Ann Appl Sport Sci 10(s1): e1108, 2022.
http://www.aassjournal.com; e-ISSN: 2322–4479; p-ISSN: 2476–4981. 10.52547/aassjournal.1108

ORIGINAL ARTICLE

Factorial Validity and Internal Consistency of The Sports Imagery Ability Questionnaire (SIAQ) Malaysian Version

[1]Amir Rifaat Abdul Rahman*, **[1]Hairul Anuar Hashim**, **[1]Garry Kuan Pei Ern**, **[1]Adam Abdul Malik**

[1]Exercise and Sports Science Unit, School of Health Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia.

Submitted 16 January 2022; Accepted in final form 06 March 2022.

ABSTRACT

Background. Imagery ability is one of the most potent factors influencing imagery effectiveness. Therefore, prior to imagery training, it is important to assess the participant's imagery ability, typically using a self-report questionnaire. **Objectives.** This study examined the factorial validity and internal consistency of the Malaysian adapted SIAQ using confirmatory factor analysis and Cronbach's alpha. **Methods.** The questionnaire was administered online to 193 participants (101 men and 92 women) with a mean age of 22.06 ± 3.72. The data were normalized, and four models were tested (model 1: data with square root transformation for values above the threshold; model 2: data with logarithm transformation for values above the threshold; model 3: data with values above threshold were logarithm transformed and values that were almost reaching the threshold (Item_4 and Item_12) were transformed by square root; and model 4: data with values above and reaching the threshold were logarithm transformed). **Results.** The result of factorial analysis for model 2 revealed a good model fit (X^2=184.76, df=80, p<0.00, X^2/df=2.31, CFI=0.94, TLI=0.92, SRMR=.05, and RMSEA=.08) for the five-factor model structure implicating a good factorial validity. Furthermore, all path loadings exceeding .50 indicated good convergent validity of the subscales. Moreover, alpha coefficients range from 0.77 to 0.85 (0.85 for skill, 0.77 for strategy, 0.84 for goal, 0.77 for affect, and 0.78 for mastery). **Conclusion.** It is concluded that SIAQ-M possesses acceptable factorial validity and internal consistency and can measure imagery ability among Malaysian athletes.

KEYWORDS: ***Factor Analysis, Psychometrics, Sports Psychology, Athletes.***

INTRODUCTION

Imagery is a popular strategy in sports and is used widely among athletes in a sports setting (1). It is a structured mental practice technique that involves creating or re-creating an experience in mind (2). The process begins with recalling the experience that has been stored in memory and reconstructing it into meaningful images (3). Athletes use imagery to achieve desired outcomes (4), such as improving motor skills, learning tactics, and optimizing several psychological aspects related to performance (5–9).

Imagery training can be used to achieve various specific and general goals. For instance, Hall et al. (1998) suggested five specific imagery functions: cognitive specific, cognitive general, motivational specific, motivational-general arousal, and motivational-general mastery (4). Cognitive specific refers to the image related to skill, such as performing archery shooting. On the other hand, cognitive general refers to the image associated with strategy or tactics, such as a football tactical plan. Images associated with

*. Corresponding Author:
Amir Rifaat Abdul Rahman, Ph.D.
E-mail: amir.rifaat@gmail.com , amir.rifaat@student.usm.my

achieving certain goals reflect motivational specific, such as winning a medal. Whereas if the image involves the manipulation of emotions and feelings, such as regulating anxiety or arousal reflects motivational-general arousal. Lastly, an image to enhance self-confidence refers to motivational-general mastery related to coping and mastering challenging situations (4). The effectiveness of imagery in achieving these specific outcomes is well-established (6, 9, 10).

However, it is moderated by individuals' imagery ability. Indeed, imagery ability is one of the most potent factors influencing imagery effectiveness (11). Imagery ability refers to an individual's ability to create, control, and sustain images (12), and different individuals tend to have different levels of imagery ability (5). Those with higher levels of imagery ability tend to benefit more from imagery training than those with lower imagery ability (13). Therefore, it is important to assess the participant's imagery ability prior to imagery training, typically using a self-report questionnaire (14, 15).

