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Cultural adaptation and validation of the Sport Imagery Questionnaire for Children (SIQ-C) to the portuguese language

Adaptação cultural e validação do Sport Imagery Questionnaire for Children (SIQ-C) para a língua portuguesa

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Abstract

The aim of this study was to translate, adapt and validate the Sport Imagery Questionnaire for Children to Brazilian Portuguese. For this purpose, analyzes of reproducibility, internal consistency and confirmatory factor analysis were conducted. The final sample consisted of 521 athletes from 14 sports and ages 14 and 19 (M = 16.31, SD = 1.18). High indices of internal consistency (α = 0.870), reproducibility (0.824) and content validity were verified. In the confirmatory factor analysis, it was observed the appropriate global indexes of adjustment to the five-factor instrument model (RMSEA = 0.060; CFI = 0.90; TLI = 0.88; SRMR = 0.047). The translated instrument has adequate psychometric indicators to evaluate sport imagery, presents a reproducible factor structure and is a reliable test to measure the frequency of imagery use in Brazilian adolescent athletes.

Keywords: Athletes; Imagery; Reproducibility of results; Surveys and questionnaires.

Resumo

O objetivo deste estudo foi traduzir, adaptar e validar o Sport Imagery Questionnaire for Children para o português brasileiro. Para tanto, foram realizadas análises de reprodutibilidade, consistência interna e análise fatorial confirmatória.

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A amostra final foi composta de 521 atletas praticantes de 14 modalidades esportivas e com idades entre 14 e 19 anos (M = 16,31, DP = 1,18). Foram verificados altos índices de consistência interna (α = 0,870), reprodutibilidade (0,824) e validade de conteúdo. Na análise fatorial confirmatória, foram observados os índices globais adequados de ajuste ao modelo do instrumento de cinco fatores (RMSEA = 0,060; CFI = 0,90; TLI = 0,88; SRMR = 0,047). O instrumento traduzido possui indicadores psicométricos adequados para avaliar a imagética no esporte, apresenta uma estrutura fatorial reproduzível e é um teste confiável para medir a frequência de uso de imagética em atletas adolescentes brasileiros.

Palavras-chave: *Atletas; Imagética; Reprodutibilidade dos testes; Inquéritos e questionários.*

Imagery is understood as the ability to represent, rehearse, and perform a task mentally (Martin et al., 1999). Furthermore, the imagery encompasses quasi-sensory and quase-perceptual experiences in which the individual is conscious, and which occur in the absence of the stimulus conditions that are known for producing their authentic sensory or perceptual counterparts (Kizildag & Tiryaki, 2012). This variable has played a central role in theories of mental function since Plato's time, and was later identified as an important contribution to memory by theorist Paivio (2017).

Regarding the application of imagery, some authors have demonstrated that the practice of this technique has the potential to enhance sleep memory consolidation (Debarnot et al., 2015), facilitate the acquisition of a second language (Deng & Zou, 2016), positively influence the learning of arithmetic and geometry (Bizzaro et al., 2018) and the consolidation of motor tasks (Ruffino et al., 2017). In the human movement field, researchers have shown that areas of the cortex used in movement control also play a relevant role in the ability to use imagery (Pilgramm et al., 2016).

Taking into account the importance of imagery in movement, Williams and Cumming (2016) pointed out that imagery is a popular and well-accepted strategy among athletes and practitioners for enhancing various aspects of performance. In addition, Simonsmeier and Buecker (2017) indicated that the use of the imagery of certain sports skills leads to better execution, learning and improvement of these skills. Other studies have pointed out that the use of imagery may produce increases in levels of self-confidence (Marshall & Gibson, 2017; Slimani et al., 2016; Williams & Cumming, 2016; Weibull et al., 2015), assist in coping with injuries and pain (Wesch et al., 2016), help in the regulation of activation (Stewart et al., 2017) and coping with stress and anxiety (Williams & Cumming, 2016).

Among the theories proposed to explain the functioning of the imagery system, the psychoneuromuscular theory (Carpenter, 1875) and the symbolic learning theory (Sacket, 1934) stand out. The psychoneuromuscular theory is based on the ideomotor principle, in which the imagery would facilitate the learning process of motor skills by virtue of the activation of neuromuscular patterns during imagination. In this case, the neuromuscular impulses produced by imagination are identical to the impulses produced during the execution of the movement, but at a much lower intensity. On the other hand, the theory of symbolic learning is based on the premise that imagination can help individuals to better understand their movements (Sacket, 1934), operating as a coding system, to help individuals understand and acquire better movement.

In order to understand the relations between the use of imagery and outcomes in physical, cognitive and emotional performance, Martin et al. (1999), based on the analytical approach of Paivio (2017), developed an applied model of the use of the imagery in sport considering the sports situation, the type of imagery and the capacity to use imagery. The types of imagery are represented a five-factor model comprised of cognitive and motivational dimensions. The cognitive dimension comprises the factors "Cognitive Specific" (CS) and "Cognitive General" (CG), so that CS refers to the imagination of specific sports skills, most often used for learning motor skills, while the CG involves the imagination of competitive tactics, strategies and planning. The motivational dimension consists of "Motivational General Mastery" (MG-M), "Motivational General Arousal" (MG-A) and "Motivational Specific" (MS). The MS refers to the imagination of specific

goals, such as achieving success in competition, MG-A involves the imagination of feelings of relaxation, excitement, anxiety and emotional arousal, and MG-M relates to control and coping with difficult or challenging situations.

