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Psychometric validation of the Self-Talk Questionnaire for sports in Brazilian Portuguese language

Validação psicométrica do Questionário de Autoconversas para esportes no idioma português brasileiro

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Abstract

Self-talk refers to audible speech or conversations directed at oneself. It is frequently used positively or negatively in sports, presenting motivational and cognitive dimensions. This study aims to verify the validity of the sports self-talk scale in the Brazilian Portuguese version and review its psychometric properties. A total of 360 participants of this investigation practiced regularly different sports. They were aged between 18 and 80 years ($M = 42.09 \pm 12.18$). A sociodemographic questionnaire and the self-talk scale in Brazilian Portuguese were used for data collection. After data collection and review, it was found that the Kaiser-Meyer-Olkin indicator ($KMO = 0.94$) and Bartlett's sphericity test ($\chi^2 = 3406.82$; $df = 55$; $p = 0.0001$) were within the standards recommended in the literature. For the scale of internal consistency, the Cronbach α was 0.947. Regarding the factors, the following internal consistency values were found motivational factors ($\alpha = 0.947$) and cognitive factors ($\alpha = 0.851$). The scale viability was evidenced based on the set criteria, and all the goodness-of-fit indices were within the recommended standards.

Keywords: Psychology, sports; Psychometrics; Sports; Surveys and questionnaires.

Resumo

Autoconversas referem-se a falas ou diálogos direcionados a si mesmo, de forma audível, amplamente utilizados no contexto esportivo com funções motivacionais e cognitivas, tanto positivas quanto negativas. Este estudo teve como objetivo verificar a validade da Escala de autoconversa para esportes na versão em português do Brasil e analisar suas propriedades psicométricas. Participaram da pesquisa 360 praticantes de exercícios físicos regulares, de diversas

modalidades esportivas, com idades entre 18 e 80 anos ($M = 42,09 \pm 12,18$). Para a coleta de dados, utilizou-se um questionário sociodemográfico e a escala de autoconversa para o português brasileiro. Observou-se que o indicador Kaiser-Meyer-Olkin ($KMO = 0,94$) e o teste de esfericidade de Bartlett (qui-quadrado = 3406,82; $gl = 55$; $p = 0,0001$) apresentaram-se dentro dos padrões recomendados na literatura. Para a consistência interna da escala foi encontrado um α de Cronbach = 0,947. Em relação aos fatores, observou-se as consistências internas que seguem: fator motivacional ($\alpha = 0,947$) e fator cognitivo ($\alpha = 0,851$). Com base nos critérios admitidos, comprovou-se a viabilidade da escala e que todos os índices de qualidade de ajuste (goodness-of-fit) estão dentro dos padrões recomendados.

Palavras-chave: Psicologia do esporte; Psicometria; Esportes; Inquéritos e questionários.

Training individuals to improve their physical fitness, whether for health or sports purposes, goes beyond simply controlling variables such as volume, intensity, loads, among others. Some techniques and behaviors observed through sports psychology have a strong influence on athletic performance, among which we highlight self-talk. The interest in understanding the effects of self-talk dates back to the 1880s, through Vygotsky's historical-cultural theories (Geurts, 2018).

However, it was from the cognitive revolution in the 1970s that these psychological strategies and mental preparations gained prominence in the world of sports (J. Hardy et al., 2018). After observing that athletes with better performances used self-talk during training and competitions, research focusing this topic gained momentum (J. Hardy et al., 2018). Earlier studies addressed the nature of self-talk, which can be positive and negative (Zervas et al., 2007). Top-performing athletes made greater use of positive self-talk than negative self-talk (J. Hardy et al., 2018).

Self-talk can be speech, conversations or communications uttered to oneself and can be expressed audibly or silently, accidentally or intentionally, and can also be expressed through gestures or expressions with the aim of stimulating, reacting, directing and evaluating events or actions (Fritsch et al., 2022). It is important to add to this concept that self-talk needs to be "syntactically recognizable", as this differentiates verbalizations from mere shouts of frustration (Latinjak, Hardy et al., 2019; Van Raalte et al., 2017).

