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Validation of the Self-Efficacy in Volleyball Scale for Youth Athletes (VSES-B)

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Abstract

This study aimed to psychometrically test the Self-Efficacy in Volleyball Scale with Brazilian athletes from youth categories. The study was conducted in four stages, with four different sample groups. For content-based evidence analysis, 20 athletes participated, with a mean age of 14.30 ± 1.17 years and practice time of 4.60 ± 2.10 years. For semantic analysis, participants were a group of four experts, with a mean age of 35.75 ± 12.23 years and experience time of 25.0 ± 11.02 years, and to verify the semantic analysis, another group of 20 athletes, with a mean age of 14.45 ± 1.30 years and practice time 5.50 ± 2.20 years took part in the pilot study. To test the evidence based on the internal structure and the evidence based on other variables, a group of 454 youth athletes of both genders, with a mean age of 14.33 ± 1.18 years and practice time of 3.79 ± 2.13 years, participated. The results indicated evidence based on content, internal structure, and other variables through convergent validity (collective efficacy and results of Confirmatory Factor Analysis) and discriminant (Average Variance Extracted and correlation between the dimensions of the present scale). The validation process of the Self-Efficacy in Volleyball Scale for Youth Athletes (VSES-B) allows the conclusion that the instrument has good psychometric properties to measure self-efficacy, considering technical, tactical, conditioning, and psychological skills of emotional and cognitive self-control that are part of the sport context of the game. In addition, it provides relevant information for the development of future psychometric research based on contemporary validity references.

Keywords: volleyball, assessment, self-efficacy, self-efficacy scale, youth athletes

VALIDAÇÃO DA ESCALA DE AUTOEFICÁCIA NO VOLEIBOL PARA ATLETAS DE BASE (VSES-B)

Resumo

O objetivo deste estudo foi testar psicometricamente a Escala de Autoeficácia no Voleibol para atletas brasileiros de categorias de base. O estudo foi conduzido em quatro etapas, com quatro diferentes grupos amostrais. Para análise das evidências baseadas no conteúdo, participaram um grupo de 20 atletas, com média de idade 14.30 ± 1.17 anos e tempo de prática 4.60 ± 2.10 anos, para análise semântica, logo após um grupo de quatro acadêmicos, com média de idade 35.75 ± 12.23 anos e tempo de experiência 25.0 ± 11.02 anos, para verificação da análise semântica e outro grupo de 20 atletas, com média de idade 14.45 ± 1.30 anos e tempo de prática 5.50 ± 2.20 anos para o estudo piloto. Para testar as evidências baseadas na estrutura interna e as evidências baseadas em outras variáveis, um grupo de 454 atletas de base, de ambos os sexos, com média de idade 14.33 ± 1.18 anos e tempo de prática 3.79 ± 2.13 anos foi verificado. Os resultados apontaram para evidências baseadas no conteúdo, evidências baseadas na estrutura interna e evidências baseadas em outras variáveis, por meio da validade convergente (eficácia coletiva e resultados da Análise Fatorial Confirmatória) e discriminante (Variância Média Extraída e correlação entre as dimensões da presente escala). O processo de validação da Escala de Autoeficácia no Voleibol para Atletas de Base (VSES-B) permite concluir que o instrumento possui boas propriedades psicométricas para mensurar a autoeficácia, considerando aspectos técnicos, táticos, condicionantes e habilidades psicológicas de autocontrole cognitivo emocional que fazem parte do contexto esportivo da modalidade. Além disso, fornece informações relevantes para o desenvolvimento de pesquisas psicométricas futuras baseadas em referências contemporâneas de validade.