As a way to operationalize the imagery construct, Hall et al (1998) developed the Sport Imagery Questionnaire (SIQ), which measures the frequency of use of the five types of imagery by adult athletes. The SIQ is widely used and the results of the studies demonstrate the positive association between the higher frequency of the use of imagery for performance improvement (Simonsmeier & Buecker, 2017) and increased levels of self-confidence (Marshall & Gibson, 2017; Slimani et al., 2016) and self-efficacy (Wesch et al., 2016; Buck et al., 2016) in the adult population.

As well as adult athletes, children and adolescents athletes also reported using the five types of imagery both in training and in competitions (Munroe-Chandler et al., 2007). Therefore, Hall, Munroe-Chandler et al. (2009), adapted the original version of SIQ for North American children and adolescents aged 7 to 14 years in a three-phase study. In the development of the Sport Imagery Questionnaire for Children (SIQ-C), the validity of the instrument was analyzed and modifications were made in the wording of some items. The response scale was changed from seven to five points on a likert scale, and there was a decrease the number of items from 30 (SIQ) to 21 (SIQ-C). In addition, the authors verified evidence of convergent validity between the MG-M domain of imagery and the variables of self-confidence ($r = 0.73$) and self-efficacy ($r = 0.61$) and evidence of discriminant validity among CS and CG with self-confidence (CS: $r = 0.39$ and CG: $r = 0.38$) and self-efficacy (CS: $r = 0.41$ and CG: $r = 0.38$).

In the light of the above, the SIQ was been translated to other languages such as Spanish (Ruiz & Watt, 2014), Finish (Watt et al., 2006) and Brazil (Filgueiras, 2017), but the the SIQ-C has not yet been adapted to other languages. Specifically in the Brazilian context, the validation of this instrument may serve as a valuable tool in the aid of sports teams in terms of knowledge of the frequency of use of each type of imagery by young athletes use and the influence of this imagery use on variables related to performance and competitions results. Thus, the objective of the present study was to translate, adapt and validate the SIQ-C for Brazilian Portuguese.

Method

Participants

This study was conducted with different samples in order to meet the objective of each stage. Thus, four adolescent athletes participated in the focus group; 33 adolescent athletes participated in the test-retest group; and 521 adolescent athletes involved in high level competition responded to the final version of the translated SIQ-C. In addition, the validation process of the instrument counted on the participation of 6 bilingual specialists in the areas of Physical Education and Human Movement Sciences.

Athletes were invited to voluntarily participate in the study, so that athletes under the age of 18 who agreed to participate, signed the Free and Informed Assent Form and had the Free and Informed Consent Form signed by the parents or coaches. Athletes over 18 years old who accepted to participate, signed the Free and Informed Consent Form, respecting the Guidelines and Norms Regulating Research in Human Subjects, in accordance with Resolution nº 466/12 National Health Council. In addition, the study was approved by the Committee of Ethics in Research with Human Subjects of the State University of *Santa Catarina* (Protocol nº 2.776.501).

Instruments

The SIQ-C (Hall et al., 2009) is a modified version of the Sport Imagery Questionnaire (SIQ) developed for adults by Hall et al. (1998) based on the theoretical model of Paivio (2017), and is used to evaluate the frequency of use of motivational and cognitive imagery of children in the following domains: Cognitive General (CG), Cognitive Specific (CS), Motivational General Arousal (MG-A), Motivational General Mastery (MG-M) and Motivational Specific (MS). In the children's version, Hall et al. (2009) sought to ensure that the modifications of the SIQ questions reflect the cognitive stage of the sample, both in writing and in format.

Regarding the construction of the instrument, the authors developed a three-phase study and verified evidence of factorial adequacy, discriminant validity, convergent validity and reliability for application with children aged 7 to 14 years. In their research, Hall et al. (2009) demonstrated the adequate psychometric properties of the SIQ-C and observed acceptable internal consistency indices for each of the five subscales, ranging from 0.69 to 0.80. In addition, they supported the five-factor structure (CG, CS, MG-A, MG-M and MS) of the instrument by means of confirmatory factorial analysis (CFA).

SIQ-C is a self-reported measure of 21 items with a 5-point likert structure in which responses range from (1) never/rarely to (5) frequently. The items are divided by the frequency that the athletes report using each of Paivio's constructs: CS, CG, MG-A, MG-M and ME. For example, the question "I can usually control how a skill looks in my head" addresses the CS function of imagery, and the question "I make up new game plans or routines in my head" is an item of CG imagery. The question "I see myself being mentally strong" is an example of MG-M imagery, and the question "In my head, I imagine how calm I feel before I compete" addresses the MG-A imagery function. Finally, the statement "I see myself doing my very best" is a MS item.

In addition to the SIQ-C, in the present study socio-demographic variables (sex and age) and variables related to sport were also collected in terms of type of sport (individual or collective), level of competition (regional, national or international), and years of experience.

Procedures

Initially, authorization was obtained from the authors of the SIQ-C to carry out this study. From this, the transcultural translation and adaptation process of the instrument followed the proposal of Herdman, Fox-Rushby and Badia (1997), considering the following steps: (a) translation; (b) back-translation; (c) technical review; (d) evaluation of specialists in the area; (e) focus group; (f) test-retest; and (g) final application. Each of the aforementioned steps was detailed below.

