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Development and Psychometric Evaluation of the Sport Imagery Ability Questionnaire Thai Version (SIAQt)

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Abstract Aiming to provide a useful tool to Thai researchers interested in sport imagery, the main goal of this study was to translate and to adapt to Thai culture the Sport Imagery Ability Questionnaire (SIAQ), as well to examine its psychometric properties. Therefore, the SIAQ was initially translated to Thai and back-translated to English. The back-translated version was compared with the original, and received small amendments in few items. After being established as an clear and comfortable instrument for Thai athletes, the SIAQ Thai version (SIAQt) was administered to a sample of 730 Thai athletes of diverse sports (67% males and 33% females, with a mean age of 19.7 [range 17-22] years and an average sport experience of 11.54 years), enrolled in physical education and sport science programs of Burapha University during the academic year 2011-2012, recruited by the method of random convenience sampling. Confirmatory factor analysis (CFA) showed that the 15 items of the 5-subscale structure found in the original version were replicated in the Thai version. The model adequately fits the data, and it was established for a final five-factor model: $\chi 2$ (80) = 328.07, $p < 0.05$, CFI = 0.98, TLI = 0.97, SRMR = 0.039, RMSEA = 0.065 (90% CI = 0.058-0.073). Likewise, the values exceed 0.90 for the reliability score and were similar to the original version. Thus, the Thai version of the SIAQ presents the same factor structure as the original and exhibits similar psychometric properties. Consequently, from a practical standpoint, the findings reported in this investigation indicate that the Thai version of the SIAQ could be reliably used to evaluate the imagery abilities of the Thai athletes for research and applied purposes.

Keywords Sport Imagery ability, Translation and adaptation, Psychometrics, Thai

1. Introduction

Currently, the imagery technique is a popular type of mental skill training and strategy used to improve performance (Cumming & Ramsey, 2009; Murphy, Nordin, & Cumming, 2008). It affects an individual's capacity to create and control images (Martin, Moritz, & Hall, 1999). Robin, Dominique, Toussaint, Blandin, Guillot, & Le Her (2007) study demonstrated that individuals with higher imagery ability experienced greater improvements in the accuracy of their tennis serve return compared with poorer imagers. Moreover, Martin et al. (1999) state that imagery ability would moderate the relationship between the imagery used and its intended outcome, a conclusion that has received support (Cumming, 2008). It has become commonplace for researchers to measure participants' imagery ability as an inclusion criteria for experiments and field-based interventions (Cumming & Ramsey, 2009). Athletes displaying poor imagery ability are excluded from studies or provided with training exercises to aid their image generation (e.g. Cumming, Olphin, & Law, 2007; Williams, Cumming, & Balanos, 2010).

The term *"imagery ability"* refers to an individual's ability to create images. This is considered to be innate in that everyone has the ability to generate images, but some people are better at it than others (Short, Tenute, & Feltz, 2005). Morris, Spittle, & Watt (2005, p. 60) defined it as *"an individual's capability of forming vivid, controllable images"*. Thus, we can refer to imagery ability as a person's ability to create images that are clear and can be controlled, or some related definition. Some result of the imagery associated with the information, construction, maintenance and modification of images with the ability of an individual is likely to capture their expertise in the performance of each of these processes. Morris et al. (2005, p. 61) suggest that the two dimension of imagery ability are vividness and controllability. The first dimension of the vividness of an image describes *"its clarity and sharpness or sensory richness"*. The term *"controllability"* describes the *"ease and accuracy with which an image can be transformed or manipulated in one's mind"*. Kosslyn (1994) explains that imaging involves the generation/formation, maintenance, and transformation of images, with an individual's imagery ability likely capturing their competence in performing each of these processes. Ease of imagery comes with its capacity

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to reflect mental and cognitive processes, generally said to be diversified and needing discussion to clearly assess imagery ability (e.g. Hall & Martin, 1997; Gregg & Hall, 2006). Therefore, the ability to visualize a number of characteristics reflects the ability of individuals to form and to maintain the images, including ease and/or vividness. Roberts, Callow, Hardy, Markland, and Bringer (2008) describe image formation as occurring through the activation of working memory, and note that vividness of images is also drawn from working memory (Baddeley & Andrade, 2000).