In the literature there are indications that self-talk increases self-confidence and makes the individual more motivated (Ada et al., 2019; Mamak, 2019). Furthermore, self-talk is linked to information processing and attentional focus (Galanis et al., 2018) and reduces the frequency of interference from other thoughts, improving concentration (Latinjak, Torregrossa et al., 2019). These mechanisms allow the athlete to remain more motivated and with less effort perception during his/her activities, especially aerobic resistance, and to better learn new fine motor skills (Pérez-Encinas et al., 2016).

Regarding the functions of intentional self-talk, we can mention the cognitive and motivational function (Mamak, 2019). The cognitive function is related to instructions for learning and improving sports skills, as well as game strategies. Due to these characteristics, other authors call this function instructional (Latinjak, Hatzigeorgiadis et al., 2019). The motivational function is associated with focus, self-encouragement, self-confidence, etc. (Zervas et al., 2007). Besides these functions, other functions are addressed in the scientific literature such as the expressive, interpretative, and self-regulation functions (Van Raalte et al., 2017).

Given the importance and functions of self-talk, another important factor is to record and evaluate the use of self-talk in sports. With this in mind, some instruments have already been developed and validated, such as Test of Performance Strategies (TOPS), The Thought Occurrence Questionnaire for Sports (TOQS), Self-Talk Use Questionnaire (STUQ), Automatic Self-Talk Questionnaire for Sports (ASTQS), Functions of Self-Talk Questionnaire (FSTQ) and Self-talk Questionnaire for Sports (S-TQ), Self-Talk and Gestures Rating Scale (STAGRS).

Among those scales, only TOPS has already undergone the process of translation into Brazilian Portuguese, cultural adaptation, and validation (Fernandes & Fernandes, 2015). The TOPS scale was developed to assess psychological skills and techniques and their use by athletes in both competitions and training. To cover these skills and techniques, TOPS displays 8 subscales: goal structuring, relaxation, activation, mental imagery, self-talk, attention control, emotion control, and automaticity (L. Hardy et al., 2010). However, this scale aims to evaluate strategies used for performance, including self-talk, and is therefore not specific for evaluating this strategy. Furthermore, the authors concluded that the confirmatory factor analysis indices were unsatisfactory.

Another scale that underwent translation and cultural adaptation to Brazilian Portuguese and was ready for the validation process was the S-TQ. The translation process for this scale was developed in four stages, namely: translation, back-translation, technical analysis in a meeting with professionals and researchers, and, finally, review of the general public's understanding of the content, achieving good quality indices in all those stages (Souza & Lopez, 2019).

The S-TQ scale was developed to measure two self-talk functions: the motivational function and the cognitive function. It is a Likert-type scale, originally written in English, composed of 11 items. After exploratory and confirmatory factor analyses, the data showed that the S-TQ scale is adequate and adjusted; the internal factors were consistent, the correlations with external criteria were significant and the reliability was very good (Bartlett's $p < 0.00001$; KMO = 0.897; α Cronbach = 0.821; IR = 0.91; RMSEA = 0.115; SRMR = 0.51; CFI = 0.933; NNFI = 0.908) (Zervas et al., 2007).

Considering that the use of motivational and cognitive self-talk can significantly influence athletes' performance and promote better learning of the sport's techniques and gestures, a scale in the athlete's language that facilitates the monitoring of these self-talks is of great importance. Such a tool is essential for sports psychologists, coaches, and trainers to be able to perform more accurate analyses and make decisions about training programs. In addition, the availability of a self-talk scale in Brazilian Portuguese will allow its application in scientific research, enriching the theoretical framework of this construct and contributing to the development of more effective and evidence-based interventions.

Given the importance of using and measuring self-talk appropriately, and the need to validate the S-TQ scale in its recent culturally adapted version in Brazilian Portuguese (S-TQ pt-br), this study aims to verify the validity of the scale and review its psychometric properties, as well as compare it with the parameters of the original version in English. We anticipate that the S-TQ scale (pt-br) will present good psychometric validity.