Translation, back-translation and technical review

The process of translation and back-translation followed the guidelines of the International Test Comission. First, two independent professional translators performed the preliminary translation of SIQ-C into Brazilian Portuguese, as Arafat et al. (2016) suggest. After that, the two versions were synthesized by the lead author of this study into a preliminary version, discussed by a research group, and back translated into English by a bilingual translator of the Human Movement Sciences area. The back-translated version was analyzed by a technical review team, in which cultural and linguistic adaptations were implemented, and then the version of the SIQ-C was finalized and sent to the evaluation of specialists in the area.

Evaluation of the specialists

At this stage, the translated instrument was sent for evaluation to six PhD specialists from the areas of Physical Education and Human Movement Sciences to evaluate the content validity of 21 items of the instrument. Specifically, they evaluated "language clarity", "practical relevance" and "theoretical relevance". To do so, the judges used a five-point Likert scale to evaluate these constructswith 1 = "Inadequate", 2 = "Not suitable", 3 = "Acceptable", 4 = "Adequate" and 5 = "Very suitable". After the specialists completed their evaluations, the content validity coefficient (CVC) proposed by Hernandez-Nieto (2002) was calculated.

In addition, each specialist answered four supplementary questions relating to the adaptation of the instrument, including: (a) "In your perception, the instrument presented constitutes a valid indicative in our language and culture for the investigation of the use of images in sports for children and adolescent athletes aged 14 to 18? ", (b)" In your view, are the issues clear and relevant to the purpose of the instrument? ", (c)" Do you think the proposed heading for the questionnaire is appropriate? " (d) "In your perception, the questionnaire questions can include both individual and collective sports athletes?". The response options were "Yes", "No" or "In part".

Focus group

In order to analyze the semantics and level of comprehension of the questions of the translated instrument, a focus group was conducted with four adolescent track and field athletes, aged 15 to 19 years. The selection of this group was made considering the proximity to the lead researcher and the technical team, and the availability of the athletes for participation in this focus group. The questions were read one by one for the group and the adolescents were asked to explain their understanding of them.

Test-retest

The test-retest stage of the translated SIQ-C was performed, with a seven-day interval between the two applications with 33 adolescent male athletes aged 14 to 18 years. The mean age of this group was 15.03 (3.03) years and the participants participated in track and field, volleyball and soccer and were from cities of *Florianópolis* (SC) and Belém (PA). Both the test and the retest were applied by the same researcher and individually. In this step, the same ethical procedures were followed as with the larger sample in the competitive environment.

Final application

The final application stage of the instrument was performed before the athletes competed in their specific sport at a major sport competition. For this purpose, the leaders of the largest delegations and coaches from each region of the State of *Santa Catarina*, Brazil were contacted to explain the study. After the authorization of the persons responsible for conducting the research, the athletes were invited to participate and those who agreed signed the assente and consent form (over 18 years old or those responsible for participants under the age of 18). The administration of the questionnaire was always carried out in the presence of the researcher, in quiet environments reserved for better concentration of the research subjects.

In all, 549 athletes answered the final version of the translated SIQ-C. Athletes who did not respond fully and/or were younger than 14 years of age were excluded from the sample. This way, 28 participants were excluded, four of them were under 14 years of age and 24 who did not answer at least one question

of the SIQ-C, which resulted in the final sample of 521 athletes belonging to both team sports (handball, soccer, volleyball and basketball), as well as individual sports (athletics, swimming, karate, taekwondo, judo, tennis, gymnastics and cycling).

Data Analysis

To analyze the data, the software SPSS for Windows (version 20.0) and Stata (v.13.1) was used. Non-normality was verified in the data distribution and, therefore, non-parametric analyzes were performed. In addition, descriptive analyzes of central tendency and dispersion were performed and Intra-Class Correlation (ICC) was used to measure the reproducibility (test-retest) of the instrument. For the comparison between the five types of imagery means and SIQ-C total score while considering the level of competition of the athletes, the Kruskall Wallis test was performed, followed by the Dunn post-hoc test. In addition, spearman correlation was performed between the years of experience in sport and the scores for the five SIQ-C factors. The cut-off point adopted to determine satisfactory levels of the content validity coefficient was CVC ≥ 0.70 as recommended by Cassepp-Borges et al. (2010).

For the evaluation of the global adjustment indicators for the model (goodness-of-fit), a CFA was conducted, which provides information about the degree of fit between the sample data and the proposed model. In order to do so, numerous indices of global adjustment to the model were investigated, including the chi-square test (χ^2), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Standardized Root Mean Square Residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA). For the estimation of the CFA model, the Weighted Least Square estimation method (WSL) was used because normality was not assumed (Williams, 2015).

In the present analysis, to obtain the appropriate model indicated by the adjustment indices, the cut-off criteria proposed by Hu and Bentler (1999) were considered. Thus, satisfactory fit indicators to the model included CFI and TLI values greater than 0.90, a RMSEA value below 0.08, and a SRMR value below 0.06. For all analyzes, a significance level of .05 was employed.

Results

Regarding the terminology and instructions employed in the instrument, in the technical review stage modifications were made after the back-translation stage. The changes were as follows: (a) the term "practices" was replaced by the term"trainings " because this term is more used in sports environments in Brazilian culture; (b) the second time the term "imagery" appeared, it was replaced by "mental images", for the reason of facilitating the understanding by the subjects of the sample; (c) the passage "... and can also be used to help with your confidence and nervousness" was replaced by "...and can also be used to increase confidence and decrease nervousness"), in order to facilitate the understanding of the sample; and (d) the passage "Feel free to use a number more than once…" was replaced by "Circle only one item for each number…".

