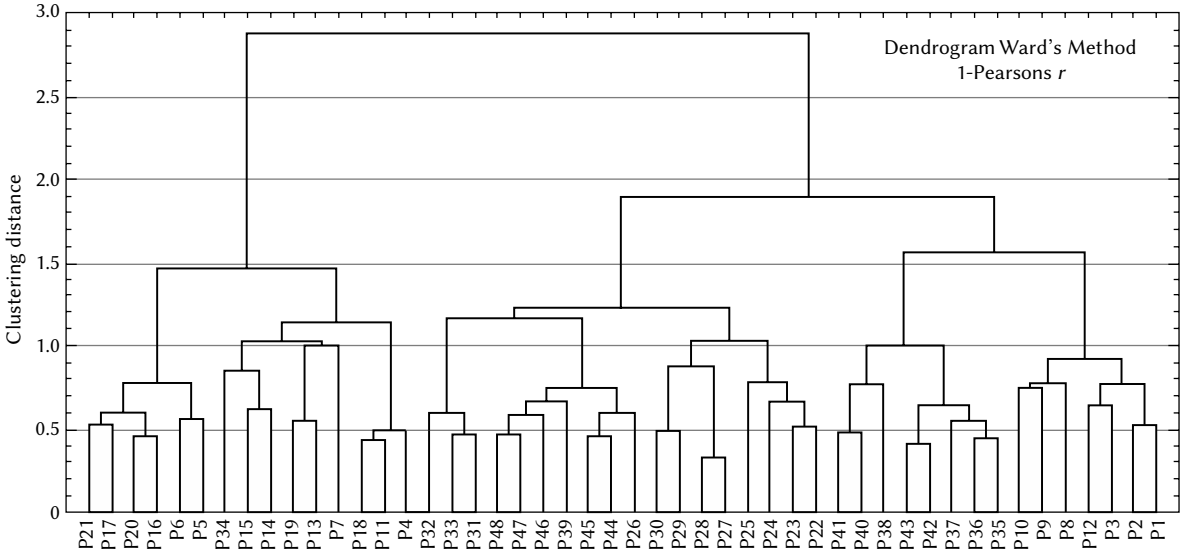

Figure 1. Dendrogram of hierarchical cluster analysis of KWS.

In order to verify the internal consistency of each of the 7 subscales of the KWS, Cronbach's α was used (Table 1).

The questionnaire in the first version consisted of 58. After removing items with the lowest Cronbach's α the final version consisted of 51 questions. The final version was further verified in the CFA model based on the data in the first and second validation sample.

The analysis was conducted using maximum likelihood estimation based on the covariance matrix between the positions of the questionnaire on the assumption that 7 latent variables distinguished in the preceding step represent 6 subscales, and the seventh is the result of a pre-defined scale named general. In addition, it was assumed that the residual variances of individual items assigned to the scales (unique variances) are not correlated, while individual subscales could be correlated.

The results of the analysis indicated that the estimated model demonstrated satisfactory fit to the data and accurately reflected relationships among the questionnaire items: NC = 2416.63, *df* = 1203, GFI = 0.944, AGFI = 0.944, CFI = 0.786, RMSEA = 0.056, *p* (RMSEA < 0.05) = 0.002 – first study; NC = 2234.39, *df* = 1203, GFI = 0.673, AGFI = 0.640, CFI = 0.691, RMSEA = 0.069, *p* (RMSEA < 0.05) = 0.000 – second study (Tables 2 and 3).

Results of the factor structure of all subscales from the first study indicate that all items are positively and strongly related to the latent variable they have been assigned. The highest factor loading was b = 0.76 for item number 28 assigned to the perspective subscale and the smallest factor loading was b = 0.34 for item number 13 assigned to modalities.

Results of the factor structure of all subscales from the second study indicate that all items are also positively and strongly related to the latent variable they have been assigned except for items numbered 11 assigned to modalities and 4, 5, 6, assigned to visual. However, they can be considered as positively related although the relation could not be as strong as for other items. The highest factor loading was b = 0.82 for item number 16 assigned to the modalities subscale.