Method

Participants

To participate in the study, people over 18 years of age, who regularly practiced sports and had the ability to read and understand Brazilian Portuguese were included. Those who delivered incomplete data were excluded. In total, 360 individuals who regularly practiced different sports, aged between 18 and 80 years ($M = 42.09 \pm 12.175$), participated in this investigation; out of this total 56.1% were male and 43.9% female.

The participants came from all 5 regions of Brazil and 48.6% lived in the Northeast region of the country, 1.2% in the North, 3.7% in the Central-West, 35.6% in the Southeast, 9.8% in the South, a total of 1.2% dwelled in other countries (Portugal, Norway, Canada and Switzerland). Regarding

the level of education, 45.8% of the participants had earned a postgraduate degree, 31.4% had completed higher education, 12.8% had incomplete undergraduate courses, 8.1% had completed secondary education and 1.9% had completed elementary education.

The sampling was non-probabilistic for convenience and was composed of individuals who voluntarily agreed to participate in the survey. Therefore, not all individuals in the population had a known probability of being part of the sample.

Procedures

For data collection, a Sociodemographic Questionnaire and the S-TQ pt-br scale were used, both hosted on the online platform Survey Monkey, and the link to access it was posted on all the most widely used social networks in Brazil (Facebook, Instagram and WhatsApp). To reach the specific target audience, which were those individuals who practiced regular physical exercise, preference was given to post the message in groups or profiles of sports practitioners. Along with the link to access the questionnaire, a short text was delivered explaining that this was a voluntary survey and identifying those in charge thereof. Any subject who agreed to click on was first directed to the Free and Informed Consent Form for acceptance.

All procedures were submitted to and approved by the Ethics and Research Committee of the Federal University of Paraíba and were approved under opinion 2,841,480.

Instruments

The instruments used included a Sociodemographic Questionnaire, which collected information on the practice of regular physical exercise, age, state or country of residence, and level of education. The second instrument was the S-TQ pt-br scale, composed of 11 items that assess two distinct dimensions: motivational and cognitive. The responses referred to the self-talk frequency of use and ranged from 1 (never) to 5 (always).

S-TQ pt-br scale is organized as follows: Motivational Dimension: it includes 4 to 10 items. These items assess aspects related to motivation through self-talk. An example of an item in this dimension is: "I talk to myself to motivate myself". Cognitive Dimension: includes items 1 to 3 and 11. These items assess aspects related to cognitive processing through self-talk. An example of an item in this dimension is: "I talk to myself to give myself instructions".

Data Analysis

The data was organized using the IBM®SPSS® version 26 statistical software. The same software was used to assess internal consistency (*Cronbach's α*), mean and range of item means, inter-item correlation, and item-total correlation. For factor retention, the principal components method was used and, concerning the factors, a fixed number of two was established considering the theoretical construct of the original scale (motivational and cognitive factor) (Zervas et al., 2007). The resulting standard matrix was rotated using oblique rotation with direct oblimin transformation ($\delta = 0$), assuming a relationship between factors. To assess the suitability for exploratory factor analysis, two tests were used: the Kaiser-Meyer-Olkin (KMO) test and *Bartlett's* sphericity test.

According to the literature, KMO values lower than 0.5 are considered unacceptable; between 0.5 and 0.7 are considered mediocre; if the values are between 0.7 and 0.8 they are classified as good; above 0.8 very good, and above 0.9 excellent (Damásio, 2012).

For the confirmatory factor analysis, the Mplus software (version 6.12) was used, considering the Weighted Least Squares (WLS) estimation method. The following parameters for the Goodness-of-Fit Indices were used: Ratio between the Chi-square and its degree of freedom (χ^2/df), indicating a fitted model with values between 2 and 3, accepting up to 5; Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) equal to or greater than 0.95; and Root Mean Square Error of Approximation (RMSEA) less than 0.06, accepting up to 0.10 (Pessoa et al., 2016). Finally, to construct the path chart with the factorial structure of the S-TQ pt-br, the Amos 26.0 software was used.