Palavras-chave: voleibol, avaliação, autoeficácia, escala de autoeficácia, atletas da base

VALIDACIÓN DE LA ESCALA DE AUTOEFICACIA DE VOLEIBOL PARA DEPORTISTAS JÓVENES (VSES-B)

Resumen

El objetivo de este estudio fue probar psicométricamente la Escala de Autoeficacia del Voleibol para deportistas brasileños de categorías juveniles. El estudio se llevó a cabo en cuatro etapas, con cuatro grupos de muestra diferentes. Para el análisis de evidencia basada en contenido, participó un grupo de 20 deportistas, con una media de edad de 14.30 ± 1.17 años y tiempo de práctica de 4.60 ± 2.10 años, para el análisis semántico, después de un grupo de cuatro académicos, con una media de edad de 35.75 ± 12.23 años y tiempo de experiencia 25.0 ± 11.02 años, para verificar el análisis semántico y otro grupo de 20 deportistas,

con una media de edad de 14.45 ± 1.30 años y tiempo de práctica 5.50 ± 2.20 años para el estudio piloto. Para probar la evidencia basada en la estructura interna y la evidencia basada en otras variables, se verificó un grupo de 454 atletas de base, de ambos sexos, con una media de edad de 14.33 ± 1.18 años y tiempo de práctica 3.79 ± 2.13 años. Los resultados apuntaron a evidencia basada en contenido, evidencia basada en estructura interna y evidencia basada en otras variables, mediante validez convergente (eficacia colectiva y resultados del Análisis Factorial Confirmatorio) y discriminante (Varianza Media Extraída y correlación entre las dimensiones de la presente escala). El proceso de validación de la Escala de Autoeficacia de Voleibol para Atletas Jóvenes (VSES-B) nos permite concluir que el instrumento tiene buenas propiedades psicométricas para medir la autoeficacia, considerando las habilidades técnicas, tácticas, condicionantes y psicológicas de autocontrol cognitivo emocional que forman parte del contexto deportivo de la modalidad. Además, proporciona información relevante para el desarrollo de futuras investigaciones psicométricas basadas en referencias de validez contemporáneas.

Palabras clave: voleibol, evaluación, autoeficacia, escala de autoeficacia, deportista de base

The field of Psychometrics has changed and evolved in the past ten years, with researchers increasingly concerned with developing and validating specific instruments for assessing psychological constructs. Based on the reformulations proposed in the Standards for Educational and Psychological Testing (2014), the validation process of an instrument must be understood as a cumulative process, combining pieces of scientific evidence into a set that ensures the interpretations of the test scores and their relevance and usefulness. These changes significantly impacted the research based on the validity concepts proposed in the tripartite model, known as the Holy Trinity of Validity, highlighting the fragility of the generalization of inferences drawn from research carried out in a specific context (Primi et al., 2009).

An adequate validation process is essential for an instrument to present appropriate psychometric properties and to be used with the target population (Flake et al., 2017). In the sports field, measures with adequate psychometric properties allow not only the reproducibility of the data obtained but also more excellent reliability of the analysis of research results or practical interventions in the control of psychological and cognitive variables that affect the sports performance of athletes (Machado et al., 2014). However, developing valid and reliable instruments constitute a critical scientific gap, making advances in this area necessary so that research data can be free of bias and not influenced by unrepresentative cultural issues.

Concerning self-efficacy specifically, the object of analysis of the present study, in a systematic review conducted by Machado et al. (2014), the authors found that, although studies have carried out translations, cross-cultural adaptations and the validation of instruments to measure self-efficacy, little can be found in the scientific literature regarding instruments constructed and validated to measure this psychological construct in the Brazilian sports context.

Self-efficacy, based on the Social Cognitive Theory proposed by Bandura (1997), considers the concept of human agency, according to which individuals are seen as agents who organize and perform actions through their acts and proactively engage in their development. From this perspective, it is considered that the athlete believes in their ability to carry out courses of action necessary to achieve a specific objective (Bandura, 1997), which acts as a critical trigger for good performance (Shoenfelt & Griffith, 2008). The importance of self-efficacy as a predictor of sports performance reinforces the growing concern of researchers with the development and validation of psychological constructs in this specific context. Positive beliefs mobilize in the athlete the confidence in their ability to acquire skills and competences that allow them to reach their maximum potential. However, if these beliefs are not well established in the individual (Bandura, 1994) or are negative, athletes doubt their skills or abilities to achieve the desired success (Stefanello, 2007).