Assessment of imagery ability can proceed with some alternatives within motor performance and sport domains (16). These include the Movement Imagery Questionnaire (MIQ; 16), Revised Movement Imagery Questionnaire (MIQ-R; 17), Movement Imagery Questionnaire - 3 (MIQ-3; 18), Vividness of Movement Imagery Questionnaire (VMIQ; 19), and Revised Vividness of Movement Imagery Questionnaire-2 (VMIQ-2; 20). An important limitation of these questionnaires is that they only measure general motor movement (ex: walking, running, and jumping) and do not assess sport-related imagery ability. Alternatively, measures that are specifically designed for use in sports are the Sport Imagery Questionnaire (SIQ; 21), the modified version of SIQ (23–25), Motivational Imagery Ability Measure for Sport (MIAMS; 25), the Sport Imagery Ability Measure (SIAM; 26), and the Sport Imagery Ability Questionnaire (SIAQ; 27).

Although several alternatives exist, there appear to be limitations in those questionnaires. Specifically, SIQ is reported to lack validity and reliability (12). On the other hand, the MIAMS is limited to measuring motivational function only. Moreover, SIAM excludes measures of the imagery function. According to Short et al. (2004), the function of the image is far more critical to be understood than the content of the image. Therefore, SIAQ appears to be the best option to measure imagery ability among the alternatives in sports. Indeed, SIAQ has been used to determine the participant's ability to form an image wholly (30) or precisely (31) before any intervention is given.

SIAQ was developed based on the SIQ, in which 35 items were initially constructed. Consistent with the five imagery functions, the items were designed to measure those five imagery functions. The initial version was administered to 403 participants. From the initial 35 items, 15 items were problematic and discarded. The 20 items version was then distributed to 375 athletes. The results revealed a four-factor model: skill, strategy, goal, and affect imagery ability. The questionnaire was further tested in another sample of 363 athletes, and the results provided further support for the four-factor model structure. However, the researcher observed additional eight problematic items, which were removed. A subsequent study added an additional factor (mastery) with three additional items.

In the analysis of the 5-factor model involving 438 athletes, an adequate fit was observed (X^2=204.53, *df*=80, *p*=<0.05, Comparative Fit Index [CFI]=0.96, Tucker Lewis Index [TLI]=0.95, Standardized Root Mean Square Residual [SRMR]=0.04, and Root Mean Square Error of Approximation [RMSEA]=0.06). All 15-item factor loadings were above 0.50 (0.62-0.88) and adequate internal consistency was also found (skill=0.79, strategy=0.85, goal=0.81, affect=0.76, and mastery=0.80). Furthermore, the results also support the questionnaire's concurrent validity. Specifically, a significant correlation ($p<0.05$) was found between SIAQ and MIQ-3 in a sample of 220 athletes. Moreover, the results also revealed differences in the imagery ability of the participants.

Although the validity and reliability of the original SIAQ have been established and are widely used in many studies, there remains a need for cross-validated instruments in diverse cultural segments of the population and other languages (32). In this regard, SIAQ has been translated into Spanish (33, 34), Persian (35, 36), Polish (37), Germany (38), and Thai languages (39). Generally, the adapted versions exhibit adequate indices of validity and reliability. Therefore, the study aimed to examine the factorial validity and internal consistency of a Malaysian language version of the five-factor model of SIAQ.

MATERIALS AND METHODS

Participants. The participants were university students in Malaysia (N=231). No missing value was observed, and multivariate outliers were detected and removed using Mahalanobis Distance (MD) (40). Any cases with the MD value of 24.996 (df=15) and above are considered multivariate outliers and excluded from further analysis. After removing the outliers, 193 samples were retained for the final analysis (101 men and 92 women). The mean age of the sample is 22.06 ± 3.72, with 7.58 ± 4.18 years of sports experience. 26.4% of participants reported they played at the national level, while 22.3% at the state level, 18.7% at the school level, 16.6% at the international level, 8.3% at the university level, and 7.8% at the recreational level. The sample is represented by athletes who participated in sports such as football, badminton, netball, bowling, futsal, athletics, archery, and others. The total sample size (N=193) exceeds the minimum requirement of 10 participants per questionnaire item suggested by Tabachnick and Fidell (41).

Measures. A demographic survey was used to collect data on gender, age, ethnic background, type of sports participated, competitive level, and years of sports experience. A 15 item SIAQ (28) was used to measure the participant's imagery ability upon five subscales: skill (i.e., *refining a particular skill*), strategy (i.e., *making up new plan/strategies in my head*), goal (i.e., *myself winning a medal*), affect (i.e., *the excitement associated with performing*), and mastery (i.e., *remaining confident in a difficult situation)*. SIAQ questions are attached to a 7-point Likert scale ranging from 1 = *very hard to image* to 7 = *very easy to imagine*.

