Psychometric Properties of the Sport Imagery Ability Questionnaire (SIAQ) in Turkish Culture

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Abstract

This study aims to adapt the Sport Imagery Ability Questionnaire (SIAQ) to Turkish culture. The data was collected via an online questionnaire from 315 university students. To test SIAQ construct validity, confirmatory factor analyses were conducted. The five-factor construct of the SIAQ ensures model data fit based on the fit indices ($\chi2$ /(df)= 171.171/ (80) =2.14, p<.001; RMSEA (90% CI) = 0.062[0.049, 0.075], CFit p =0.058; TLI = 0.934; CFI = 0.950; SRMR = 0.038). As a result, the five-factor model confirms the construct at a high level of agreement. Second-order CFI results show that the sport imagery ability consists of five sub-constructs is well supported ($\chi2$ /(df)= 180.156/ (85) =2.25, p<.001; RMSEA (90% CI) = 0.062 [0.049, 0.074], 0.062, CFit p =0.062; TLI = 0.935; CFI = 0.947; SRMR = 0.039). SIAQ determined measurement invariance in gender groups, and metric invariance was provided. Due to factor loadings being over 0.5 and AVEs being around 0.5, and CRs being over 0.7, convergent validity is provided. In addition, the Cronbach alpha values of the scale and all subdimensions were over 0.7. According to the results, SIAQ is a reliable and valid instrument for measuring sport imagery ability in Turkish culture.

Keywords: Sport imagery ability questionnaire, Validity, Reliability, Confirmatory factor analysis

Sporda İmgeleme Becerisi Ölçeği'nin (SİBÖ) Türk Kültüründe Psikometrik Özellikleri

Öz

Bu çalışmanın amacı, Spor İmgeleme Becerisi Ölçeği'nin (SİBÖ) Türk kültürüne uyarlanmasıdır. Veriler, 315 üniversite öğrencisinden çevrimiçi anket yoluyla toplanmıştır. SİBÖ yapı gecerligi doğrulayıcı faktör analizi ile test edilmiştir. SİBÖ' nün beş faktörlü yapısı, uyum indekslerine ($\chi2$ /(df)= 171.171/ (80) =2.14, p<.001; RMSEA (%90 CI) = 0.062[0.049, 0.075, CFit p =0.058; TLI = 0.934; CFI = 0.950; SRMR = 0.038) dayalı olarak yapıyı yüksek bir uyum düzeyinde doğrulamaktadır.İkinci dereceden doğrulayıcı faktör analizi sonuçları, spor imgeleme becerisinin beş alt boyuttan oluştuğunu göstermektedir ($\chi2$ /(df)= 180.156/ (85) =2.25, p<.001; RMSEA (%90 CI) = 0.062 [0.049), 0.074], 0.062, CFit p = 0.062; TLI = 0.935; CFI = 0.947; SRMR = 0.039). SİBÖ cinsiyet gruplarında ölçme değişmezliği test edilmiş ve metrik değişmezlik sağlanmıştır. Faktör yüklerinin 0.5'in üzerinde: ortalama çıkarılan varyans değerlerinin 0.5 civarında ve birleşik güvenirliğin 0,7'nin üzerinde olması yakınsak geçerliğin sağlandığını göstermektedir. Ayrıca ölçeğin ve tüm alt boyutlarının Cronbach alfa değerleri 0.7'nin üzerindedir. Elde edilen sonuçlara göre SİBÖ, Türk kültürlerinde spor imgeleme becerisini ölçmek için geçerli ve güvenilir bir ölçme aracıdır.

Anahtar Kelimeler: Spor imgeleme becerisi ölçeği, Geçerlilik, Güvenilirlik, Doğrulayıcı faktör analizi

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INTRODUCTION

The concept of imagery is the process of imagination and application of an ability solely with the mind and all related senses and without any physical effort (İkizler & Karagözoğlu, 1997). Furthermore, it refers to the process of either learning a new skill or strengthening an existing one, utilizing only one's imagination without the use of physical activity (Feltz & Riessinger, 1990). Imagery in sports helps an athlete create a positive sense of self and improves certain psychological factors, such as coping with anxiety and self-confidence (Hall, 2001). The images represent imagery that appears in mind activated by mental exercise (Baddeley & Andrade, 2000). Therefore, the skill of imagery can be reflected by one's abilities, which represent the capacity to create, preserve and convert images (Cumming & Ramsey, 2009).