Considering collective sports, a systematic review study conducted by Machado et al. (2018) showed that most of the studies found evaluated athletes from English-speaking countries, with no information about athletes from other locations and continents, which limits assessments and comparisons of this construct among different cultures. Furthermore, few

studies evaluating sports self-efficacy in volleyball players have included technical, tactical, and psychological aspects that are important for the sport. Each sport has specific physical, technical, tactical, and psychological characteristics; these aspects are particularly relevant and must be considered in assessing athletes' self-efficacy.

The only instrument found in the literature that aimed to assess self-efficacy in elite and non-elite volleyball players, including technical, tactical, and psychological aspects – the Volleyball Multidimensional Self-Efficacy Scale (V-MSES) (Guicciardi et al., 2016), has no explanation offered by the researchers on how the items were prepared, the sample of elite volleyball players was composed of only 58 individuals. The factor analysis was performed with only 133 athletes. To accomplish this type of analysis, at least 300 subjects are required (Laros, 2012; Tabachnick & Fidell, 2013). If this is not respected, it can compromise the instrument's psychometric properties and its reproducibility for the context for which it was designed.

To fill this scientific gap, the Self-Efficacy in Volleyball Scale (*Escala de Autoeficácia no Voleibol* [VSES]) (Machado, 2018) for high-performance Brazilian athletes (12) was constructed and validated, which presented good psychometric properties. However, as the athletes of the youth categories are in training, the possibilities of learning game strategies that will be part of the athletic structure of these individuals until they reach the higher categories. It is necessary to emphasize that youth athletes have different characteristics from high-performance athletes in physical, technical, tactical, and psychological terms and their vocabulary repertoire. Therefore, a term used by athletes with more experience, higher skill level, and higher education level may often not be understood by an individual who has not had the same experiences, which may make it impossible to correctly measure the intended construct at the time when the athlete responds to the instrument. Such difficulties may occur because, when responding to a scale, the individual goes through a four-stage process: (1) interprets the item; (2) retrieves relevant thoughts and feelings; (3) formulates a judgment based on these relevant thoughts and feelings; and (4) selects a response (Tourangeau & Rasinski, 1988).

In Brazil, in addition to the male and female adult volleyball teams occupying the first and second place in the world ranking, respectively (Fivb, 2021), the youth categories are among the ten best teams in the world ranking in the four categories (men's U-21, 4th; and U-19, 10th; women's U-20, 9th; and U-18, 3rd) (Fivb, 2021). These indications corroborate the increased interest in investigations with this specific group, young volleyball athletes, given their role in maintaining the practice of volleyball in the national scenario.

Considering that volleyball is one of the most practiced games worldwide by both genders and that high-performance athletes distinguish themselves in relation to athletes of other levels, particularly among those who are maturing and developing their skills and abilities, the use of specific instruments for these categories becomes relevant. Therefore, this study aimed to adapt and psychometrically test the Self-Efficacy in Volleyball Scale (VSES) (Machado, 2018) for young Brazilian volleyball athletes.

Method

The study was authorized by the organization of the Paraná Cup 2018 and approved by the Research Ethics Committee of the Federal University of Paraná, Health Sciences Sector/SCS CAAE (1.574.185). All four experts agreed to participate in the study. Participants (athletes) and tutors (parents or coaches) were asked to read and sign consent forms agreeing to participate in the study.

The study was a cross-sectional quantitative empirical investigation in the Psychometrics area, intending to validate an instrument to measure the sports self-efficacy of youth category volleyball athletes. Psychometric studies, represented by observable behaviors, using statistics as a tool, seek to identify the psychometric properties of an instrument (Pasquali, 2010).