Results

To verify data adequacy to perform exploratory factor analysis, a principal components analysis was performed on the 11 items of the scale. It was observed that the KMO indicator ($KMO = 0.94$) and Bartlett's sphericity test ($\chi^2 = 3406,82$; $df = 55$; $p < 0.001$) were within the standards recommended in the literature (Tabachnick & Fidell, 2013) to perform the exploratory factor analysis. The initial analyses showed that the average inter-item correlations were adequate ($R^2 = 0.87$), as well as the values for all items in the anti-image correlations, which were above 0.91, representing an adequate sample size.

To observe the internal consistency of the scale with all the items, *Cronbach's* $\alpha = 0.947$ was found. Regarding the factors, the following internal consistencies were observed: motivational factor ($\alpha = 0.947$) and cognitive factor ($\alpha = 0.851$). The internal consistency data together with the mean, variance, and correlations between the total items and factors are reported in Table 1. The data for eigenvalues were 10.16 for one factor and 1.41 for two factors (65.89% and 9.14% of the construct variance, respectively). The analysis of the factor structure observed in Table 1 shows factor 1 (motivational) represented by items 04 to 11 and factor 2 (cognitive) formed by items 01, 02, and 03.

The effect of excluding some items on the instrument's *Cronbach's* alpha was tested and it was found that any exclusion would not improve the scale's reliability ($\alpha \leq 0.947$). Furthermore, all items presented satisfactory factor loading (above 0.3) and high communalities (above 0.5), detailed information for which can be seen in Table 2.

Table 1

Factor structure, exploratory factor analysis and item-by-item reliability (N = 360)

S-TQ Items pt-br	Cronbach's α if the item is deleted	Item-total correlation	Communalities	Factor loading	
				Factor 1	Factor 2
Item 01	0.945	0.687	0.760		0.812
Item 02	0.947	0.634	0.813		0.944
Item 03	0.944	0.716	0.724		0.710
Item 04	0.939	0.844	0.781	0.757	
Item 05	0.938	0.866	0.823	0.823	
Item 06	0.940	0.833	0.762	0.756	
Item 07	0.939	0.851	0.826	0.894	
Item 08	0.940	0.837	0.810	0.900	
Item 09	0.944	0.719	0.708	0.945	
Item 10	0.944	0.711	0.634	0.830	
Item 11	0.944	0.730	0.598	0.660	
Eigenvalue				10.163	1.410
% variance explained				65.89	9.14

Note: Factor loading below 0.30 was not presented. S-TQ pt-br: Self-Talk Questionnaire - Brazilian Portuguese Version.

As this is a translated scale and in the original construct item 11 was associated with the cognitive factor (Zervas et al., 2007), which differs from what was found in our study whose item was associated with the motivational factor, three models were created for this next analytical stage: model 1 (M1) unifactorial; model 2 (M2) with two factors with item 11 inserted in factor 1 (motivational) and model 3 (M3) which will follow the theoretical construct of the original scale, that is, with the same two factors as M2; however, item 11 will be inserted in factor 2 (cognitive). All these models were compared with the data obtained in the validation study of the original scale and the results can be seen in Table 3.

Table 2

Exploratory factor analysis and reliability of the scale and by factors

Scale/Factors	Item Mean (Range)	Item Variance (Range)	Inter-Item Correlation (Range)	Cronbach's α
S-TQ pt-br	3.616 (3.23–3.867)	1.402 (1.240–1.503)	0.834 (0.390–0.870)	0.947
Motivational factor	3.706 (3.39–3.867)	1.408 (1.317–1.485)	0.718 (0.582–0.834)	0.947
Cognitive factor	3.459 (3.239–3.656)	1.393 (1.240–1.503)	0.588 (0.477–0.667)	0.851

Note: S-TQ pt-br: Self-Talk Questionnaire - Brazilian Portuguese Version.