Imagery exercises were deemed one of the essential psychological exercises to enhance an athlete's performance (Weinberg & Gould, 2003) and became a strategy to increase said performance (Cumming & Ramsey, 2009; Murphy et al., 2008). The effectiveness of this strategy depends on one's ability to create and control images (Martin et al., 1999). In other words, the effectiveness of imagery exercises will be higher in individuals who have high imagery skills (Hall et al., 1992).

Mental imagery, one of the main concepts of applied sports psychology (Morris et al., 2005), is accepted as one of the essential mental techniques that athletes must master. Frequent and systematic use of mental imagery is a crucial property of skilled athletes, and it has been long known that it separates successful athletes from less successful ones (Cumming & Hall, 2002; Simonsmeier & Buecker, 2017; Van Gyn et al., 1990).

Simon's definition of using psychological skills as a training technique within the process of using imagery (2000) is quite interesting due to the close relationship between imagery, idea, and action. By utilizing imagery, athletes can detect their mistakes, focus on them and take corrective actions. With the help of external imagery, athletes can pinpoint incorrect aspects of a skill and observe where they make mistakes (Taylor & Wilson 2005). To get successful results from exhibited skills in sports, it is imperative to select the correct techniques, avenues, time, and methodology and make the correct decisions with appropriate timing. Imagery applications can significantly help athletes to improve their decision-making and execution abilities (Konter, 1999). It is found in conducted studies that physical exercises that were accompanied by mental exercise are more effective than only physical exercises (MacIntyre & Moran, 2007; Özdal et al., 2013; Weinberg, 2008).

In this context, the concept of imagery is thought to be a critical item affecting sportive performance. In the international literature, there are many studies on imagery and the effect of imagery on sports performance in various branches (Abma et al., 2002; Cumming & Williams, 2012; Gammage et al., 2000; Kızıldağ & Tiryaki 2012; Liu, 1999; Nordin & Cumming, 2008; Solmon et al., 1994; Weigand et al., 2007; Williams et al., 2013)

This study aims to adopt the Sport Imagery Ability Questionnaire (SIAQ), which was developed by Williams and Cummings (2011), aims to evaluate application of imagery by measuring one's ability to focus and create image compositions, and consists of 15 questions

and five sub-dimensions (skill, strategy, goal, affect, and mastery imagery ability), to Turkish culture. The Sport Imagery Ability Questionnaire was designed to (1) evaluate sports-related images instead of generic actions/movements and (2) simultaneously utilize cognitive and motivational imagery abilities to draw direct comparisons from different image contents. The questionnaire exhibits factor validity, internal and time reliabilities, non-variance regarding gender, and the ability to distinguish athletes from different levels of competitiveness. It also emphasizes the importance of making separate evaluations of imagery skills for different contents. SIAQ is currently developed in English, SIAQ has been adapted in German, Persian and Spanish.

MATERIALS AND METHODS

The study was conducted within the scope of quantitative research model and the psychometric properties of the Sport Imagery Ability Scale in Turkish culture were examined.

Participants

This research is conducted with 315 students via an online questionnaire from Yozgat Bozok University, Faculty of Sport Science. 36% (N=112) of the students are female, 64% (N=203) are male, 55% (N=174) of them have team sports, and 45% (N=141) are individual sports. In addition, 12% (N=38) of the students are national athletes.