In addition, with regard to the translated SIQ-C and following the experts' recommendations, the excerpt "Any statement that explains an imagery situation that you often use should be given a high number" was deleted to avoid a possible desirability effect by the study sample. Moreover, the phrase "Consider skills, such as gestures or sports movements (for example, to swim, to run, to jump)" was added to exemplify the meaning of the motor skills concept for the sample.

With regard to the writing of the questions, modifications were also necessary based on the technical review and evaluation of the specialists. In questions 1, 5, 11 and 20 the terms "routines" and "game

plans" were replaced by "strategies" and "game schemes", respectively, because these terms are more understandable in the Brazilian sports context. In addition, in questions 1, 5, 9, 10, 13, 14, 16, 17, 18, 19, 20 and 21, the verb "see" was modified to "imagine" in order to standardize the verb for all items of the instrument.

Similarly, the starting section of question 4, "In my head...", was replaced by "I imagine..." in order to standardize this question with other questions that also started with this verb. In question 10, the verb "to do" was replaced by "to execute". In question 11, the "...even if it is not going well.", was replaced by "... even if they are not working". In Table 1, the stages of translation, back-translation and final version of each of the questions of the translated SIQ-C into Portuguese are illustrated in detail.

Table 1

Description of the stages of translation, back-translation and final version of the SIQ-C (BR)

Original	Translation	Back-translation	Final version
1. I make up new game plans or routines in my head.	1. *Eu crio novos planos de jogo ou rotinas na minha cabeça.*	1. I make new game plans or routines in my head.	1. *Eu crio novas estratégias ou esquemas de jogo na minha cabeça.*
2. I see myself doing my very best.	2. *Eu me vejo fazendo o meu melhor.*	2. I see myself doing my best.	2. *Eu me imagino fazendo o meu melhor.*
3. I imagine myself being confident in competition.	3. *Eu me imagino estar confiante na competição.*	3. I imagine myself being confident in the competition.	3. *Eu me imagino estar confiante na competição.*
4. In my head, I imagine how calm I feel before I compete.	4. *Na minha cabeça, eu imagino o quão calmo eu sinto antes de competir.*	4. In my head, I imagine how calm I feel before competing.	4. *Eu imagino o quão calmo estarei antes de competir.*
5. I see what I would do if my game plans or routines do not work out.	5. *Vejo o que eu faria se meus planos de jogo ou rotinas não funcionassem.*	5. I see what I would do if my game plans or routines didn't work out.	5. *Eu imagino o que eu faria se minhas estratégias ou esquemas de jogo não funcionassem.*
6. I imagine myself staying calm in competitions.	6. *Eu me imagino ficando calmo em competições.*	6. I imagine myself getting calm in competitions.	6. *Eu me imagino ficando calmo em competições.*
7. I imagine other people telling me that I did a good job.	7. *Eu imagino outras pessoas me dizendo que fiz um bom trabalho.*	7. I imagine other people telling me that I did a good job.	7. *Eu imagino outras pessoas me dizendo que fiz um bom trabalho.*
8. I can usually control how a skill looks in my head.	8. *Eu posso geralmente controlar como uma habilidade parece na minha cabeça.*	8. I can generally control how a skill looks like in my head.	8. *Eu posso geralmente controlar como uma habilidade aparenta na minha cabeça.*
9. I see the audience cheering for me.	9. *Eu vejo o público torcendo por mim.*	9. I see the public cheering for me.	9. *Eu imagino o público torcendo por mim.*
10. When I think of doing a skill, I always see myself doing it perfectly.	10. *Quando eu penso em fazer uma habilidade, sempre me vejo fazendo isso perfeitamente.*	10. When I think about performing a skill, I always see myself doing it perfectly.	10. *Quando eu penso em executar uma habilidade, sempre me imagino fazendo isso perfeitamente.*
11. I imagine continuing with my game plan or routine even if it is not going well.	11. *Eu imagino continuar com o meu plano de jogo ou rotina, mesmo que não esteja indo bem.*	11. I imagine continuing with my game plan or routine, even if it is not going well.	11. *Eu imagino continuar com as estratégias e esquemas de jogo mesmo que não estejam dando certo.*
12. When I think of a competition, I imagine myself getting excited.	12. *Quando eu penso numa competição, eu me imagino ficando entusiasmado.*	12. When I think in a competition, I imagine myself getting excited.	12. *Quando eu penso numa competição, eu me imagino ficando entusiasmado.*
13. Before trying a skill, I see myself doing it perfectly.	13. *Antes de tentar uma habilidade, me vejo fazendo isso perfeitamente.*	13. Before trying a skill, I see myself doing it perfectly.	13. *Antes de tentar uma habilidade, me imagino fazendo isso perfeitamente.*
14. I see myself being mentally strong.	14. *Eu me vejo sendo mentalmente forte.*	14. I see myself being mentally strong.	14. *Eu me imagino sendo mentalmente forte.*
15. I imagine how exciting it is to be in a competition.	15. *Imagino o quão emocionante é estar em uma competição.*	15. I imagine how exciting is to be in a competition.	15. *Eu imagino o quão emocionante é estar em uma competição.*
16. I see myself as a champion.	16. *Eu me vejo um campeão.*	16. I see myself a champion.	16. *Eu me imagino como campeão.*
17. I see myself being focused in a tough situation.	17. *Eu me vejo focado numa situação difícil.*	17. I see myself focused on a hard situation.	17. *Eu me vejo focado numa situação difícil.*