Roberts, Callow, Hardy, Markland, and Bringer (2008) describe image formation as a process occurring through the activation of working memory. This analogue is based on perceptional information that is called up by the "memory". It is necessary to assume at least two steps in this process short-term and long-term memory. Imagery, then, occurs as cognitive and memory systems working to create or recreate images, so this process cannot be directly measured. The measurement variations in imager-influenced performance, however, are possible, though such measurements cannot be equated with the actual assessment of characteristics such as imagery ability. Most researchers have assessed athletes' imagery ability through self-reporting inventories such as questionnaires (Robin, Dominique, Toussaint, Blandin, Guillot, & Le Her, 2007).

Mental imagery measures have been used for the last 40 years. Generally, researchers have assessed athletes' imagery ability through self-reporting questionnaire inventories. Such as, the Questionnaire Upon Mental Imagery (QMI) (Betts, 1909), the Shortened form of the Questionnaire on mental imagery (SQMI) (Sheehan, 1967), The Survey of mental Imagery (SMI) (Switras, 1978), The Vividness of Visual Imagery Questionnaire (VVIQ) (Marks, 1973), the Vividness of Movement Imagery Questionnaire (VMIQ) (Isaac, Marks & Russell, 1986), the Movement Imagery Questionnaire (MIQ) (Hall & Pongrac, 1983), the Revised versions of the Movement Imagery Questionnaire (MIQ-R) (Hall & Martin, 1997), The Florida Praxis Imagery Questionnaire (FPIQ) (Ochipa, Rapcsak, Maher, Gonzalez Rothi, Bowers & Heilman, 1997), the Sport Imagery Questionnaire (SIQ) (Hall, Mack, Paivio & Hausenblas, 1998), Kinesthetic and Visual Imagery Questionnaire (KVIQ) (Malouin, Richards, Jackson, Lafleur, Durand & Doyon, 2007), the Sport Imagery Ability Measure (SIAM) (Watt, 2003), Motivational Imagery Ability Measure for Sport (MIAMS) (Hall & Gregg, 2006), and the Vividness of Movement Imagery Questionnaire (VMIQ-2) (Roberts, Callow, Hardy, Markland & Bringer, 2008). However, Williams and Cumming (2011) was to develop a new assessment of athletes' imagery ability called the Sport Imagery Ability Questionnaire (SIAQ).

In recent years, Williams and Cumming (2011) developed a new questionnaire to assess athletes' imagery ability called the Sport Imagery Ability Questionnaire (SIAQ). Their study was carried out to pool 30 items drawn from the Sport Imagery Questionnaire (SIQ), modified to remove and add item words. In total, the questionnaire included 35 items designed to assess five types of imagery. The factor analysis providing the loading score in this structure reduced the 35 items to 20 items. The loading score in study 1 decreased the items to the final 12 items, using confirmatory factor analysis (CFA) to validate these findings with a new sample in study 2, which cross-validates the findings in study 1, demonstrating a good fit with the data for the four-factor model. Findings suggest it would be redundant to separately assess *"ease to see"* and *"ease to feel"* each image; study 3, then, creates a fifth mastery subscale, and adds three items.