Data Collection Instruments

The Sport Imagery Ability Questionnaire (SIAQ): The Sport Imagery Ability Questionnaire (SIAQ) was developed by Williams and Cumming (2011). The scale is a 7-point Likert scale comprising 15 items and five subscales that measure skill, strategy, goal, affect, and mastery imagery ability. Confirmatory factor analysis (CFA) results based on Williams and Cumming (2011)'s study illustrates that the final five-factor model, $\chi 2$ (80) = 204.53, $p < .05$, CFI = .96, TLI = .95, SRMR = .04, RMSEA = .06 (90% CI = 0.05–0.07) demonstrated good content and factorial validity. Internal Consistency and Inter-factor Correlations the SIAQ demonstrated good internal reliability for all five subscales with CR values ranging from .76 to .86 and AVE values ranging from .51 to .68. Internal Consistency Both the SIAQ and MIQ-3 demonstrated good internal reliability for each subscale. Cumming and Williams (2011) also conducted a measurement invariance study according to gender groups and competitive levels of athletes to prove the construct validity of the scale.

Adaptation Procedure

We contacted the corresponding author to adapt SIAQ for Turkish culture, and the necessary permissions were obtained. Afterward, items were translated into Turkish by two field experts. These two translations were combined and examined by a language expert, and upon receiving their feedback, a single form was prepared. This form was translated back to its original language. Another language expert compared the original form and the back-translated form. After ensuring semantic validity, two measurement and assessment specialists examined

the Turkish version of the form. Consequently, a pilot study was conducted with 5 participants from the target sample group. It was concluded that scale questions were clear and understandable enough to prepare the final form of the scale.

Research Ethics

The study was approved by the Yozgat Bozok University Social and Human Sciences Ethics Committee (Approved date 15.01.2020 and number 06/03).

Data Analysis

Within the scope of the validity study of the SIAQ, CFA was applied first to reveal the factor construct of the scale in Turkish culture. CFA was conducted using Mplus 7.3 with maximum likelihood estimation procedures. Following recommendations of model fit indices were considered in this study: absolute fit (chi-square goodness-of-fit [$\chi2$], standardized root mean square residual [SRMR]), parsimony-corrected fit (root mean square error of approximation [RMSEA]), and comparative fit (Tucker–Lewis fit index [TLI], comparative fit index [CFI]). The following cutoff values were used to indicate model fit: $0<\chi^2/sd<3$, which shows a perfect consistency (Schermelleh-Engel et al., 2003); TLI and CFI ≥ 0.90 (Kline, 2005; Hooper et al., 2008), RMSEA and its upper 90% confidence limit ≤ 0.08, RMSEA's close fit p > .05, and SRMR ≤ 0.08 (Brown, 2006). Another study conducted to content validity of the SIAQ was the determination of measurement invariance in gender groups with multiple group confirmatory factor analysis (MG-CFA). To establish convergent validity, the factor loading of the indicator, composite reliability (CR) and the average variance extracted (AVE) have to be considered. Convergent validity was indicated by an item factor loading ≥ 0.5 and p < .05 (Hair et al., 2009), AVE ≥ 0.5, and CR ≥ 0.7 (Fornell & Larcker, 1981). The discriminant validity is evaluated by using Fornell & Larcker criterion. This method compares the square root of the average variance extracted with the correlation of latent constructs (Hair et al., 2014). Therefore, the square root of each construct's AVE should have a greater value than the correlations with other latent constructs. Internal consistency reliability of the scale was examined by Cronbach-alpha and composite reliability (CR). Cronbach alpha and composite reliability is between .60-.70, the scale reveals to be reliable (Hair et al., 2014).

RESULTS

Descriptive Statistics of SIAQ

SIAQ and its subscale scores' means, standard deviations, and skewness-kurtosis values are reported in Table 1.

Table 1. Descriptive statistics of SIAQ

	M	SD	Skewness	Std.Er.	Kurtosis	Std.Er.
Skill	14.58	3.6	-.301	.137	-.441	.274
Strategy	14.89	3.5	-.293	.137	-.532	.274
Goal	14.14	3.9	-.424	.137	-.397	.274
Affect	15.45	3.6	-.472	.137	-.341	.274
Mastery	13.27	3.6	.002	.137	-.606	.274
SIAQ	72.33	15.3	-.393	.137	-.196	.274

According to the descriptive statistics about total SIAQ score and its subscales, the affect subscale has the highest average (M=15.45, SD=3.6), and mastery has the lowest average (M=13.27, SD=3.6). SIAQ's own and sub-dimension score averages were normally distributed and had similar standard deviations.