Table 1

Description of the stages of translation, back-translation and final version of the SIQ-C (BR)

2 of 2

Original	Translation	Back-translation	Final version
18. When learning something new, I see myself doing it perfectly	18. *Quando aprendo algo novo, me vejo fazendo-o perfeitamente.*	18. When I learn something new, I see myself doing it perfectly.	18. *Quando aprendo algo novo, me imagino fazendo perfeitamente.*
19. I see myself being in control in tricky situations.	19. *Me vejo estando no controle em situações difíceis.*	19. I see myself being on control in hard situations.	19. *Eu me imagino no controle em situações difíceis.*
20. I see myself following the game plan or routine at competitions.	20. *Me vejo seguindo o plano de jogo ou rotina nas competições.*	20. I see myself following the game plan or routine in competitions.	20. *Eu me imagino seguindo as estratégias e esquemas de jogo nas competições.*
21. I see myself getting through tough situations with good results.	21. *Eu me vejo superando situações difíceis com bons resultados.*	21. I see myself surpassing hard situations with good results.	21. *Eu me imagino superando situações difíceis com bons resultados.*

After performing the modifications and adjustments suggested by the experts in the evaluation of the instrument, a CVC of 0.867 and mean of 4.33 (0.82) points were verified for "language clarity", a CVC of 0.933 and mean of 4.67 (0.52) points for "practical relevance" and a CVC of 0.967 and mean of 4.83 (0.41) points for "theoretical relevance".

The translated SIQ-C was discussed in the focus group with the four male adolescents from track and field modality. After administration and discussion of each of the questions, no modifications were suggested. However, participants pointed out difficulty in interpreting the meaning of question 8 ("I can usually control how a skill looks like in my head").

In the test-restet phase, composed of 33 adolescent male athletes aged 14 to 18 years, a intraclass correlation coefficient (ICC) of 0.824 (95% CI: 0.645-0.913) ($p < 0.001$) was found. At this stage, no statistically significant differences were observed between the test and retest means, with a mean of 4.14 (0.40) points in the test and a mean of 4.13 (0.14) points in the retest of the instrument ($p = 0.845$).

Table 2 shows the means and standard deviations of the five imagery types for the Brazilian version of the SIQ-C. There were higher mean scores in questions 2, 15 and 16 and lower mean scores in questions 4, 5 and 11. In addition, higher mean scores were observed for MG-M with a score of 4.09 (0.65) and MS with a mean score of 4.09 (0.71), and a lower score for GC with a mean score of 3.44 (0.66).

Table 2

Descriptive analysis of the SIQ-C (BR) (N = 521)

1 of 2

Domains/indicators	*M*	*SD*
Cognitive General (CG)		
1. I create new strategies or game schemes in my head.	3.50	1.02
5. I imagine what I would do if my strategies or game schemes didn't work.	3.16	1.18
11. I imagine continuing with my my strategies or game schemes, even if it is not going well.	2.93	1.20
20. I imagine myself following the strategies or game schemes at competitions.	4.18	0.86
CG total, points	3.44	0.66
Cognitive Specific (CS)		
8. I can usually control how a skill looks in my head.	3.44	0.97
10. When I think about performing a skill, I always see myself doing it perfectly.	4.15	0.93
13. Before trying a skill, I see myself doing it perfectly.	4.12	0.98
18. When I learn something new, I see myself doing it perfectly.	4.10	0.94
CS total, points	3.95	0.70
Motivational General Mastery (MG-M)		
3. I imagine myself being confident in competition.	4.31	0.78
14. I imagine myself being mentally strong	4.04	1.01