Participants

Group 1. Athletes - Semantic Analysis

Twenty athletes participated in this phase with a mean age of 14.30 ± 1.17 years (minimum 11.04 years and maximum 17.40 years) and practice time of 4.60 ± 2.10 years (minimum five months and maximum five years). Ten of these athletes were male, with a mean age of 14.0 ± 1.11 years (minimum 11.05 years and maximum 17.40 years) and practice time of 3.90 ± 2.00 years (minimum six months and maximum 12 years). The ten female athletes had a mean age of 14.13 ± 1.23 years (minimum 11.04 years and maximum 17.33 years) and practice time of 4.60 ± 2.08 years (minimum six months and maximum five years). As inclusion criteria, athletes with at least six months of experience in the sport of both genders participated and were randomly selected. Using a small sample of participants to check the understanding of items within the target population has been used in other scale validation studies (Machado et al., 2016; Paes et al., 2021).

Group 2. Academics - Analysis of the items

This stage of the study was composed of four experts in the field of volleyball, psychometry, and self-efficacy, two Ph.D. holders, and two Ph.D. candidates, with a mean age of 35.75 ± 12.23 years (minimum 28 years and maximum 54 years) and experience time of 25.0 ± 11.02 years (minimum 17 years and maximum 44 years). As inclusion criteria, specialists with expertise in the areas involved, the game, the construct, and psychometrics, participated in the study. In addition, these experts were intentionally selected, due to their knowledge of the subject, as performed in other psychometric studies (Machado et al., 2016; Paes et al., 2021).

Group 3. Athletes - Pilot study

To test the instrument with the reformulated items and to verify the time for completion, 20 athletes participated in the pilot study, with a mean age of 14.45 ± 1.30 years (minimum 11.50 years and maximum 17.00 years) and practice time of 5.50 ± 2.20 years (minimum six months and maximum five years). Ten of these athletes were male, with a mean age of 14.30 ± 1.36 years

(minimum 11.55 years and maximum 17.10 years) and practice time of 4.10 ± 2.20 years (minimum six months and maximum ten years). The ten female athletes had a mean age of 14.27 ± 1.70 years (minimum 11.22 years and maximum 17.01 years) and practice time of 5.20 ± 2.00 years (minimum six months and maximum five years). As inclusion criteria, athletes with at least six months of experience in volleyball, of either gender and who had participated in competitions in the previous two years participated in this stage. Using a small sample of participants to test the instrument with the target population has been used in other scale validation studies (Machado et al., 2016; Paes et al., 2021).

Group 4. Athletes - Validation

A total of 454 athletes, with a mean age of 14.33 ± 1.18 years (minimum 11.06 years and maximum 17.86 years) and practice time of 3.79 ± 2.13 years (minimum six months and maximum 12 years) participated in this stage of the study. Of these athletes, 175 were male, with a mean age of 14.54 ± 1.29 years (minimum 11.06 years and maximum 17.86 years) and practice time of 3.18 ± 2.07 years (minimum six months and maximum 12 years), while 279 of the athletes were female, with a mean age of 14.20 ± 1.08 (minimum 11.19 years and maximum 17.26 years) and practice time of 4.17 ± 2.08 years (minimum six months and maximum ten years). No questionnaire needed to be excluded from the sample, as the respondents correctly completed all. Regarding the inclusion criteria, athletes with at least six months of experience in volleyball, of both genders, who had already participated in a national competition at least once, and who represented the most diverse regions of the country, participated in this stage. Carried out at the leading South American youth volleyball competition, the Paraná Volleyball Cup (*Taça Paraná de Voleibol*), consisted of athletes from eight Brazilian states, the majority of them corresponding to clubs in the South and Southeast regions of the country.

The specialized literature on psychometrics (Goldberg & Velicer, 2006; Laros, 2012) recommends at least 300 athletes for the analysis of the evidence of the validity of an instrument, especially concerning evidence based on the internal structure (factor analysis and internal consistency). Accordingly, it was sought to include the maximum number of athletes in this category of both genders, inviting all teams participating in the competition to collaborate with the research. Four hundred fifty-four athletes responded to the instrument, equivalent to 64.58% female and 72.91% male of the total competitors. Athletes who did not participate in the study were those the clubs did not authorize.