Sample questions included in each KWS subscale:

Physiological feelings (6 questions):

1. How clearly did you feel the emotions that you experienced?
2. How clearly was the feeling of the movements executed by you?
3. How clearly did you feel your heart beat?

Modalities (7 questions):

1. How clearly did you hear the words that were spoken in this situation?
2. You used taste in your image.

Easy/control (10 questions):

1. How easy is it to recall this episode from end to beginning?
2. How easily can you change the tactics in your imagination?

Perspective (8 questions):

1. How easily can you correct the movements of your body while visualizing?
2. How easy is it for you to change the perspectives of looking at the situation – once looking with your own eyes from inside your body, and once looking from the side on you?

Affirmations (8 questions):

1. You tune in positively to a successful start.
2. You feel ready to win.

Visual (6 questions):

1. Were colours that occurred in this situation clear?
2. How sharp and clear was the picture in the whole situation?

Table 1

Internal consistency of each of 7 subscales of the KWS

Name of subscale	Number of items	Cronbach's α	Mean of items' total correlations	Number of items after removal of low discrimination items	Cronbach's α after removal of low discrimination items	Mean of items' total correlations after removal of low discrimination items
1. Feelings	6	0.75	0.34	6	0.75	0.34
2. Modalities	9	0.66	0.18	7	0.69	0.24
3. Ease/Control	10	0.79	0.27	10	0.79	0.27
4. Perspective	8	0.74	0.26	8	0.74	0.26
5. Affirmations	8	0.79	0.32	8	0.79	0.32
6. Visual	7	0.65	0.21	6	0.64	0.23
7. General	10	0.69	0.19	6	0.79	0.39

Table 2

Standardised and unstandardised path coefficients of CFA model in study 1

		Estimate	S.E.	C.R.	*P*	*β*
gen1	GENERAL	0.636	0.045	14.099	***	0.735
gen2	GENERAL	0.715	0.054	13.289	***	0.704
gen3	GENERAL	0.657	0.054	12.073	***	0.654
gen4	GENERAL	0.501	0.056	8.868	***	0.507
gen7	GENERAL	0.573	0.049	11.763	***	0.640
gen8	GENERAL	0.570	0.049	11.707	***	0.638
p21	FEELINGS	0.831	0.064	12.994	***	0.703
p17	FEELINGS	0.836	0.069	12.095	***	0.664
p20	FEELINGS	1.091	0.128	8.540	***	0.497
p16	FEELINGS	0.804	0.081	9.927	***	0.565
p6	FEELINGS	0.756	0.067	11.346	***	0.632
p5	FEELINGS	0.643	0.060	10.638	***	0.599
p15	MODALITIES	0.650	0.082	7.956	***	0.468
p14	MODALITIES	0.553	0.093	5.967	***	0.360
p19	MODALITIES	0.635	0.069	9.221	***	0.532
p13	MODALITIES	0.352	0.064	5.524	***	0.335
p18	MODALITIES	0.969	0.070	13.930	***	0.743
p11	MODALITIES	0.955	0.075	12.756	***	0.694
p4	MODALITIES	0.876	0.074	11.765	***	0.651
p32	EASE/CONTROL	0.565	0.057	9.988	***	0.546
p33	EASE/CONTROL	0.613	0.060	10.155	***	0.553
p31	EASE/CONTROL	0.529	0.064	8.326	***	0.466
p48	EASE/CONTROL	0.625	0.059	10.646	***	0.576
p47	EASE/CONTROL	0.711	0.054	13.143	***	0.680
p46	EASE/CONTROL	0.601	0.051	11.826	***	0.627
p39	EASE/CONTROL	0.689	0.064	10.704	***	0.579
p45	EASE/CONTROL	0.720	0.058	12.354	***	0.649
p44	EASE/CONTROL	0.708	0.052	13.634	***	0.699
p26	EASE/CONTROL	0.676	0.062	10.832	***	0.583
p30	PERSPECTIVE	0.679	0.075	9.011	***	0.512
p29	PERSPECTIVE	0.703	0.077	9.151	***	0.518
p28	PERSPECTIVE	0.983	0.066	14.880	***	0.761
p27	PERSPECTIVE	0.887	0.064	13.763	***	0.719
p25	PERSPECTIVE	0.540	0.066	8.149	***	0.468
p24	PERSPECTIVE	0.591	0.065	9.026	***	0.512
p23	PERSPECTIVE	0.611	0.063	9.704	***	0.545
p22	PERSPECTIVE	0.720	0.064	11.198	***	0.613
p41	AFFIRMATIONS	0.702	0.062	11.417	***	0.619