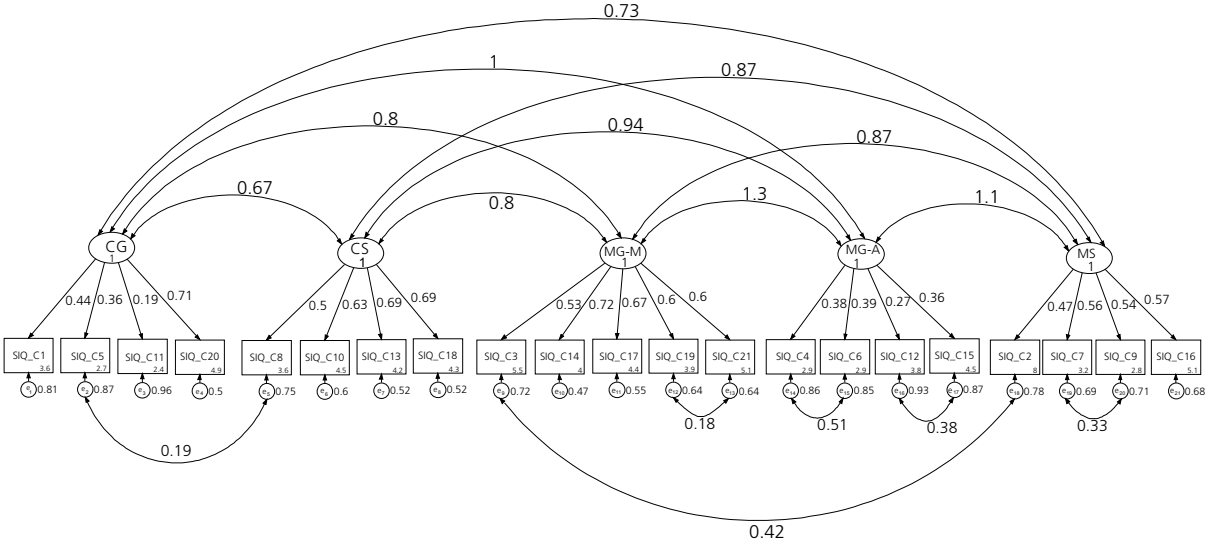
Table 2

Descriptive analysis of the SIQ-C (BR) (N = 521)

Domains/indicators	*M*	*SD*
17. I imagine myself focused in a tough situation.	4.05	0.93
19. I imagine myself being in control in tricky situations.	3.75	0.95
21. I see myself surpassing tough situations with good results.	4.30	0.81
MG-M total, points	4.09	0.65
Motivational General Arousal (MG-A)		
4. I imagine how calm I feel before competing.	3.35	1.15
6. I imagine myself getting calm in competitions.	3.46	1.18
12. When I think of a competition, I imagine myself getting excited.	3.96	1.06
15. I imagine how exciting it is to be in a competition	4.32	0.96
MG-A total, points	3.77	0.72
Motivational Specific (MS)		
2. I imagine myself doing my best.	4.64	0.58
7. I imagine other people telling me that I did a good job.	3.71	1.15
9. I imagine the public cheering for me.	3.55	1.27
16. I imagine myself a champion.	4.47	0.87
MS total, points	4.09	0.71
SIQ-C (BR) total, points	3.88	0.53

Figure 1

Graphical representation of the CFA of SIQ-C composed of five factors



Note: Factors are represented by the circle and the indicators (questions) are represented by rectangles. The arrows starting from the factors for the indicators represent the factorial loads. Simple variances are represented by the circle below the indicators. The arrows linking the factors indicate the correlation between them.

By comparing the mean of the SIQ-C domains according to sex, it was found that boys had a higher mean score in the MG-M (*M* = 4.17; *SD* = 0.59 versus *M* = 4.01; *SD* = 4.01), CS (*M* = 4.05; *SD* = 0.65 versus *M* = 3.85; *SD* = 0.74) and MG-A (*M* = 3.85; *SD* = 0.69 versus *M* = 3.69; *SD* = 0.74) compared to girls. Regarding the age group, it was found that older athletes (17 to 19 years old) had a higher average score only in the MG-M domain compared to younger athletes (14 to 16 years old) ($p = 0.037$). Regarding the type of sport, there were no differences in the mean scores in any of the domains of the SIQ-C between individual and collective sports athletes ($p > 0.05$).

In order to provide support for the five factor SIQ-C composition, a CFA of the original model was performed. The first analysis showed a poor overall fit in which RMSEA = 0.083, CFI = 0.795, TLI = 0.760 and SRMR = 0.068. However, in order to improve the adjustment indices, correlations were required between some indicators as pointed out by the CFA Modification Indices analysis. Accordingly, correlations between questions 19 and 21, 4 and 6, 12 and 15, 7 and 9, 5 and 8 and 2 and 3 were performed (Figure 1).

After these adjustments, it was found that the new five factor model met the majority of the acceptability criteria related to the global adjustment indicators (RMSEA = 0.060, CFI = 0.900, TLI = 0.881 and SRMR = 0.047), in which the absolute adjustment index (RMSEA = 0.060) was below the maximum adjustment value of 0.08 and the Standardized Root Mean Square Residual index was below the maximum adjustment value of 0.05 (SRMR = 0.047). The CFI incremental adjustment index reached the recommended minimum of 0.90 (CFI = 0.902) and the TLI presented a value slightly below the recommended of 0.90 (TLI = 0.881). The values of the overall fit indices of the proposed model are provided in Table 3.

Regarding the analysis of the difference between the means of the SIQ-C (BR) scores stratified by level of competition (regional, national and international), there were higher mean scores by international athletes for most imagery types except CS, in which it was equal among the three groups (p = 0.165) (Table 4). For the remaining imagery types, the Dunn post hoc test was performed and the following results were found: higher CG mean score for international level athletes compared to national level athletes (p = 0.035); higher MG-M mean score for international level athletes compared to regional (p = 0.001) and national (0.004) level athletes; higher MG-A mean score for international level athletes compared to regional (p = 0.015) and national level athletes (0.016); higher MS mean score for international level athletes compared to regional level (p = 0.001) and national level athletes (0.004); higher MS mean score for international level athletes

Table 3
Global indicators of adjustment of the SIQ-C confirmatory factor analysis model for Brazilian adolescent athletes

Variables	Indexes
KMO	0.883
Cronbach's alpha	0.870
RMSEA	0.060 (95%CI 0.053-0.066)
CFI	0.90
TLI	0.88
SRMR	0.047

Note: CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root Mean Square Error of Approximation; SRMR: Standardized Root Mean Square Residual; KMO: Kaiser-Meyer-Olkin.