Procedures

Four stages were carried out to test the Self-Efficacy in Volleyball Scale for youth category athletes. In the first stage, the semantic analysis of the items by the athletes of the youth category was considered. In the second stage, the experts analyzed the items highlighted by the athletes as challenging to understand to make the necessary adjustments to their wording. The third stage comprised a pilot study to test the comprehension of the items by the athletes

after modification by the experts of the terms that presented difficulty in understanding. In the fourth stage, data collection for the psychometric analysis of the instrument was carried out during the Paraná Volleyball Cup / 2018, according to the availability of each team, between October and November 2018.

Stage 1

This stage aimed to verify whether the items could be understood by the target population (youth category volleyball athletes of both genders), as well as to identify possible biases in the wording of the 19 items that made up the version of the original instrument for high-performance athletes (VSES). The 19-item instrument was answered by Group 1. The items were evaluated on a 100-point scale, with 10-unit intervals: 0 ("I can't do this"); 50 ("Moderately certain I can do this"), indicating an intermediate degree of assurance; and 100 ("I am highly certain I can do this") when the individual is entirely confident that they can perform the item in question. The respondents needed to record the strength of their efficacy beliefs (efficacy expectations), as proposed by Bandura (2006).

The athletes in Group 1 responded to the instrument and indicated difficulty in understanding some items that made up the original instrument: item 2 ("Maintain control and stability of your function at different points in the game"), item 4 ("Have conviction in decisions to perform actions in difficult times"), item 9 ("Be able to adjust your concentration according to the requirements in the match"), item 16 ("Define a hard point") and item 19 ("Be daring to perform necessary actions in the match").

Stage 2

After the semantic analysis performed by the athletes (Group 1), items 2, 4, 9, 16, and 19 were reassessed by the group of academic specialists (Group 2) to make the appropriate adjustments concerning the terms that presented difficulty in comprehension by the athletes of basic categories. In item 2, the original wording was changed to "Maintain your high level of play at different points in the game." Item 4 "Be sure of decisions to perform actions in difficult times." Item 9 "Be able to adapt your concentration level at different moments in the match." Item 16, "Score a hard point," and item 19, "Be brave enough to perform actions necessary for the game."

The items modified by Group 2 were inserted into the pilot instrument (preliminary), and stage 3 was initiated.

Stage 3

The 19-item instrument was applied to the pilot sample of volleyball athletes (Group 3) to test the comprehension of the reformulated items' wording, determine the completion time, verify the study's feasibility, test the instrument, and solve questions that could arise. The athletes responded to the instrument and, on this occasion, did not present suggestions for

changes in the items, taking around 10 to 15 minutes to complete the instrument. As there were no new suggestions and the process was carried out satisfactorily, the following study stage was performed.

Stage 4

After completing the previous phases satisfactorily, the instrument was applied to 454 volleyball athletes from youth categories (Group 4) to test the psychometric properties of the scale adapted to this category. The results of this stage are presented in the results topic.

Instruments

Self-Efficacy in Volleyball Scale (*Escala de Autoeficácia do Voleibol* – VSES) (Machado, 2018). Assesses the strength of self-efficacy (efficacy expectations) on a scale from 0 to 100 points, with 10-unit intervals, where 0 (zero) corresponds to 'None' (does not believe in your ability); 50 'moderately' (moderate degree of belief in your ability); and 100 'Completely' (completely convinced of your ability to perform). The VSES has 19 items, distributed in three dimensions: (1) Self-Efficacy in the Game (SEG); (2) Defensive Self-Efficacy in Volleyball (DSEV); and (3) Offensive Self-Efficacy in Volleyball (OSEV). Twelve items pertain to SEG (e.g., "Recover quickly from an error, not caring about the error"). Four items refer to DSEV (e.g., "Be able to guide your team and command the defensive court zone"), and three items refer to OSEV (e.g., "Define a hard point"). The VSES provides a mean score for each dimension (SEG, DSEV, and OSEV) and a total score (Global Self-Efficacy in Volleyball – GSEV). When applied with the libero player, the OSEV dimension was excluded from the instrument, using the mean of the SEG and DSEV dimensions to calculate the GSEV.