(Table 2 continues)

Table 2
(Table 2 continued)

		Estimate	S.E.	C.R.	*P*	*β*
p40	AFFIRMATIONS	0.524	0.062	8.497	***	0.483
p38	AFFIRMATIONS	0.496	0.063	7.927	***	0.454
p43	AFFIRMATIONS	0.806	0.059	13.745	***	0.714
p42	AFFIRMATIONS	0.817	0.060	13.667	***	0.711
p37	AFFIRMATIONS	0.669	0.055	12.052	***	0.646
p36	AFFIRMATIONS	0.815	0.055	14.809	***	0.754
p35	AFFIRMATIONS	0.712	0.061	11.682	***	0.631
p10	VISUAL	0.528	0.069	7.677	***	0.457
p9	VISUAL	0.524	0.060	8.756	***	0.515
p8	VISUAL	0.539	0.090	5.977	***	0.364
p3	VISUAL	0.636	0.067	9.507	***	0.552
p2	VISUAL	0.689	0.053	12.875	***	0.708
p1	VISUAL	0.693	0.064	10.776	***	0.612

General (6 questions):
1. Do you generally create ideas easily?
2. Do you imagine the events waiting for you?

ANALYSIS OF TEMPORAL STABILITY

In order to verify the assumption that the questionnaire KWS maintains stability over time, the test-retest method was used. The results are presented in the table below.

The highest correlation was observed in the scale of affirmations (r = 0.74), and the lowest in the scale of perspective (r = 0.55). These results indicated that the questionnaire is stable over time (Table 4).

ANALYSIS OF CONCURRENT AND CONSTRUCT VALIDITY

In order to verify the assumption that the KWS measures the ability to visualize in sport the relationships between the KWS subscales and the SIAM (Sport Imagery Ability Measure) in Polish adaptation (Budnik-Przybylska, Karasiewicz, Morris & Watt, in press) were examined. The sample consisted of 472 people (combined results of study I and II – missing data were recorded). Results are presented in the table below.

The results of the analysis indicated that the correlations between the scales of the KWS and the corresponding scales of the questionnaire SIAM are relatively low or at most moderate (0.11 – 0.47) but all are in the expected direction. The strongest correlation was observed between the modality subscale and the subscale kinaesthetic (r = 0.342), the least (correlation irrelevant) gustatory and affirmations (Table 5).

In the next step, construct validity, which is the ability to differentiate the results of the KWS with factors related to gender, level of sport and age of the respondents, was estimated. Independent samples t-test and correlation analysis were used. The above analyses were performed on a group originating from the two studies (total sample N = 479, 186 females, 293 males). Results of the independent samples t-test to examine gender differences in the KWS subscales revealed significant differences in the following variables: easy/control ($t(477) = -2.57$, p = 0.01), affirmations ($t(476) = = -2.55$, p = 0.01) and vision ($t(477) = -2.03$, p = 0.04), where males' scores were higher than those of females. Further analysis concerned the participation level: athletes more advanced (N = 258) had statistically significantly higher scores than the less advanced (N = 122) in all subscales except modality. Finally, the KWS results were analysed according to age. No significant correlation between the KWS subscales and age was observed (Tables 6 and 7).