Procedures. Upon receiving the University Human Research Ethics Committee's approval, the back-translation method was applied to translate the SIAQ source language (English) to the target language (Malaysian). The process involves appointing two bilingual experts to translate the SIAQ from English to Malay. Then, both translated versions were given to the third translator to check, compare and provide the final Malay version. Afterward, the process is reversed. Precisely, another two bilingual experts translated the Malay version back into the English version, and the back-translated English version was compared to the original English version. The semantic equivalence to the original version was ensured for the final translated version.

The data was collected via an online platform, PsyToolkit (42, 43). The SIAQ items were coded into the PsyToolkit website, including the respondent's demographic background, and then the link was shared through various social media. The respondents were allowed to answer the survey if they fit the inclusion criteria, which are aged between 18 to 35 years old, had experience in sports, and were able to understand the Malay language. A brief introduction was provided at the beginning of the survey, and the participants were asked to complete the survey as honestly as possible. As SIAQ involves different scenarios, the respondents were advised to imagine each scene accordingly and rated their ability based on the ease of imagining (how easy to imagine).

Data analysis. Descriptive statistics were used to complete mean, standard deviation, minimum, and maximum values. The normality test was examined using values of skewness and kurtosis (40, 44, 45). Following Kim (2013), a z-test is applied for assessing the normality of data in which the skewness or kurtosis values are divided by the standard errors to obtain the z-value (46). The distribution is considered non-normal if the z-value obtained is above 3.29 for medium-sized samples (50<n<300) with an alpha level of 0.05. The SIAQ subscales' internal consistency reliability was assessed using Cronbach's Alpha. All of the abovementioned measurements were calculated using SPSS version 20 (46).

Subsequently, confirmatory factor analysis (CFA) was analyzed to test the fit of the five-factor model proposed by Williams and Cumming (2011) using maximum likelihood estimations (19). Following Williams and Cumming (2011) reported Goodness-of-fit indices, the chi-square statistic (X^2), relative chi-square (X^2/df) CFI, TLI, SRMR, and RMSEA were used to evaluate the model fit. The model is considered good if the X^2/df is below 2.0, and acceptable if the value is between 2.0 to 5.0 (44). Suggest proper fit CFI and TLI values above .90 (47, 48). Meanwhile, the SRMR and RMSEA values should be below .08 to represent an acceptable fit and .05 for close fit (48).

RESULTS

Descriptive statistic and normality test. The descriptive statistics of the primary variable are presented in Table 1. Tests of normality and z-value are shown in Table 2. There are four variables that the distribution shape does not meet the normal distribution after the z-value calculation. Therefore, normalizing transformation using logarithm was performed on those variables to meet confirmatory factor analysis requirements; that is, the data should be normally distributed (45). At the same time, the reflection transformation was used for the remaining negatively skewed variables (45).

Table 1. Descriptive statistics of demographic background and SIAQ subscales

	n	Min	Max	Mean (SD)
Age	193	18	35	23.06 (3.72)
Type of sports				
Individual	46			
Team sport	68			
Both	79			
Competitive level				
International	32			
National	51			
State	43			
University	16			
School	36			
Recreational	15			
Years of experience	193	1	24	7.58 (4.18)
SIAQ subscales				
Skill imagery ability	193	2.67	7.00	5.37 (1.00)
Strategy imagery ability	193	2.00	7.00	5.07 (0.94)
Goal imagery ability	193	2.00	7.00	5.30 (1.12)
Affect imagery ability	193	2.67	7.00	5.89 (0.88)
Mastery imagery ability	193	2.00	7.00	5.17 (1.03)

Table 2. Testing for normality, z-value, and transformation

	Shape Descriptors					
	Skewness		Kurtosis			
Variable	**Statistic**	**z-value**	**Statistic**	**z-value**	**Description**	**Transformation**
Item_1	-0.30	-1.69	0.07	0.19	Acceptable	Reflection
Item_2	-0.63	**-3.62**	-0.18	-0.51	Non-normal	Logarithm
Item_3	-0.31	-1.74	-0.51	-1.46	Acceptable	Reflection
Item_4	-0.57	-3.25	-0.48	-1.39	Acceptable	Reflection
Item_5	-0.78	**-4.47**	0.47	1.36	Non-normal	Logarithm
Item_6	-0.21	-1.22	-0.56	-1.62	Acceptable	Reflection
Item_7	-1.43	**-8.15**	1.81	**5.19**	Non-normal	Logarithm
Item_8	-0.44	-2.53	-0.62	-1.78	Acceptable	Reflection
Item_9	-0.15	-0.85	-0.95	-2.72	Acceptable	Reflection
Item_10	-0.08	-0.43	-0.74	-2.13	Acceptable	Reflection
Item_11	-0.64	**-3.68**	-0.04	-0.13	Non-normal	Logarithm
Item_12	-0.56	-3.22	-0.14	-0.41	Acceptable	Reflection
Item_13	-0.31	-1.75	-0.71	-2.03	Acceptable	Reflection
Item_14	-0.42	-2.40	-0.43	-1.25	Acceptable	Reflection
Item_15	-0.17	-0.97	-0.78	-2.24	Acceptable	Reflection