Construct Validity Results of SIAQ

Confirmatory Factor Analysis

The factor construct of the SIAQ was determined by confirmatory factor analysis applied to the data set collected from the first sample. Before applying the CFA, the data set had been tested in terms of the assumptions of the factor analysis. Univariate outliers' values were examined by converting the item scores of the scale to the standard z score (Tabachnick & Fidel, 2007), and there is no observation outside the ±4 z score range (Mertler & Vannata, 2005). Mahalanobis Distances (MU) were calculated for the multivariate outliers' examination, and 11 observations with MU values exceeding $\alpha = 0.001$ and critical $= 37.70$ at 15 degrees of freedom were removed from the data set (Tabachnick & Fidell, 2007). The skewness coefficients of the items varied between -1.032 and 0.045 and did not exceed $|3|$ (Chou & Bentler,1995); the kurtosis coefficients were between -0.972 and 0.330 and did not exceed $|10|$ (Kline, 2005). The scatter plot (Figure 1) formed by the squared mahalanobis distance values (m_{i^2}) and the inverse cumulative chi-square values shows a linear structure, so multivariate normality assumption has been achieved (Alpar, 2011). For multi-collinearity, the binary correlations of the items were examined and no correlation value exceeding the critical value of $r = 0.85$ was found (Kline, 2005). As a result of testing the assumptions, 11 observations were extracted from the first sample of 294 data, and CFA was applied to a data set of 294 people of 15 items.
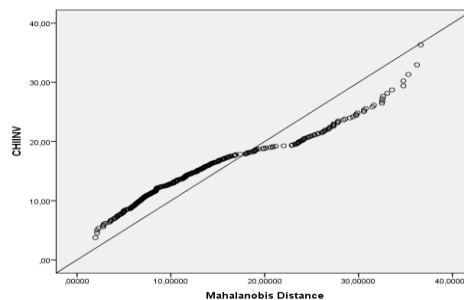

Figure 1. Scatter Plot

To verify the five-factor construct of the SIAQ, first-order and second-order confirmatory factor analysis (CFA) was performed. Table 2 shows CFA results regarding the five-factor construct of the scale. The item factor loadings ranged from 0.588 to 0.838 (figure 2. a), higher than the recommended load value of 0.4 (Hair et al., 2014). According to table 2, the five-factor construct of the SIAQ ensures model data fit based on the fit indices ($\chi2$ /(df)= 171.171/ (80) =2.14, p<.001; RMSEA (90% CI) = 0.062[0.049, 0.075], CFit p =0.058; TLI = 0.934; CFI = 0.950; SRMR = 0.038). In other words, the five-factor model confirms the construct at a good level.

Table 2. CFA findings of SIAQ

Factors	Items	Item factor loadings	Item – Total correlation	M (SD)
Skill	3. Refining a particular skill	.764	.694	4.86(1.4)
	8. Improving a particular skill	.785	.718	4.89(1.4)
	12. Making corrections to physical skills	.814	.744	4.80(1.3)
Strategy	1. Making up new plans/strategies in my head	.652	.593	5.13(1.4)
	6. Alternative plans/strategies	.732	.690	4.95(1.4)
	13. Creating a new event/game plan	.767	.689	4.77(1.4)
Goal	5. Myself winning a medal	.719	.635	4.98(1.7)
	9. Being interviewed as a champion	.588	.501	4.06(1.6)
	14. Myself winning	.836	.734	5.13(1.5)
Affect	4. The positive emotions I feel while doing my sport	.667	.615	5.67(1.4)
	7. The anticipation and excitement associated with my sport	.717	.659	5.19(1.5)
	11. The excitement associated with performing	.710	.664	4.55(1.6)
Mastery	2. Giving 100% effort even when things are not going well	.699	.625	4.73(1.4)
	10. Staying positive after a setback.	.703	.582	4.03(1.6)
	15. Remaining confident in a difficult situation	.838	.717	4.83(1.4)