The established test – retest reliability and the coefficients of SIAQ were skill, strategy, goal, affect, and mastery images high than 0.75. The model is an adequate fit to the data established for a final five-factor model, $\chi 2$ (80) = 204.53, $p < 0.05$, CFI = 0.96, TLI = 0.95, SRMR = 0.04, RMSEA = 0.06 (90% CI = 0.05–0.07). All factor loadings (0.62–0.88) in the 15 final items, the modification indices, and standardized residuals were within acceptable fit. Moreover, study 4 was designed to examine the relationships between the SIAQ and the Movement Imagery Questionnaire, the Movement Imagery Questionnaire-3 (MIQ-3). However, the results of both the SIAQ and MIQ-3 demonstrated good internal reliability for each subscale. The relationship between the SIAQ and MIQ-3 appears to be influenced by imagery content of the SIAQ, with greater correlations for affect and mastery images rather than skill and strategy. Although the majority of SIAQ subscales correlate with the MIQ-3 subscales, goal imagery failed to significantly correlate with either of the MIQ-3 visual imagery subscales. This highlights how different the visual characteristics of goal images are compared with movement images assessed by the MIQ-3. This provides further support for the suggestion that discrepancies between the two questionnaires are a result of differing content rather than other factors such as the construct of imagery ability being assessed or the discrepancy in the rating scales. However, research should continue to validate the SIAQ on a much wider scale, and demonstrating the SIAQ's predictive validity of imagery use and other outcomes would further establish this questionnaire as an effective assessment of athlete imagery ability.

Although the English-language SIAQ has proven itself to be a useful tool for sport psychology researchers and consultants, its wider application requires that it be translated into other languages and that its psychometric characteristics be assessed in different cultural contexts (Marsh, 2007). As a new questionnaire, the SIAQ has opened various avenues of future research and it should undergo further validation. Moreover imagery has been associated with various motivational concept and outcomes as well as performance improvements. With the existence of a valid and reliable questionnaire providing a comprehensive assessment of the athletes' ability to image content, the relationship is established between imagery ability and psychological characteristics. Presently, the SIAQ lacks the support of cross-cultural research on the general utilization of the model and measure. In this research we provide a suitable

translation, cultural adaptation, and validation of the SIAQ for Thai culture. Our aim was to assess not only whether the dimensional structure of the original test remained unaltered in the Thai version, but also whether the psychometric characteristics of the test justify its valid application to Thai athletes.

2. Methods

Participants

The sample was made up of 730 Thai college athletes (243 women, 486 men and 1 no definition) enrolled during the academic year 2011-2012 in both the physical education and the sport science faculties of the Burapha University, where the participants can get experience from physical education and sport classes, by the method of random convenience sampling. Their mean age was 19.7 yr. (±*1.3*), with ages ranging from 17 to 22 years. The participants' average sport experience was 11.54 years (5.27). All of them were involved in sports, such as football (235), basketball (92), athletics (47), badminton (21), boxing (19), bicycle (6), futsal (53), fencing (8), handball (10), petanque (20), rugby (10), rowing (13), softball (2), swimming (15), table tennis (11), takraw and sepak takraw (8), tennis (11), volleyball (55), taekwondo (9), wood ball (7), weight lifting (1), extreme skateboard (1), golf (5), martial arts (1), softball tennis (2), and general sports activities (24). Moreover, they took part in official competitions at regional (n=14), university (37), national (n=182), and international (n=2) level.

Instrument Development

The test used was SIAQ, containing 15 items to assess imagery ability, arranged into five factors with three items each and their corresponding labels: Skill Images (e.g. *"I modify my skill to be better"*); Strategy Images (e.g. *"I create a new game plan/strategy in my mind"*); Goal Images (e.g. *"I feel that I must be the winner"*); Affect Images (e.g. *"I feel that I must be the winner"*); and Mastery Images (e.g. *"I try 100% even though I cannot do it well"*). Questions were answered by means of a 7-point Likert-type scale ranging from 1 (*very hard to image*) to 7 (*very easy to image*). In this research, the item wording was modified to add "I" because the Thai population is familiar with seeing complete sentences when reading the item. Moreover, this item passed check understanding. The reliability was 0.94. All subscales demonstrated adequate CR skill imagery = 0.89, strategy imagery = 0.76, goal imagery = 0.77, and affect imagery = 0.59, and mastery imagery = 0.77. It is follow to expect reliability coefficients to fall in the range of 0.7 to 0.9, and a reliability of 0.70 is a minimum for a good test." (Kline, 2000, 13). Bivariate correlations revealed significant moderate relationships between the subscales, with values ranging from 0.50 to 0.69 ($p < 0.01$). The size of these relationships indicates that the subscales of the SIAQ-T are measuring related but distinct constructs.