Note: *The z values are derived by dividing the statistics by the appropriate standard errors of .18 (skewness) and .35 (kurtosis). The value in bold is the value above 3.29 (threshold).*

Model Fit, Convergent Validity, Construct Reliability, and Discriminant Validity. The overall Goodness-of-fit for the five-factor model revealed an adequate fit of the data; X^2=184.76, *df*=80, *p*<0.00, X^2/df=2.31, CFI=0.94, TLI=0.92, SRMR=0.05, and RMSEA=0.08. Furthermore, all Unstandardized Regression Weights loadings are significant. The individual standardized factor loadings (regression weights) obtained were above 0.50, indicating convergent validity (44, 49). Figure 1 illustrates standardized loadings.

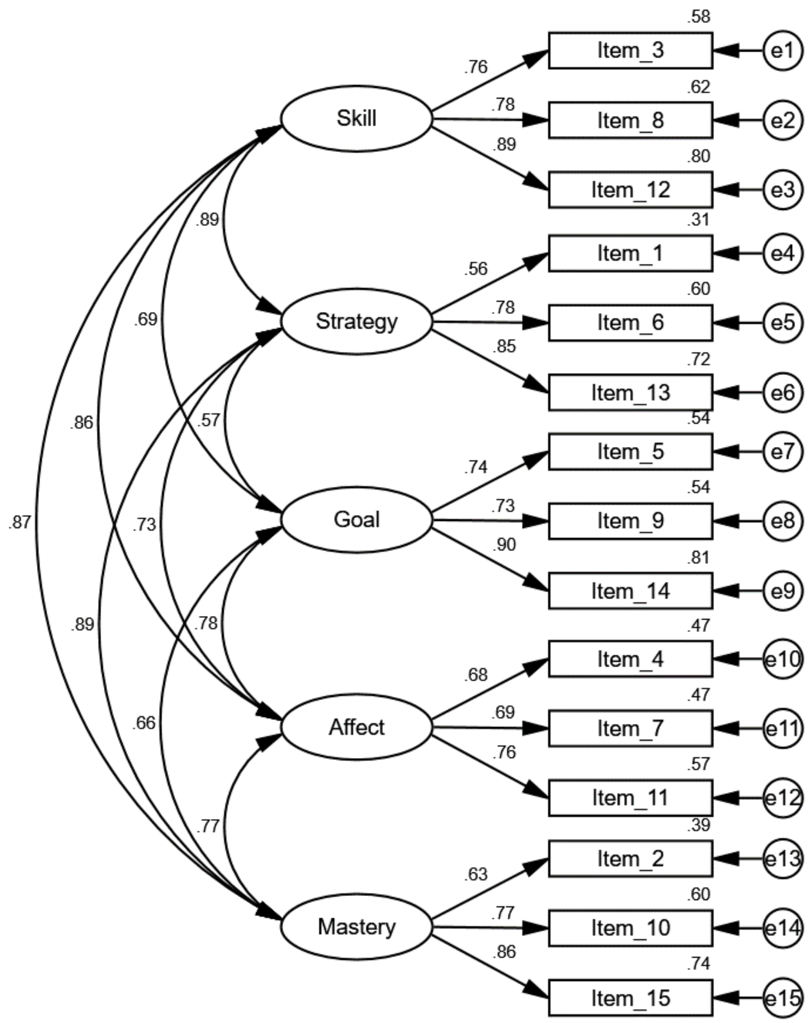

Figure 1. The SIAQ-Malay.