	Model Fit Indexes				
First order CFA	χ^2 /(df), p	RMSEA (90% CI), CFit p	CFI	TLI	SRMR
	171.171/ (80), <.001	0.062[0.049, 0.075], 0.058	0.950	0.934	0.038
Second order CFA	χ^2 /(df), p	RMSEA (90% CI), CFit p	CFI	TLI	SRMR
	180.156 /(85), <.001	0.062 [0.049, 0.074], 0.062	0.947	0.935	0.039

The second-order CFA results in figure 2b show that the "Global measure of sport imagery ability" sport imagery ability loads well on its five subconstructs. The factor loading of "Global measure of sport imagery ability" on "Skill imagery ability," "Strategy imagery ability," "Goal imagery ability," "Affect imagery ability," and "Mastery Imagery Ability" are 0.95, 0.97, 0.88, 0.96 and 0.86 respectively. Furthermore, the R^2 for all sub-constructs is high (0.90, 0.94, 0.78, 0.93, and 0.73), which reflects the contribution of the "Global measure of sports imagery ability" on its five sub-constructs is good. In other words, the theory that the "Global measure of sport imagery ability" consists of five sub-constructs is well supported. All fitness indexes also show that the second-order model has acceptable fit indexes values (χ^2 /(df)= 180.156/ (85) =2.25, p<.001; RMSEA (90% CI)= 0.062 [0.049, 0.074], 0.062, CFit p =0.062; TLI = 0.935; CFI = 0.947; SRMR = 0.039).
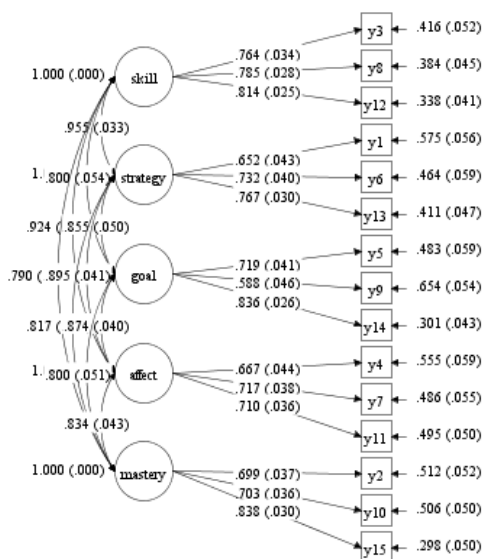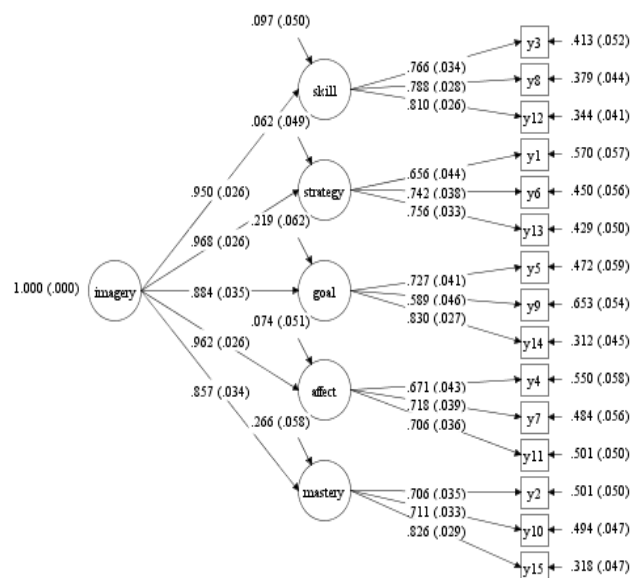