DISCUSSION

The aim of the study was to create a valid and reliable sport imagery ability measure which combines both features of visualization: imagery ability – the capacity to generate and use images (Hall, 1998, p. 165); and aspects of imagery use – how athletes use their imagery. The KWS satisfied those conditions.

The first step was to create the instruction of the questionnaire and a set of questions. After verifica-

Table 3
Standardised and unstandardised path coefficients of CFA model in study 2

		Estimate	S.E.	C.R.	*P*	β
gen1	GENERAL	0.403	0.043	9.293	***	0.671
gen2	GENERAL	0.491	0.058	8.435	***	0.621
gen3	GENERAL	0.480	0.063	7.617	***	0.571
gen4	GENERAL	0.316	0.067	4.689	***	0.371
gen5	GENERAL	0.394	0.051	7.789	***	0.581
gen6	GENERAL	0.473	0.068	6.983	***	0.530
p5	FEELINGS	0.614	0.070	8.803	***	0.640
p6	FEELINGS	0.477	0.073	6.527	***	0.488
p14	FEELINGS	0.957	0.093	10.334	***	0.712
p15	FEELINGS	0.926	0.090	10.235	***	0.707
p18	FEELINGS	1.029	0.087	11.833	***	0.785
p19	FEELINGS	0.853	0.079	10.823	***	0.737
p4	MODALITIES	0.975	0.102	9.585	***	0.716
p10	MODALITIES	0.871	0.097	8.964	***	0.651
p11	MODALITIES	0.117	0.093	1.259	.208	0.103
p12	MODALITIES	0.371	0.122	3.034	.002	0.244
p13	MODALITIES	0.529	0.107	4.961	***	0.390
p16	MODALITIES	0.995	0.084	11.914	***	0.816
p17	MODALITIES	0.434	0.091	4.747	***	0.374
p24	EASE/CONTROL	0.567	0.075	7.599	***	0.549
p29	EASE/CONTROL	0.531	0.081	6.567	***	0.485
p30	EASE/CONTROL	0.489	0.070	7.022	***	0.514
p31	EASE/CONTROL	0.502	0.069	7.292	***	0.530
p36	EASE/CONTROL	0.419	0.077	5.413	***	0.408
p41	EASE/CONTROL	0.518	0.053	9.690	***	0.668
p42	EASE/CONTROL	0.623	0.061	10.245	***	0.697
p43	EASE/CONTROL	0.559	0.061	9.202	***	0.642
p44	EASE/CONTROL	0.648	0.060	10.723	***	0.721
p45	EASE/CONTROL	0.566	0.061	9.333	***	0.649
p21	PERSPECTIVE	0.525	0.074	7.094	***	0.528
p20	PERSPECTIVE	0.549	0.078	6.990	***	0.522
p22	PERSPECTIVE	0.543	0.078	6.950	***	0.519
p23	PERSPECTIVE	0.794	0.088	8.997	***	0.643
p25	PERSPECTIVE	0.856	0.083	10.252	***	0.711
p26	PERSPECTIVE	0.973	0.091	10.666	***	0.732
p27	PERSPECTIVE	0.636	0.102	6.236	***	0.473
p28	PERSPECTIVE	0.626	0.098	6.390	***	0.483
p32	AFFIRMATIONS	0.400	0.062	6.446	***	0.488

(Table 3 continues)

Table 3

(Table 3 continued)

		Estimate	S.E.	C.R.	*P*	β
p33	AFFIRMATIONS	0.566	0.056	10.101	***	0.705
p34	AFFIRMATIONS	0.469	0.050	9.320	***	0.663
p35	AFFIRMATIONS	0.407	0.076	5.321	***	0.411
p37	AFFIRMATIONS	0.415	0.071	5.858	***	0.448
p38	AFFIRMATIONS	0.437	0.069	6.298	***	0.478
p39	AFFIRMATIONS	0.699	0.067	10.498	***	0.726
p40	AFFIRMATIONS	0.619	0.061	10.158	***	0.708
p1	VISUAL	0.816	0.083	9.828	***	0.735
p2	VISUAL	0.687	0.070	9.761	***	0.731
p3	VISUAL	0.564	0.087	6.461	***	0.510
p4	VISUAL	0.102	0.099	1.033	0.302	0.075
p5	VISUAL	0.049	0.068	0.716	0.474	0.051
p6	VISUAL	0.180	0.074	2.427	0.015	0.184