Procedure

In order to adapt the instrument of the Sport Imagery Ability Questionnaire (SIAQ) by Williams and Cumming (2011) for research in Eastern cultures, a reliable Thai version is required. Back-translation, defined as the translation of a target-language text back to the source language, has the advantage of making unintentional omissions, additions, or changes in meaning evident. However, this can be also be achieved more effectively by a careful comparison of the source language and target language versions. Just as errors may be made in the (forward) translation process, additional errors may be made in the back-translation process, thus further complicating the procedure, and causing time to be spent on aspects that will not contribute to the quality of the final product.

The following procedure was designed to ensure that sufficient analysis would take place during the different stages of the translation process in view of the pros and cons of back-translation. To prevent bias, members of the target culture, native speakers of Thai, prepared two initial translations into the target language. One of the translations (T1) was done by a bilingual person and expert in sport science, the other (T2) was done by a sport psychologist who was instructed to make the necessary linguistic and cultural adaptations. A comparison was made of the two translations, and based on those two texts a third preliminary version (T3) was checked and prepared by three bilingual researchers (mutidisciplinary in sport and sport science) . Each of the items was analyzed and discussed in detail, taking into consideration the target-language readership and the standard usage of the Thai language. The version "T3" was back-translated into English by a bilingual researcher and expert in sport psychology. The ensuing version "T3" was given to a group (n = 15, sample from the faculty of sport science) who were asked to underline anything that was unclear, and make note of their suggestions. Problems detected at that time were taken into account in making modifications to T3. Then, a second version was presented to a native speaker for proofing of the content.

Data collection

A heterogeneous sample of participants was recruited from sports science and physical education classes. Those agreeing to participate understood it was voluntary and signed a written consent form. Individuals were contacted directly by an investigator who provided them with an information sheet and explained the nature of the study. Next, participants completed the SIAQt and provided their demographic information in a quiet environment, usually before or after a typical training session. Participants were asked to complete the questionnaire as honestly as possible and not to confer with any other athletes. Once finished, all completed materials were returned to the investigators.

Data analysis

The CFA was implemented by means of the program LISREL, following the Maximum Likelihood Estimation

Method with Satorra and Bentler's robust correction to calculate the goodness-of-fit statistics and standard errors. The rest of the statistical analyses were implemented by means of the IBM SPSS statistic program. To estimate the reliability of the scales we used two complementary procedures: (a) internal consistency by means of Cronbach's α coefficient, and (b) test-retest.

3. Results

Confirmatory Factor Analysis (CFA)

Analysis of the CFA conditions of application. We assumed that the Thai version of SIAQ complied with the same theoretical five-dimension configuration obtained by the authors of the test. Consequently, their distributions were deemed to be within normal values (Pérez, 2004, p. 62). As for multivariate normality, Mardia's coefficient of kurtosis revealed a distribution that departed significantly from a multivariate normal distribution. In order to prevent any possible effect of the lack of multivariate normality, we utilized the Satorra-Bentler Robust Maximum Likelihood estimation method to estimate the factor model. This is the recommended method to deal with large sample distributions lacking multivariate normality (Byrne, 2006, p. 22). In fact, the correlations between the five subscales rank between low and moderate (0.48-0.68) (Table 1).