Figure 2a. First order CFA

Figure 2b. Second order CFA

Measurement Invariance

Table 3 includes the findings of the MG-CFA. Sokolov (2019) stated that CFI and SRMR values of measurement invariance with MG-CFA should be considered. To ensure metric and scalar invariance as relative goodness of fit cut-off values, it should be ΔCFI <-0.01 and ΔSRMR <0.01. Accordingly, when Table 3 is examined, it can be observed that the scalar invariance where metric invariance is ensured is very close to the limit value. Metric invariance is based on the assumption that factor loads between groups are equal. Thus, factor variances and structural relationships between groups are comparable. Consequently, it can be stated that the factor loads of the SIAQ are equal between gender groups.

Table 3. MG-CFA Results of SIAQ based on gender

Model	χ^2	df	p	CFI	SRMR
Configural	464.916	180	0.000	0.882	0.057
Metric	475.585	194	0.000	0.883	0.067
Scalar	510.370	208	0.000	0.874	0.071
Metric-Configural	10.669	14	0.7118	-0.001	0.008
Scalar- Configural	45.455	28	0.0198	-0.008	0.019
Scalar-Metric	34.785	14	0.0016	-0.009	0.011

Convergent Validity Results of SIAQ

SIAQ had good convergent validity, as indicated by the high factor loadings (Table 3), acceptable AVE value, and high CR value (Table 4). The AVE value of the effect subscale is lower than the cut-off criteria. However, Fornell and Larcker (1981) stated that the convergent validity of the construct is still sufficient if the average variance is less than 0.5, but the composite reliability is higher than 0.6. As seen in Table 4, the composite reliability value of the affect subscale is 0.74. Therefore, it can be observed that the convergent validity of this subscale scale is also ensured.

Table 4. Cronbach Alpha, CR and AVE of SIAQ

Factors	Number of items	Cronbach Alpha	AVE	CR
Skill	3	0.83	0.62	0.83
Strategy	3	0.76	0.52	0.76
Goal	3	0.77	0.52	0.76
Affect	3	0.74	0.49	0.74
Mastery	3	0.79	0.56	0.79
Global measures of imagery	15	0.93	0.54	0.95

Discriminant Validity Results of SIAQ

In Table 5, it is seen that the square root of the AVE inferred by each dimension is higher than the relationships between dimensions. Therefore, it was revealed that the discriminant validity of the SIAQ was also provided.

Table 5. Square root of the AVE with the correlation of latent constructs

	Skill	Strategy	Goal	Affect	Mastery	$\sqrt{AVE}$
Skill	1.00	.751	.619	.723	.645	0.79
Strategy			.613	.674	.624	0.72
Goal				.637	.585	0.72
Affect					.640	0.70
Mastery					1.00	0.75

Reliability Findings

Internal consistency reliability of the SIAQ has been examined with Cronbach Alpha and composite reliability. When Table 4 is examined, the Cronbach alpha and CR values of the SIAQ and subscales were over 0.74. The scale is reliable as the lower limit for Cronbach alpha and composite reliability is between 0.60-0.70 (Hair et al., 2014).

DISCUSSION

The main aim of this current study was to adapt the SIAQ measuring the ability to image different content athletes frequently use in their sport (i.e., skills, strategies, goals, feelings and emotions, and mastering difficult situations) to Turkish culture. The SIAQ is a seven-point Likert scale with 15 positive items and five subscales that measure skill, strategy, goal, affect, and mastery imagery. It can be used to evaluate an athlete's ability to visualize this sport-specific content (i.e. ease of imaging) as a one-time assessment or to monitor how imagery ability changes over time. CFA was used to demonstrate the construct validity of the Turkish culture scale. Findings pointed out strong support for the first-order and the second-order model consistent in Turkish culture. The CFA model's fit index values confirmed the scale's further construct validity. The Cronbach's alphas and CR values were over .70 in the SIAQ. This reliability demonstrated sufficient internal consistency in each sub-scale. In addition, Pearson correlations between the factors were calculated. The five subscales demonstrated moderate, positive, and significant correlations. This means that although the five factors seem to share a common essence, each represents a separate dimension.