Table 4

Time stability correlation values for 7 subscales of KWS

N = 32	II feelings	II modalities	II ease/ control	II perspective	II affirmations	II visual	II general
Feelings	0.72*						
Modalities		0.62*					
Ease/Control			0.68*				
Perspective				0.55*			
Affirmations					0.74*		
Visual						0.62*	
General							0.72*

Note. $^{*}p < 0.05$

tion and removal of ambiguities the first version of the questionnaire was used in the first study. Cluster analysis was used, which allowed the following subscales to be extracted: physiological feelings, sensory modalities, ease/control, perspective, affirmations, visual, general.

The next step was to check the internal consistency of the measure. After removing a few questions Cronbach's α of each subscale ranged from 0.64 for the visual to 0.79 for the ease/control, affirmations and general. Those indices confirmed that the measure was internally consistent. The second improved version was used in the second study.

Two confirmatory factor analyses (CFA) were then conducted to verify whether the estimated model showed a satisfactory fit to the data. The results from both studies were used separately for this purpose. The proposed model achieved satisfactory fit values in both studies.

Test-retest reliability analyses indicated that the KWS subscales maintained good stability over a 3-week period. The highest correlation was observed in the scale of affirmations ($r = 0.74$), the lowest in the scale of adoption of the perspective ($r = 0.55$).

The next step was to analyse the concurrent and construct validity. For this purpose, the relationships between KWS subscales and The Sport Imagery Ability Measure (SIAM) (Watt *et al.*, 2004) were examined. Although there is a relationship between the questionnaires they measure different variables.

Relevant demographic characteristics including gender, age, and competitive skill level were examined for differences as an indication of the construct validity of the KWS.

Table 5

Bivariate correlations between the KWS subscales and SIAM subscales

N = 443		Feelings	Modalities	Ease/ Control	Perspective	Affirma-tions	Visual	General
SubCont	Pearson's correlations	0.197**	0.207**	0.283**	0.308**	0.227**	0.278**	0.230**
	p	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SubEase	Pearson's correlations	0.171**	0.159**	0.250**	0.279**	0.207**	0.248**	0.204**
	p	0.000	0.001	0.000	0.000	0.000	0.000	0.000
SubSpeed	Pearson's correlations	0.134**	0.136**	0.216**	0.243**	0.185**	0.223**	0.171**
	p	0.005	0.004	0.000	0.000	0.000	0.000	0.000
SubDurat	Pearson's correlations	0.108*	0.157**	0.146**	0.190**	0.101*	0.152**	0.113*
	p	0.023	0.001	0.002	0.000	0.035	0.001	0.017
SubVisul	Pearson's correlations	0.065	0.093	0.129**	0.153**	0.078	0.165**	0.090
	p	0.171	0.050	0.006	0.001	0.100	0.000	0.059
SubAudit	Pearson's correlations	0.219**	0.329**	0.160**	0.184**	0.125**	0.170**	0.147**
	p	0.000	0.000	0.001	0.000	0.009	0.000	0.002
Subkinas	Pearson's correlations	0.338**	0.342**	0.244**	0.258**	0.209**	0.254**	0.230**
	p	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SubOlfac	Pearson's correlations	0.151**	0.284**	0.092	0.118*	0.071	0.098*	0.095*
	p	0.001	0.000	0.054	0.013	0.137	0.040	0.046
SubGusta	Pearson's correlations	0.093	0.215**	0.041	0.081	0.024	0.039	0.034
	p	0.053	0.000	0.388	0.092	0.623	0.420	0.474
SubTact	Pearson's correlations	0.246**	0.298**	0.214**	0.247**	0.176**	0.235**	0.195**
	p	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SubEmot	Pearson's correlations	0.223**	0.262**	0.161**	0.147**	0.116*	0.165**	0.144**
	p	0.000	0.000	0.001	0.002	0.014	0.000	0.002
TOTSIAM	Pearson's correlations	0.252**	0.326**	0.245**	0.280**	0.191**	0.258**	0.210**
	p	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{*}p < 0.05$