Table 1. Means, standard deviations, alpha coefficients and inter-correlations between each SIAQ–T subscale for the present

Subscale	SIAQ-T	Inter-correlations				SIAQ original
	Mean	1	2	3	4	*Mean*
1. Skill	4.70	-				5.16
2. Strategy	4.34	.68**				4.83
3. Goal	4.71	.53**	.48**			4.83
4. Effect	5.18	.65**	.53**	.55**		5.92
5. Mastery	4.51	.64**	.60**	.50**	.60**	4.90

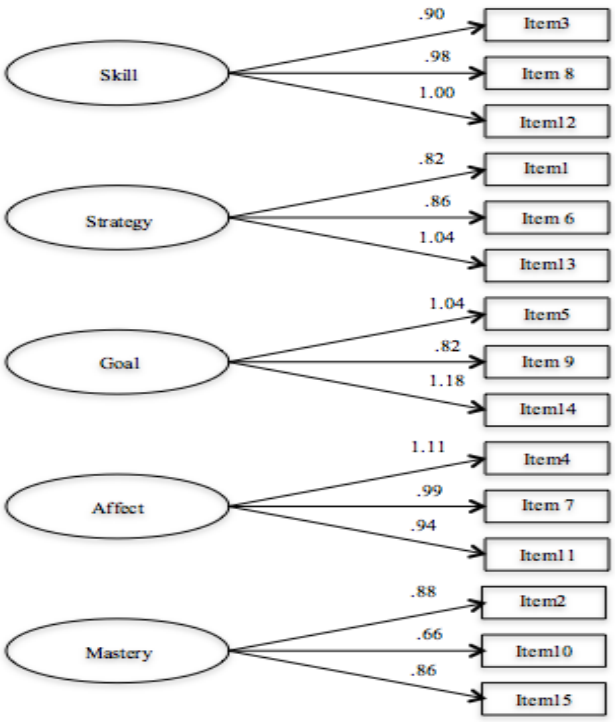
** P < 0.01

Estimation and goodness-of-fit of the metric model.

The model's overall goodness-of-fit was tested using the χ2, SRMR, TLI, CFI, and RMSEA. The model's adequate fit to the data was established for a final five-factor model, $\chi 2$ (80) = 328.07, $p < .05$, CFI = .98, TLI = .97, SRMR = .039, RMSEA = .065 (90% CI = (0.058-0.073). The model fit was acceptable; since the NNFI and CFI indexes were above .90 and the RMSEA was near .05, the configuration fit was considered satisfactory, including all factor loadings (0.66–1.18) (see in picture 1).

Reliability

We calculated test reliability coefficients, in this case using 30 athletes at 0.94. Almost subscales demonstrated adequate CR: skill imagery = 0.89, strategy imagery = 0.76, goal imagery = 0.77, affect imagery = 0.59, and mastery imagery = 0.77(Kline, 2000, 13). In affect imagery was reliability estimates below 0.60 are usually regarded as unacceptably low. Lower reliability is acceptable when tests are used for preliminary rather than final decisions , and tests are used to sort people into a small number of groups based on gross individual differences e.g. height or sociability /cross culture (Murphy & Davidshofer, 2001, p.142). Bivariate correlations revealed significant moderate relationships between the subscales, with values ranging from 0.50 to 0.69 ($p < .01$). The size of these relationships indicates that the subscales of the SIAQ-T are measuring related but distinct constructs.



Picture 1. Factor loading in each item

4. Discussion

The SIAQ-T provides a comprehensive assessment of athlete imagery ability by assessing five types of imagery content closely associated with the five functions of athlete imagery use. The translation resulted in a Thai version of the SIAQ that has a factorial structure equivalent to that of the original test. This first conclusion permits us to interpret our subsequent results with confidence. The CFA conducted with the total sample of Thai athletes yielded NNFI and CFI indexes higher than .90 and a RMSEA well below .05. Following Marsh's recommendation (2007), the fit with the five-factor model is quite satisfactory. In addition, the CFAs carried out with separate male and female subsamples also produced a satisfactory fit in both cases, since the RMSEA was .065 and the CFI was close to or higher than .90. These results are similar to Williams and Cummings in study 3, where the model's overall goodness of fit was tested using

the $\chi 2$, SRMR, TLI, CFI, and RMSEA. An adequate fit to the data was established for a 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). Moreover, the internal reliability for all five subscales with CR values ranges from .76 to .86, and AVE values ranging from .51 to .68. Significant interfactor correlations between the five subscales ranged from 0.26 to 0.46 ($p < .001$). Nevertheless, the goodness-of-fit indexes, particularly the RMSEA, are much more favorable for Thai athletes. This is probably due to some aspects associated with the quality of the corresponding standardization samples.