Thus, five subscales demonstrated modest evidence of convergent validity. Then, the gender invariance of the latent construct was evaluated with MG-CFA. The findings indicated that metric invariance is ultimately achieved for the five-factor structure of SIAQ across gender. It means that male and female participants use a similar conceptual domain and that participants calibrate the intervals used on the measurement scale in similar ways (Riordan & Vandenberg, 1994). Convergent and discriminant validity of SIAQ were also provided. According to the results, the SIAQ, which consist of five subscales is valid and reliable instrument for measuring sport imagery ability in Turkish cultures.

Conflict of Interest: All authors declare that they have no conflict of interest.

Researchers' Statement of Contribution Rate: Research Design EAI, GS, BBC; Statistical analysis GS; Preparation of the article, EAI, GS, BBC; Data Collection was carried out by EAI, BBC.

Information on Ethics Committee Permission

Board Name: Yozgat Bozok University Social and Human Sciences Ethics Committee

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EK I. Sport Imagery Ability Questionnaire Original Form

	easy is it for me to image…	Very hard to image	Hard to image	Somewhat hard to	Neutral (not easy or hard)	Somewhat easy to image	Easy to image	Very easy to image
1	Making up new plans/strategies in my head	1	2	3	4	5	6	7
2	Giving 100% effort even when things are not going well	1	2	3	4	5	6	7
3	Refining a particular skill	1	2	3	4	5	6	7
4	The positive emotions I feel while doing my sport	1	2	3	4	5	6	7
5	Myself winning a medal	1	2	3	4	5	6	7
6	Alternative plans/strategies	1	2	3	4	5	6	7
7	The anticipation and excitement associated with my sport	1	2	3	4	5	6	7
8	Improving a particular skill	1	2	3	4	5	6	7
9	Being interviewed as a champion	1	2	3	4	5	6	7
10	Staying positive after a setback.	1	2	3	4	5	6	7
11	The excitement associated with performing	1	2	3	4	5	6	7
12	Making corrections to physical skills	1	2	3	4	5	6	7
13	Creating a new event/game plan	1	2	3	4	5	6	7
14	Myself winning	1	2	3	4	5	6	7
15	Remaining confident in a difficult situation	1	2	3	4	5	6	7

EK II. Sporda İmgeleme Becerisi Ölçeği Türkçe Formu

	Yaptığım spor dalında imgeleme yapmak benim için ne kadar kolay	İmgelemek Çok Zor	İmgelemek Zor	İmgelemek Kısmen Zor	İmgelemek ne zor ne	İmgelemek Kısmen	İmgelemek Kolay	İmgelemek Çok Kolay
1	Zihnimde yeni planlar / stratejiler yapma	1	2	3	4	5	6	7
2	İşler iyi gitmediğinde bile % 100 çaba gösterme	1	2	3	4	5	6	7
3	Belirli bir beceriyi geliştirme	1	2	3	4	5	6	7
4	Sporumu yaparken olumlu duygular hissetme	1	2	3	4	5	6	7
5	Kendimi bir madalya kazanırken	1	2	3	4	5	6	7
6	Alternatif planlar / stratejiler yapma	1	2	3	4	5	6	7
7	Sporumla ilgili beklenti ve heyecan	1	2	3	4	5	6	7
8	Belirli bir beceriyi geliştirme	1	2	3	4	5	6	7
9	Şampiyon olarak röportaj yapma	1	2	3	4	5	6	7
10	Yenilgi sonrası olumlu kalma	1	2	3	4	5	6	7
11	Performansla ilgili heyecan	1	2	3	4	5	6	7
12	Fiziksel becerilerde düzeltmeler yapma	1	2	3	4	5	6	7
13	Yeni bir etkinlik / oyun planı oluşturma	1	2	3	4	5	6	7
14	Kendim kazanıyor görme	1	2	3	4	5	6	7
15	Zor bir durumda kendinden emin olma	1	2	3	4	5	6	7