Table 4
Comparison of the means of the SIQ-C (BR) imagery types according to the level of competition of the athletes in the sample (N = 521)

Domains	Competition level						*p-value**
	Regional		National		International		
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	
CG, points	3.43	(0.68)	3.40	(0.67)	3.58	(0.56)	0.032
CS, points	3.93	(0.72)	3.92	(0.67)	4.07	(0.67)	0.165
MG-M, points	4.05	(0.64)	4.04	(0.65)	4.30	(0.64)	0.001
MG-A, points	3.74	(0.72)	3.72	(0.68)	3.97	(0.76)	0.010
MS, points	4.02	(0.74)	4.10	(0.67)	4.30	(0.61)	0.005
Total, points	3.84	(0.53)	3.85	(0.51)	4.06	(0.51)	0.001

Note: *Kruskall Wallis test and e Dunn's post hoc. CS: Cognitive Specific; CG: Cognitive General; MG-A: Motivational General Arousal; MG-M: Motivational General Mastery; MS: Motivational Specific.

compared to those of a regional level ($p = 0.003$); and higher SIQ-C (BR) mean score for international athletes compared to regional ($p = 0.001$) and national level athletes ($p = 0.003$). No differences were identified in the mean scores between the five imagery types and total score of the SIQ-C (BR) when considering sport (individual and collective) ($p > 0.005$).

Moreover, there were significant correlations between the number of years of experience in sport and MG-M ($r = 0.111$; $p = 0.011$) and CG ($r = 0.086$; $p = 0.049$) imagery. However, no significant correlations were identified between years of experience in sports and CS, MG-A, MS and total SIQ-C (BR) score ($p > 0.05$).

Discussion

In the present study the criteria of scientific authenticity of the SIQ-C (BR) were investigated, considering its objectivity, reliability and content validity. The content validity coefficients of language clarity = 0.867, practical relevance = 0.933, theoretical relevance = 0.967, internal consistency (Cronbach alpha = 0,870) and reproducibility (ICC = 0.824, $p < 0.001$) were in accordance with the criteria recommended by the literature (Mokkink et al., 2016). In addition, in the semantic analysis of content, important adaptations were included into the final instrument, reinforcing the adequacy and relevancy of the instrument for Brazilian adolescent athletes.

Regarding the results of the descriptive analyses, higher scores were found for MG-M and MS imagery. This finding is in agreement with those of Hall et al. (2009) in their SIQ-C development study. In addition, higher mean scores for MG-M imagery were observed in studies with adults from Finland (Watt, Jaakkola & Morris, 2006) United States (Abma et al., 2002) and Spain (Ruiz & Watt, 2014). MG-M imagery has found to be an important predictor of the self-confidence and self-efficacy of athletes (Levy et al., 2015). Callow et al. (2001), in a four-week intervention study with MG-M imagery sessions with six high-level athletes, found evidence that the use of this technique is an efficient psychological tool for athletes to use, both to increase confidence during the competitive season and to reduce confidence fluctuations during a specific competition.

The Supporting the higher frequency of imagery use for motivational purposes by Brazilian adolescent athletes, it was found that the questions with the highest SIQ-C (BR) score belonged to MG-A and MS imagery, being represented by question 15 ("I imagine how exciting it is to be in a competition" MG-A), question 16 ("I imagine myself as champion" - MS) and question 2 ("I imagine myself doing my best."- MS). Hall et al. (2009), suggested that the motivational function of the imagery used by young athletes may be related by their involvement in competitions, which takes relies on goal setting, emotion regulation and increased confidence. Thus, the fact that the athletes in the present study were involved in a high-level sport competition may have contributed to the higher scores found for motivational imagery.

With respect to the questions with lower SIQ-C (BR) scores, these included questions 11 ("I imagine continuing with strategies and game schemes even if it is not going well" - CG), 5 ("I wonder what I would do if my strategies or game schemes did not work" – CG) and 4 ("I wonder how calm I'll be before competing" – MG-A). The low means scores found for questions 11 and 5 pertaining to CG imagery can be explained by the age group and years of experience of the participants in the present sport. It is likely that younger athletes are more focused on imagining themselves performing specific motor skills, especially given their stage of learning, rather than imagining applying such skills together to competitive tactics, strategies and detailed game planning (Hall et al., 2009). The positive correlation found between years of experience in sport and the CG score mean ($r = 0.086$; $p = 0.049$) indicates the relationship between the highest number of years of experience in sport and the higher frequency of CG imagery use.

The other question which had a lower mean score was related to being calm before competition (question 4), contrasting with the higher mean score related to imagining how exciting it is to be in a

competition (question 15), both of which represent MG-A imagery. Such contrasts can be explained by pre-competitive expectation and anxiety factors. According to Weinberg and Gould (2001), people may consider the symptoms of anxiety as positive (facilitators) or negative (debilitating) for performance, leading to more or less significant actions in different tasks. In the case of the present study, the fact that athletes present a higher frequency of imagery related to the intensity of the emotion of participating in the competition and less frequency in imagining themselves calm before the competition may be associated with their pre-competitive anxiety, which in turn may have contributed to their answers regarding the frequency of use of the imagery under these conditions.

The principles of Martin et al. (1999) imagery application model, in which they propose that the particular characteristics of the sporting situation, such as the level of competition and type of sport in which the athlete participates, could affect the way they use imagery, in training and competition was partially confirmed in the present study. It was found that athletes at a higher level of competition (international level) had higher mean scores for their use of most types of imagery as measured by the SIQ-C (BR) (CG, MG-M, MG-A and MS) compared to athletes at a lower competition level (regional and national). However, no differences were observed in the use of imagery with respect to the type of sport (individual or team).