Table 3

Fit indices of three Self-Talk Questionnaire models

Model Fit indices	M ₁	M ₂	M ₃	Original model (Zervas et al., 2007)
χ^2/df	4.419	3.83	4.04	3.05
SRMR	0.044	0.038	0.052	0.051
NNFI	0.989	0.991	0.990	0.918
CFI	0.992	0.993	0.992	0.956
RMSEA	0.097	0.089	0.092	0.109
CI 90% RMSEA	(0.082–0.113)	(0.075–0.103)	(0.078–0.106)	(0.087–0.129)

Note: χ^2/df : chi-square ratio to degrees of freedom. CFI: Comparative fit index; CI 90% RMSEA: RMSEA Confidence Interval; NNFI: Non-normed fit index; RMSEA: Root mean square error of approximation; SRMR: Standardized Root Mean Squared.

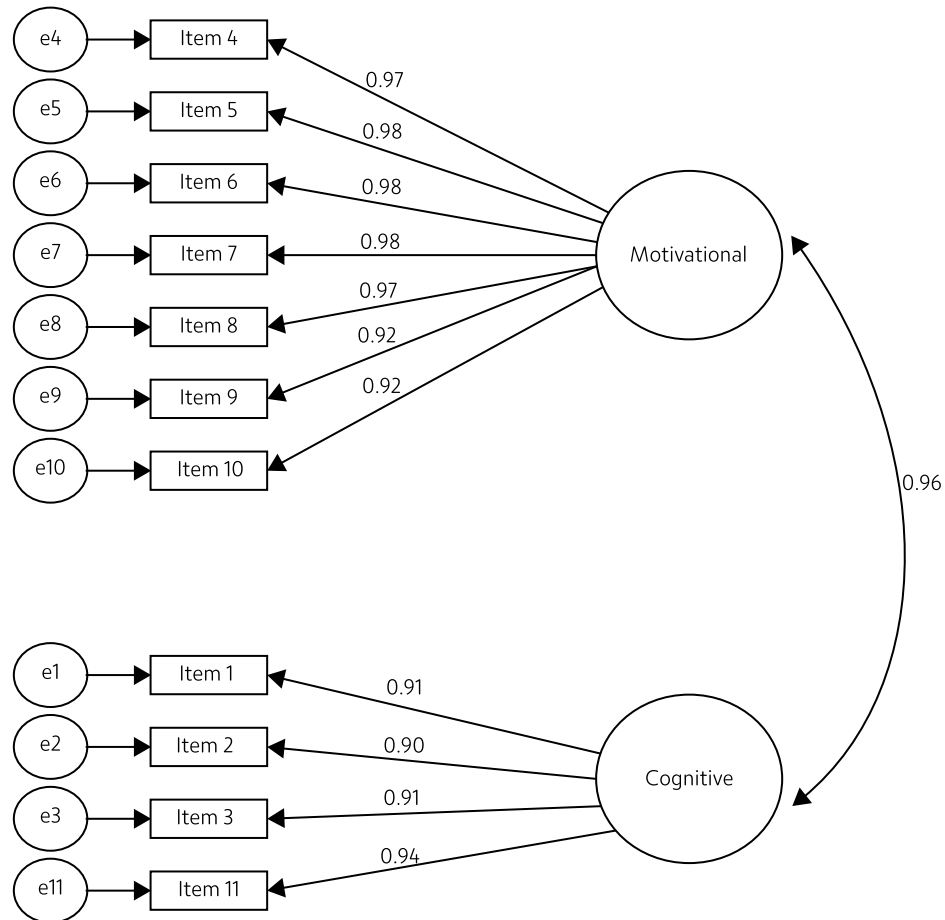
Considering that the items are intercorrelated, the confirmatory factor analysis presented acceptable adjustment indicators for an adequate model (Table 3). It is important to highlight that the confirmatory factor analysis demonstrated that all parameters (saturation, λ) of the items in the factors were statistically different from zero ($z > 1.96$, $p < 0.05$), ranging from 0.90 (Item 2) to 0.98 (Items 5, 6 and 7). A statistically significant association was also observed between the two factors of the S-TQ pt-br ($p < 0.01$), Motivational $\leftrightarrow$ Cognitive (0.96). A summary of the factor structure can be seen in Figure 1.