In this study, we also intended to develop a good psychometric for evaluation of mental imagery ability. Descriptive statistics from the Thai version varied slightly from data derived from other samples that completed the English versions. Different mean values for the imagery ability subscale were also observed when comparing the Thai sample and English versions. The SIAQ-T was found to have good validity after validation and development into different languages with minimal adaptation to each language. The rationale for this localization is to adjust for the cultural and other community-specific differences. This finding suggests a possible cultural or conceptual difference in the response behaviors to certain imagery use questions (particularly those related to feeling confident or mentally tough). Yi and Park (2003) found that people with different cultural backgrounds were more likely to have different attitudes and styles of decision-making in negotiation, bargaining processes, and problem solving in various social settings because value systems differed.

The questionnaire developed in this study was focused on Thai athletes. The instrument translates to be loyal to the original context of the source instrument, and it should also reflect a cultural understanding of the target language. Although the English version intended to assess imagery content rather than function, the item wording was modified to remove reference, which deleted *"I image…"* wording when creating the SIAQ, to limit the reasons why athletes image. But in our check-understanding process, we found that Thai students were unclear on several items because the Thai population is familiar with complete sentences when reading a questionnaire. Students said, *"I need some wording to explain about detail what the item is asking"*. Then researchers returned to the questionnaire and re-modified wording by using "I modify/feel/image…" on SIAQ-T items. The revision also enhanced the understanding and accuracy of the translated instrument. Concepts should not be translated word-for-word, but in a way that is meaningful to the context of the Thai population. This task involved not only translation into the Thai language and culture, but also maintaining the structure of the questionnaire.

This research has made progress toward filling in the cross-cultural gap of imagery ability understanding in Thailand. We know that the SIAQ-T focuses on measuring an individual's ability to generate imagery content. However, a gap currently exists between the imagery content commonly reported by athletes and how their ability to generate this content is typically assessed. Although the authors have provided evidence to support the validity and reliability of the questionnaire, the SIAQ-T is limited to the new assessment. There is some literature in studies to support that cultural effect is one of the important factors to explain a certain pattern of individual thought and behavior from the psychological aspects.

Limitations of this study are related first to the ability to generalize the results. This current study adopted a convenient sampling method due to the difficulty in obtaining a sample of all athletes of Burapha University. Therefore, care should be taken when generalizing the results of this study. More specifically, the results of this current study might not be generalizable beyond the population of college students. However, the study still added more information to the understanding of globalization of action sports to the existing literature. Thus, future research should now assess other estimates of reliabilities and the factor structure of the Thai version of the SIAQ using a varied sample of athletes. Although this study examined imagery ability characteristics in athletes from several sports, it is a small sample in each sport. Further research investigating imagery use functions across different types of sport (i.e., team vs. individual) as well as different situations (i.e., practice vs. competition), and age difference and levels of experience (i.e., elite vs. novice), is also warranted. Additional examination of the reliability and factor structure of the SIAQ-T are necessary to further validate this version of the measure.

In summary, the SIAQ-T preserves the factor structure of the original English version: its structure applied to reliability is good on the total scale and acceptable on the subscales, and results are consistent with the results of studies carried out in other cultural environments. Consequently, the SIAQ can be applicable and useful to evaluate athletes in Thai-speaking cultural environments. The results should also encourage sport psychologist consultants and researchers to investigate and utilize the measure in the future. Moreover, it would be of interest to complement research enabling a comparison of the imagery ability model variance in different East Asian cultural groups (e.g. Japanese, Chinese, Vietnamese, et al.).

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