The results also revealed good internal consistency of the subscales with Cronbach's alpha values above 0.70 (0.85 for skill, 0.77 for strategy, 0.84 for goal, 0.77 for effect, and 0.78 for mastery). The improved Heterotrait-Monotrait (HTMT2) ratio of correlations was also used to determine the discriminant validity between the five constructs (50). HTMT2 method examines the ratio of indicators correlation within and between constructs. This method has shown superior effectiveness in detecting discriminant validity than the recommended Fornell and Larcker (1981) criterion (52). The HTMT2 has been modified from the traditional HTMT to show less biased estimation and consistent measures for congeneric measurement models. There are three approaches to assessing the constructs' discriminant validity. The first two approaches rely on the predefined threshold, which is $HTMT_{.85}$ (45) and $HTMT_{.90}$ (53). The attained correlation below $HTMT_{.85}$ shows better discriminant validity. As the correlation increases, the distinctiveness decreases, making it less likely to violate discriminant validity. A more tolerant criterion is to get a correlation below .90. The third approach is the last option for establishing discriminant validity through a statistical test (introduced as $HTMT_{inference}$). A bootstrapping procedure is executed to determine the construct confidence interval (CI). A lack of discriminant validity is suggested if the CI contains value one. Conversely, the constructs are empirically distinct if value one is outside the lower and upper limit range (52).

The HTMT2 ratio of correlation was calculated in the Henseler et al. (2015) online HTMT calculator by inserting the number of latent variables and the correlation matrix (52).

Then the HTMT2 is generated in a correlation matrix. Table 3 shows construct (latent factor) intercorrelations from AMOS (in the lower triangular part) and HTMT2 ratio of correlation generated from the online calculator (in the upper triangular part).

Table 3. Internal consistency reliability, inter-factor correlations, and HTMT2 ratio

Subscales	Reliability	Intercorrelations				
	α	SK	ST	GO	AF	MA
Skill (SK)	0.85		0.89	0.69	0.86	0.87
Strategy (ST)	0.77	0.89***		0.57	0.73	0.89
Goal (GO)	0.84	0.69***	0.57***		0.78	0.66
Affect (AF)	0.77	0.86***	0.73***	0.78***		0.77
Mastery (MA)	0.78	0.87***	0.89***	0.66***	0.77***	

Notes: ****p<.001. The correlation among the factors is located in the lower triangular part, and the HTMT2 ratio of correlation coefficients is located in the upper triangular part.*

The results indicate that four out of ten factors (SK and ST; SK and AF; SK and MA; ST and MA) violate the 0.85 thresholds. However, using a more tolerant criterion ($HTMT_{.90}$) seems acceptable. Therefore, the discriminant validity is established with the 0.90 threshold using the HTMT2 ratio of correlation. The third approach is not calculated as the criterion met with the 0.90 threshold.

DISCUSSION

The present study examined the factorial validity and the internal consistency of the Malaysian adapted SIAQ. The study starts with comprehensive data preparation, screening, and cleaning, which are critical before conducting the CFA (45). No missing data was detected, and the multivariate outliers were removed. Data transformation was also performed to achieve normality.

The initial analysis of the five-factor model of the SIAQ-Malay proposed by Williams and Cumming (2011) revealed a good model fit. First, the X^2/df attained value is considered acceptable (44). Both CFI and TLI values are above the satisfactory value (47, 48). Also, the SRMR and RMSEA values represent an acceptable fit (48).

Furthermore, the convergent validity was also established with standardized factor loading between .56 to .90 (44, 49), and Cronbach alpha values range between 0.77 to 0.85 (54). In addition, our analysis also supports the discriminant validity of the subscales with HTMT2 ratio of correlation values are between 0.57 to 0.89.

Concerning the HTMT2 ratio, the present study met the criterion of $HTMT_{.90,}$ but Roemer et al. (2021) recommended getting a lower correlation value (below 0.85; 42) to guarantee higher distinctiveness among the factors. From the results, four correlation values are noticeably above the recommended value: correlation of skill-strategy, skill-affect, skill-mastery, and strategy-mastery. Such finding contrasts with the original Williams and Cumming (2011) study, whereby the inter-correlation reported ranges (0.26 to 0.46) are below .85. Also, other languages adapted SIAQ, such as Germany (0.19 to 0.45), Thai (0.50 to 0.68), Polish (0.51 to 0.74), and Spanish (0.45 to 0.70), reported values below the threshold (28). Although the result is acceptable, the use of these scores should proceed with some cautions.

The validated SIAQ may be used to gauge athletes' ability to imagine. If the athletes have the objective of improving their skills, low imagery ability related to skill may not be beneficial. Similarly, if the athletes need is to regulate their anxiety level, those with lower imagery ability related to affect-factor may have a less significant effect than those with higher ability. Understanding this aspect may help coaches develop better psychological readiness, an essential part of sports performance. Coaches could then deliver suitable imagery training according to the athletes' needs. With this present validated SIAQ-Malay study, the coaches can use it to determine their athlete's imagery ability more accurately as it is prepared in the local language to increase the Malaysian athletes' understanding of the meaning of the item.