Discussion

With this study we intended to provide a good instrument to assess the use of self-talk during sports activities in the Portuguese language with the cultural specificities of Brazil. We also sought to present the content validity and internal reliability of the S-TQ pt-br scale, previously translated and culturally adapted (Souza & Lopez, 2019). This scale was originally developed in English at the University of Thessaly, Thessaly, Greece (Zervas et al., 2007); hence, this discussion will be based at times on the comparison between the Portuguese and English versions. To the best of our knowledge, currently this is the first scale in the Portuguese language version to exclusively record the use of self-talk in sports.

Figure 1

Factor structure of the Self-Talk Questionnaire – Brazilian Portuguese Version



Based on the criteria accepted for the AFE and AFC, the viability of the model proposed by the original scale was proven, and all the goodness-of-fit indices (goodness-of-fit) are within the standards recommended in the literature (Damásio, 2012; Pessoa et al., 2016). Therefore, it seems plausible to admit evidence of factorial validity of the S-TQ pt-br, which presents two factors (motivational and cognitive). Furthermore, both the total scale and its specific factors presented *Cronbach's* alpha (internal consistency) that can be considered, at the very least, meritorious for research purposes, as discussed. Thus, it is estimated that the objectives of this study of adapting the S-TQ pt-br by gathering evidence of its factorial validity and internal consistency have been achieved.

Correlations between items on the scale, as well as item-total correlation, are important to check to observe its homogeneity. A correlation between items above 0.20 and an item-total correlation greater than 0.50 are considered adequate (Hair et al., 2009). Thus, the S-TQ pt-br was superior to the acceptable parameters, with an average inter-item correlation of 0.87 and all items presenting item-total correlation between 0.634 and 0.866, enhancing the stability of this construct. Another important data that deserves to be observed is the anti-image correlation, which must have values above 0.7 and, on this scale, values above 0.91 were obtained, indicating an adequate sample size.

The S-TQ pt-br also showed good internal consistency for the scale since *Cronbach's* α value was above 0.7 (*Cronbach's* $\alpha = 0.947$). The alpha values for each factor (motivational and

cognitive) also showed adequate internal consistency with values 0.947 (motivational factor) and 0.851 (cognitive factor). Comparing with the English version scale, whose values were 0.83 and 0.92 for the cognitive and motivational factors, respectively; a similarity in the results was observed.

It can be stated that all items are contributing to the scale construct since commonalities above 0.5 were found, a condition for the scale construct suggested in the literature (Hair et al, 2009). Furthermore, the exclusion of any item would not promote improvements in Cronbach's alpha. In all items in the Portuguese scale, the commonalities values were higher than in the English scale. These results lead us to the decision to maintain all 11 items initially proposed.

The observed eigenvalue data supports the original theoretical construct with two factors: Motivational factor and cognitive factor. However, considering that the variance rate explained with one factor exceeds 60% (Patil et al., 2008), a single-factor model was added. Still, in the construction of the factorial structure, it can be seen that item 11 ("I talk to myself to correct my mistakes") presented an adequate factorial load for factor 1 but to be inserted in factor 2, at this point, there are differences between the scale in Portuguese and English. Perhaps item 11 could, in future studies, have its wording improved so that this item be framed more consistently in the cognitive factor.

It can be stated that all the models tested (M1, M2, M3) are adjusted and acceptable and that there were no initial doubts about rejection since the CFI (Comparative Factor index) and NNFI (Non-normalized Tucker-Lewis Factor Index) indexes were above 0.95, being very close to 1 (Brown, 2006). However, it is clear that the single-factor model M1 presented the poorest adjustments, corroborating what was found in the original validation and confirming that the construct fits better with two factors (Zervas et al., 2007).

Corroborating the recommended adjustment values, the χ^2/df ratio, where values between 2 and 3 are recommended but up to 5 are acceptable, was found in both M2 and M3. S-TQ also presented this number within the parameters and similar to that found in this study, slightly more adjusted. Another absolute index used was the SRMR, which recommends cutoff values lower than 0.08 and evaluates the difference between predicted and observed covariances. M2 presented, again, more adjusted values; however, the M3 of the S-TQ pt-br is within the recommended range and much closer to the original scale.