In the current results there were three out of seven differences between women and men, where men presented a higher level of imagery, which was in accordance with some previous studies that have identified gender differences in imagery ability (e.g., Campos, Pérez-Fabello & Gómez-Juncal, 2004; Williams & Cumming, 2011). Those results were in contrast to previous imagery studies for gender that

Table 6

Differences between males and females for 7 subscales of KWS – results from both studies

	Females N = 186		Males N = 293		*t*	*df*	*p*
	M	*SD*	*M*	*SD*			
Feelings	20.83	5.52	20.77	5.36	0.12	477.00	0.91
Modalities	19.61	5.85	19.10	5.75	0.94	477.00	0.35
Ease/Control	37.34	7.72	39.05	6.63	−2.57	477.00	0.01
Perspective	26.89	6.50	27.82	6.29	−1.56	477.00	0.12
Affirmations	31.66	6.47	33.02	5.06	−2.55	476.00	0.01
Visual	22.42	4.43	23.24	4.19	−2.03	477.00	0.04
General	25.15	4.09	25.02	3.65	0.34	475.00	0.73

Table 7

Differences between novices and more skilled athletes for 7 subscales of KWS – results from both studies

	Novices N = 122		More skilled athletes N = 258		*t*	*df*	*p*
	M	*SD*	*M*	*SD*			
Feelings	19.62	5.33	21.14	5.30	−2.60	378.00	0.01
Modalities	18.65	5.72	19.38	5.86	−1.14	378.00	0.26
Ease/Control	36.39	7.21	39.02	7.17	−3.33	378.00	0.00
Perspective	26.07	6.81	27.61	6.26	−2.19	378.00	0.03
Affirmations	30.57	5.70	33.18	5.67	−4.17	377.00	0.00
Visual	21.63	4.11	23.44	4.24	−3.93	378.00	0.00
General	24.02	4.08	25.43	3.65	−3.37	376.00	0.00

reported no difference in the level of imagery ability for males and females (Bhasavanija *et al.*, 2011; Hall, 2001; Richardson, 1994; Richardson, 1999).

The explanation of those results may be the large group size. According to the law of large numbers the statistical significance could be sharpened to 0.01. None of the differences between males and females achieved significance below 0.01, which may indicate the gender invariance.

Significant imagery ability differences were also observed between novices and more skilled athletes in all but one subscales (modalities), which was consistent with previous research (Elfving, Riches, Lintunen, Watt & Morris, 2001; Watt & Morris, 2001; Cumming & Hall, 2002; Oishi & Maeshima, 2004; Gregg & Hall, 2006; Arvinen-Barrow, Weigand, Thomas, Hemmings & Walley, 2007; Roberts *et al.*, 2008; Bhasavanija *et al.*, 2011; Williams & Cumming, 2011). No significant correlation between age and the results of the measure was found, which was in accordance with previous studies (Bhasavanija *et al.*, 2011).

A limitation of the current research was some incomplete data, which caused discrepancies in numbers in descriptive analysis.

Future research will concern further validation of the KWS by using it for a specific group of athletes: for example one discipline. Another example of future research would be observation of psychophysiological variables such as heart rate, muscle innervation, respiration or brain waves during visualization of the tasks from the KWS.

CONCLUSIONS

The results of the present study support the psychometric properties of the KWS. The KWS has the potential to be a valuable tool for researchers and applied sport psychologists interested in measuring imagery ability. In research and applied work the KWS may be used for various purposes, including a screening tool for imagery interventions and a method of validating the effectiveness of the mental training interventions.

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