CONCLUSION

Although our analysis revealed an acceptable factorial validity and reliability level, some limitations exist in this study. Inherent in any self-report measure, our data depend on respondent honesty. Secondly, it is limited to the adult age group, and its use with children requires further analysis. Future studies are needed to examine if the results are sample-specific or general.

Future research should consider further validation of the Malaysian version of the SIAQ, for example, by administering it to a specific group of athletes (individual sport athlete versus team sport athlete), different age groups and gender, and levels of expertise (novice to elite). The present SIAQ-Malay is another validated psychological tool that can be used to assess the imagery ability of the athlete, limited to the current study samples. Another data collection may confirm the present study findings and establish better validity.

APPLICABLE REMARKS

- This finding could provide knowledge to the coaches and athletes on the various imagery functions and employ this validated psychological tool to assess athletes' imagery ability which is essential for imagery training, especially among Malaysian athletes.
- This tool could provide the coaches with their athletes' imagery ability. The higher the ability, the more beneficial the imagery training would be. Therefore, realizing the current imagery ability could drive the coaches to tailor specific training accordingly.

ACKNOWLEDGEMENT

The authors want to express their gratitude to Dr. Shamsulariffin Samsudin, Maisarah Mohd Saleh, Syed Husin Syed Ahmad, Dr. Marhasiyah Rahim for their continuous support. The authors also thank the respondents for their contribution.

CONFLICT OF INTERESTS

There are no conflicts of interest to declare by any of the authors of this study.

REFERENCES

1. Toth AJ, McNeill E, Hayes K, Moran AP, Campbell M. Does mental practice still enhance performance? A 24 Year follow-up and meta-analytic replication and extension. Psychology of Sport and Exercise. 2020;48:101672. **doi:**10.1016/j.psychsport.2020.101672
2. Vealey RS, Forlenza ST. Understanding and Using Imagery in Sport. In: Williams JM, Krane V, editors. Applied Sport Psychology: Personal Growth to Peak Performance2. 7th ed. New York: McGraw-Hill; 2015. p. 240-73.
3. Weinberg R, Daniel G. Foundations of Sport and Exercise Psychology 7th Ed. 2019.
4. Hall CR, Mack DE, Paivio A, Hausenblas HA. Imagery use by athletes: Development of the sport imagery questionnaire. Int J Sport Psychol. 1998;29(1):73-89. **doi:**10.1037/t52953-000
5. Cumming J, Williams SE. The role of imagery in performance. The Oxford handbook of sport and performance psychology. Oxford library of psychology. New York, NY, US: Oxford University Press; 2012. p. 213-32. **doi:**10.1093/oxfordhb/9780199731763.013.0011
6. Filgueiras A, Hora G, Lacerda A, Baltar YC, Barreto BP, Melo R, et al. Difference in Imagery use between Full-contact and Limited contact sports. Cuad Psicol del Deport Murcia. 2018;18(2):57-65.
7. Kuan G, Morris T, Terry P. Effects of music on arousal during imagery in elite shooters: A pilot study. PLoS One. 2017;12(4):e0175022. **doi:**10.1371/journal.pone.0175022 **pmid:**28414741
8. Fortes LS, Freitas-Júnior CG, Paes PP, Vieira LF, Nascimento-Júnior JRA, Lima-Júnior DRAA, et al. Effect of an eight-week imagery training programme on passing decision-making of young volleyball players. Int J Sport Exerc Psychol. 2020;18(1):120-8. **doi:**10.1080/1612197X.2018.1462229
9. Simonsmeier BA, Androniea M, Buecker S, Frank C. The effects of imagery interventions in sports: a meta-analysis. Int Rev Sport Exerc Psychol. 2020;0(0):1-22. **doi:**10.31234/osf.io/g5tp2
10. Simonsmeier BA, Buecker S. Interrelations of Imagery Use , Imagery Ability , and Performance in Young Athletes. J Appl Sport Psychol. 2017;29(1):32-43. **doi:**10.1080/10413200.2016.1187686
11. Martin KA, Moritz SE, Hall CR. Imagery use in sport: A literature review and applied model. Sport Psychol. 1999;13(3):245-68. **doi:**10.1123/tsp.13.3.245
12. Morris T, Spittle M, Watt AP. Imagery in Sport. Leeds, England: Human Kinetics; 2005.