Regarding the other two models (M2 and M3), the RMSEA of M2 performed more adequately than the others. This parsimonious adjustment index estimates how well the model parameters reproduce the population covariance (Steiger & Linj, 1980), with 0.00 being the value that would represent the accuracy of this representation. The recommended values for RMSEA should be less than 0.06, with values up to 0.08 being acceptable (Brown, 2006).

This index is sensitive to the number of parameters and the degrees of freedom of the model. Therefore, the chi-square can be used to calculate the RMSEA confidence interval. When performing this calculation, M3 also has minimum values in a range lower than 0.8. Both models tested here (M2 and M3) behaved similarly, slightly better. However, such data ought to be observed with caution since they are affected by the complexity of the model and sample size used.

Although Model M2 of the S-TQ pt-br presented better values in the adjustment indices, we should consider that this cannot be the only criterion for deciding the scale construct. In this connection, the M3 of the S-TQ pt-br also presented its indices within all the parameters evaluated and with values like those of the original scale (S-TQ in English), and therefore it is considered the best model to use.

Given the appropriate adjustments and reliability, the S-TQ pt-br scale becomes an instrument that can be accepted as support for assessing the use of motivational and cognitive

factors of self-talk in sports. The high correlations found between the factors corroborate the idea that self-talk does not have a unidimensional construct, but rather a multidimensional one (Zervas et al., 2007). Therefore, it is suggested that the scale score should be the result of the addition of all the items on the scale.

As limitations, it can be said that S-TQ pt-br does not cover all the functions of self-talk mentioned in the literature, such as the expressive, interpretative, and self-regulation functions (Van Raalte et al., 2017); however, it can be stated that it involves the most comprehensive functions mentioned in the scientific articles in this area (J. Hardy et al., 2018).

Another limitation that ought to be mentioned is that the S-TQ pt-br also does not involve feelings, emotions, or physiological factors related to self-talk. Theoretically, this instrument is limited to self-talk used specifically during sports practice, not involving the time before and after sports practice, much less, the daily tasks, making it necessary to use other recording instruments in case such complementation becomes necessary.

To this end, further studies are required to better understand the results obtained by this scale with other physiological and emotional phenomena of self-talk. It is also recommended that the effectiveness of this scale be evaluated with different audiences to determine the possibility of generalizing and popularizing its use or, on the contrary, determining the specificities of the target population.

The S-TQ pt-br can also help Portuguese-speaking countries understand the differences in the use of self-talk concerning variables such as age, gender, level of competition (amateur or professional), characteristics of the sport, and the physical skills most required in the sport (strength, flexibility, cardiorespiratory endurance, etc.). Another advantage of this scale is that it is short and easy to understand (Souza & Lopez, 2019), which makes it practical for applications even in large populations.

Final Considerations

The self-talk scale for sports in its S-TQ pt-br can be considered to have good psychometric validity and be reliable for recording the use of this psychological strategy during sports practice. However, the S-TQ pt-br does not address all possible experiences with self-talk as it seeks to evaluate strategies that improve sports performance, which is the main application and differential of this scale.

During the study, no significant difficulties were encountered that could hamper the results. However, it is important to highlight that the application of the S-TQ pt-br can be influenced by contextual variables specific to different sports and levels of competition.

The application of the S-TQ pt-br can help monitor athletes (amateurs or professionals), contributing to the development of their sports performance. The S-TQ pt-br can also be used in conjunction with other scales to improve the understanding of the mental strategies for sports performance. In addition, seeking to associate the S-TQ pt-br with other visual or discursive records can help to better understand the effects and define strategies for the Self-Talk Scale use.

To continue improving the validity of the scale, it is essential to conduct new studies that explore different contexts and sports populations. Future research can broaden the understanding of the different dimensions of self-talk and investigate the application of the scale in diverse groups, as well as consider the influence of cultural and individual factors on self-talk.

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