Regarding the CFA, when global indicators of fit to the original model were poor, using the information provided through the modification indice analysis produced an acceptable model fit (RMSEA = 0.060, CFI = 0.90, TLI = 0.88, SRMR = 0.047). In the CFA of the original SIQ-C, the authors reported global fit indices of the appropriate five-factor model with CFI = 0.89, GFI = 0.89, and RMSEA = 0.07 (Hall et al., 2009). It is notable that the values for CFI and GFI were a little below the limit of 0.90 in the literature (Hu & Bentler, 1999).

In present study, to obtain the acceptable overall fit indices to the model, correlations between questions 19 ("I imagine myself being in control in hard situations") and 21 ("I imagine myself overcoming hard situations with good results"), questions 4 ("I imagine how calm I feel before competing") and 6 ("I imagine myself staying calm in competitions "), questions 12 (" When I think of a competition I imagine myself getting excited") and 15 ("I magine how exciting it is to be in a competition. "), questions 7 ("I imagine other people telling me that I did a good job") and 9 ("I imagine the public cheering for me"), questions 5 ("I imagine what I would do if my strategies or game schemes didn't work out") and 8 ("I can usually control how a skill looks like in my head") and between questions 2 (" I imagine myself doing my best") and 3 ("I imagine myself being confident in competition") were necessary.

In the search to understand the reason for the need for such correlations, it was considered whether the correlations between questions belonged to the same type of imagery., The correlations between questions 19 and 21 (MG-M), 4 and 6 (MG-A), 12 and 15 (MG-A) and 7 and 9 (MS) can be possibly explained by the similar interpretation of these questions by the athletes. For example, the athletes' perceptions of how calm they are before competing (question 4) and imagining being calm in competition (question 6) may have been interpreted as the same, being calm in the competition as a whole, independent whether it is before or during it. Likewise, one can explain the convergence of content between question 7 ("I imagine other people telling me that I did a good job") and question 9 ("I imagine the public cheering for me").

With regard to the correlation between question 2 ("I imagine myself doing my best") (MS) and question 3 ("I imagine myself being confident in competition") (MG-M), it can be explained on the understanding that for athletes to imagine themselves performing a motor skill with excellence, they are presumed to have a high level of confidence in their sport. In this sense, although the two questions represent to different types of imagery, the two imagined situations refer to the athletes' confidence in their abilities to execute their sports skills successfully (Vealey, Chase & Cooley, 2017). And with regard to the required correlation between questions 5 ("I imagine what I would do if my strategies or game schemes didn't work out") (CG) and 8 ("I can usually control how a skill looks like in my head") (CS), there seems to have been difficulty in

abstracting the meaning of these issues by the Brazilian athletes, in the sense that question 8 indicates a capacity to control the way in which the skill appears in the head, while question 5 denotes the imagination of a situation of overcoming some setback related to the strategy that was defined aprioristically.

Considering the necessary correlations between the questions belonging to the same type of imagery, it is suggested that they remain in the SIQ-C (BR). In addition, the continued use of both question 2 for MG-M imagery and question 3 for MS imagery is proposed because although they were similarly interpreted by the subjects of the present study, they were identified in the construction of the original instrument. However, it is suggested that question 8 for CS imagery be reconsidered because its interpretation seemed confusing to the adolescent athletes, and it was also targeted as propblematic by the focus group and in the evaluations of the language clarity by the specialists. In a complementary confirmatory factor analysis, considering hypothetically the exclusion of question 8, there were better indices of global adjustments to the model with RMSEA = 0.058, CFI = 0.91, TFI = 0.89 and SRMR = 0.045 (data not shown). Levando-se em consideração que a validação de um instrumento é algo processual e cumulativo, sugerem-se novas pesquisas que explorem a aplicação da Teoria de Resposta ao Item do SIQ-C traduzido, a fim de verificar o comportamento dos itens que apresentaram maior dificuldade de compreensão pelos atletas adolescentes. Taking into consideration that the validation of an instrument is something procedural and cumulative, further research is suggested to explore the application of the Item Response Theory models to test the construct validity of the translated SIQ-C on an item level in order to gather empirical support as well as the appropriateness of the most complex items.

Conclusion

In view of the overall results of the confirmatory factor analysis and the internal consistency values, it can be concluded that the questionnaire is suitable for examining the frequency of imagery use in samples of Brazilian adolescent athletes, and that the factorial structure seems to be reproducible for the Brazilian culturegiven some adjustment in the composition of the questions. In addition, the results provided evidence of content validity, reproducibility and cultural adaptation of the SIQ-C (BR), which corresponded with the original instrument construction (SIQ-C) analyzes.

In addition, the relationship between the higher competition levels and the higher frequency of imagery use by Brazilian adolescent athletes was confirmed. Finally, we suggested future studies that apply cross-sectional, longitudinal and interventional methods of using the SIQ-C (BR) with young Brazilian athletes, as has already been observed in international studies with adult athletes.

Contributors

D. G. BARBOSA was ahead of the research design, data analysis and on the manuscript writing. C. HALL contributed to review and approval of the final version and E. P. G. FELDEN contribute on the data analysis and interpretation, conception, research design and on review and approval of the final version.

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