13. Robin N, Dominique L, Toussaint L, Blandin Y, Guillot A, Her M Le. Effects of motor imagery training on service return accuracy in tennis: The role of imagery ability. Int J Sport Exerc Psychol. 2007;5(2):175-86. **doi:**10.1080/1612197X.2007.9671818
14. Bedir D, Erhan SE. The Effect of Virtual Reality Technology on the Imagery Skills and Performance of Target-Based Sports Athletes. Front Psychol. 2021;11(January):1-16. **doi:**10.3389/fpsyg.2020.02073 **pmid:**33551887
15. Dana A, Gozalzadeh E. Internal and External Imagery Effects on Tennis Skills Among Novices. Percept Mot Skills. 2017;124(5):1022-43. **doi:**10.1177/0031512517719611 **pmid:**28799864
16. Budnik-Przybylska D, Karasiewicz K, Morris T, Watt A. Original article Reliability, factor structure, and construct validity of the Polish version of the sport imagery ability measure. Curr Issues Personal Psychol. 2014;4(December):196-207. **doi:**10.5114/cipp.2014.47444
17. Hall C, Pongrac J, Buckholz E. The measurement of imagery ability. Hum Mov Sci. 1985;4(2):107-18. **doi:**10.1016/0167-9457(85)90006-5
18. Hall C, Martin K. Measuring movement imagery abilities: A revision of the Movement Imagery Questionnaire. J Ment Imag. 1997;21:143-54. **doi:**10.1037/t07979-000
19. Williams SE, Cumming J, Ntoumanis N, Nordin-Bates SM, Ramsey R, Hall C. Further validation and development of the movement imagery questionnaire. J Sport Exerc Psychol. 2012;34(5):621-46. **doi:**10.1123/jsep.34.5.621 **pmid:**23027231
20. Isaac A, Marks DF, Russell DG. An instrument for assessing imagery of movement: The Vividness of Movement Imagery Questionnaire (VMIQ). J Ment Imag. 1986;10(4):23-30. **doi:**10.1037/t07980-000
21. Roberts R, Callow N, Hardy L, Markland D, Bringer J. Movement imagery ability: development and assessment of a revised version of the vividness of movement imagery questionnaire. Journal of sport & exercise psychology. 2008;30(2):200-21. **doi:**10.1123/jsep.30.2.200 **pmid:**18490791
22. Martens R. Imagery in sport, unpublished paper presented at the Medical and Scientific Aspects of Elitism in Sport Conference. Brisbane (Australia); 1982.
23. Vealey R, Greenleaf C. Seeing believes: Understanding and using imagery in sport. Appl Sport Psychol Pers growth to Phys Perform. 1998;200-24.
24. Vealey RS. Conceptualization of Sport-Confidence and Competitive Orientation: Preliminary Investigation and Instrument Development. J Sport Exerc Psychol. 1986;8(3):221-46. **doi:**10.1123/jsp.8.3.221
25. Vealey RS, Walter SM. Imagery training for performance enhancement and personal development. Appl Sport Psychol Pers growth to peak Perform. 1993;2:200-21.
26. Gregg M, Hall C. Measurement of motivational imagery abilities in sport. J Sports Sci. 2006;24(9):961-71. **doi:**10.1080/02640410500386167 **pmid:**16882630
27. Watt AP, Morris T, Andersen MB. Issues in the development of a measure of imagery ability in sport. J Ment Imag. 2004;28(3&4):149-80.
28. Williams SE, Cumming J. Measuring Athlete Imagery Ability: The Sport Imagery Ability Questionnaire. J Sport Exerc Psychol. 2011;33:416-40. **doi:**10.1123/jsep.33.3.416 **pmid:**21659671
29. Short SE, Monsma E V, Short MW. Is what you see really what you get? Athletes' perceptions of imagery's functions. Sport Psychol. 2004;18(3):341-9. **doi:**10.1123/tsp.18.3.341
30. Spindler DJ, Allen MS, Vella SA, Swann C. Motivational-general arousal imagery does not improve decision-making performance in elite endurance cyclists. Cogn Emot. 2019;33(5):1084-93. **doi:**10.1080/02699931.2018.1529656 **pmid:**30296909
31. Quinton ML, van Zanten JV, Trotman GP, Cumming J, Williams SE. Investigating the protective role of mastery imagery ability in buffering debilitative stress responses. Front Psychol. 2019;10(JULY):1657. **doi:**10.3389/fpsyg.2019.01657 **pmid:**31396128
32. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine. 2000;25(24):3186-91. **doi:**10.1097/00007632-200012150-00014 **pmid:**11124735
33. Alcaraz-Ibanez M, Manuel Aguilar-Parra J, Alias Garcia A, Rodriguez Martinez A. Spanish adaptation and validation of the sport imagery ability questionnaire. Rev Mex Psicol. 2017;34(1):65-76.

34. Arruza-Gabilondo JA, Gonzalez Rodríguez O, Cecchini Estrada JA, Fink-Smith C. Factorial validity and reliability of the Spanish version of Sport Imagery Ability Questionnaire (SIAQ). Cuad Psicol del Deport. 2018;18(1):229-36. **doi:**10.1037/t69097-000
35. Ashrafi SVS, Talab RH, Shojaei M. Validity and reliability of Persian version of the Sport Imagery Ability Questionnaire. Int J Sport Stud. 2015;5(4):482-7.
36. Tahmasbi F, Hatami F, Hatami Shahmir E. The study of psychometric Properties of Persian Version of Sport Imagery Ability Questionnaire. Sport Psychol Stud. 2020;
37. Budnik-Przybylska D, Karasiewicz K. Reliability and Validity of the Polish Version of the Sport Imagery Ability Questionnaire. Polskie Forum Psychologiczne. 2020;25(2): 221-37.
38. Simonsmeier BA, Hannemann A. Die deutsche übersetzung des SIQ und SIAQ zur erfassung von vorstellungsgebrauch und vorstellungskompetenz im sport. Zeitschrift fur Sport. 2017;24(3):100-10. **doi:**10.1026/1612-5010/a000204
39. Singnoy C, Vongjaturapat N, Fonseca AM. Development and Psychometric Evaluation of the Sport Imagery Ability Questionnaire Thai Version (SIAQt). Int J Sport Sci. 2015;5(1):33-8.
40. Tabachnick BG, Fidell LS. Using Multivariate Statistics. 7th ed. New York: Pearson; 2018.
41. Tabachnick BG, Fidell LS. Using Multivariate Statistic. 4th ed. New York: Harper and Row; 2001.
42. Stoet G. PsyToolkit: A Novel Web-Based Method for Running Online Questionnaires and Reaction-Time Experiments. Teach Psychol. 2017;44(1):24-31. **doi:**10.1177/0098628316677643
43. Stoet G. PsyToolkit: A software package for programming psychological experiments using Linux. Behav Res Methods. 2010;42(4):1096-104. **doi:**10.3758/BRM.42.4.1096 **pmid:**21139177
44. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate Data Analysis. 8th ed. United Kingdom: Cengage Learning; 2019.
45. Kline RB. Principles and Practice of Structural Equation Modeling. 4th ed. New York: The Guilford Press; 2016.
46. Kim H-Y. Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. Restor Dent Endod. 2013;38(1):52. **doi:**10.5395/rde.2013.38.1.52 **pmid:**23495371
47. Bentler PM. Comparative fit indexes in structural models. Vol. 107, Psychological Bulletin. US: American Psychological Association; 1990. p. 238-46. **doi:**10.1037/0033-2909.107.2.238 **pmid:**2320703
48. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Model. 1999;6(1):1-55. **doi:**10.1080/10705519909540118
49. Byrne BM. Structural equation modeling with AMOS: Basic concepts, applications, and programming, 2nd ed. Structural equation modeling with AMOS: Basic concepts, applications, and programming, 2nd ed. New York, NY, US: Routledge/Taylor & Francis Group; 2010. xix, 396-xix, 396. (Multivariate applications series.).
50. Roemer E, Schuberth F, Henseler J. HTMT2-an improved criterion for assessing discriminant validity in structural equation modeling. Ind Manag Data Syst. 2021;121(12):2637-50. **doi:**10.1108/IMDS-02-2021-0082
51. Fornell, C., & Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. J Mark Res. 1981;18(1):39-50. https://doi.org/10.2307/3151312 **doi:**10.1177/002224378101800104
52. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J Acad Mark Sci. 2015;43(1):115-35. **doi:**10.1007/s11747-014-0403-8
53. Gold AH, Malhotra A, Segars AH. Knowledge management: An organizational capabilities perspective. J Manag Inf Syst. 2001;18(1):185-214. **doi:**10.1080/07421222.2001.11045669
54. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate Data Analysis. 7th ed. Prentice Hall; 2010. (Always learning).