The factorial structure of the VSES presented good psychometric properties ($\chi^2 = 447.78$, $df = 148$, $S-B\chi^2 = 354.20$, $p < .05$, $RMSEA = .07$, $NNFI = .91$, and $CFI = .92$). The α , Ω and CR coefficients for each dimension ranged from .87 to .94. The average variance extracted (AVE) indicators ranged from .57 to .71, and the chi-square differences ($\chi^2 = 23.55$, $df = 16$; $p = .10$) indicated factor invariance for gender ($p < .001$).

CEQS-B

The Collective Efficacy Questionnaire for Sport – Brazilian Version (*Questionário de Eficácia Coletiva para o Esporte – Versão Brasileira* [CEQS-B]) (Paes et al., 2021), adapted and validated from the original English version (Short et al., 2005), was used to verify the evidence of validity based on the relationship with other variables. The CEQS-B is a multidimensional instrument that measures the collective efficacy of sports teams through 20 items, divided into five factors: ability, effort, preparation, persistence, and unity. Each item has a Likert-type scale of 10 points (0–9), and each factor can present a score through the arithmetic mean of the answers to the items that compose it, as well as being able to obtain an overall total score for the questionnaire (through the arithmetic mean of the five dimensions). The fit indices based on

the responses of the sample of athletes participating in the validation study of the Brazilian version confirmed a multidimensional model with five dimensions: Chi-square 422.08; df 155; χ^2/df 2.72; CFI .92; TLI .90; RMSEA .06. Regarding the internal consistency of each dimension of the CEQS-B, values between α .69 (Preparation) to α .85 (Ability) and Ω .69 (Preparation) to Ω .86 (Ability) were considered acceptable for internal consistency (Field, 2005; Kline, 2012). The CEQS-B fit indices for the sample of the present study, in a five-dimensional model, were: Chi-square 526.16; df 160; χ^2/df 3.29; CFI .90; TLI .88; RMSEA .07. The relation between the Self-Efficacy in Volleyball Scale for youth athletes (VSES-B) and other variables were tested using Spearman's correlations between the means of the VSES-B and the Collective Efficacy Questionnaire (CEQS), based on the general score and the scores of each dimension that compose it. Considering that specific Self-Efficacy in Volleyball may be related to collective effectiveness, the CEQS was used to verify the relationship between the two constructs since there is currently no particular instrument for assessing sports self-efficacy in the Brazilian Portuguese language.

Statistical Analysis

Evidence based on internal structure. The data were verified, and none of the items presented missing values. Bootstrapping for 454 subjects was performed. Data normality was verified by the Kolmogorov-Smirnov test in all variables that did not present normality ($p \leq .001$) (Marsaglia et al., 2003). Asymmetry greater than two and kurtosis greater than 7 indicates non-normal distribution (Finney & DiStefano, 2006). The skewness statistic did not exceed the threshold of 2 (maximum skewness = -3.65), and the kurtosis scores did not exceed the threshold of 7 (maximum kurtosis = -3.68). Consequently, the assumption of normality of the data was accepted, with no objections to the use of untransformed data for the CFA. In the kurtosis, according to Hair et al. (2005), "a curve is very sharp when the kurtosis exceeds +3 and is very flat when it falls below -3." whereas, for a normal curve, the value of kurtosis should be zero (Malhotra, 2006).

With 454 respondents for the 19 items, the sample size requirements for CFA were fulfilled (Laros, 2012; Pasquali, 2012). The mean scores (mean and standard deviation) of Global Self-Efficacy in Volleyball for the final 19 items of the instrument and the three factors (Self-Efficacy in the Game, Defensive Self-Efficacy in Volleyball, and Offensive Self-Efficacy in Volleyball) were calculated.

The item properties were initially analyzed using item-total correlation coefficients and variations in Cronbach's Alpha coefficients if items were eliminated, in addition to instrument reliability (Hung et al., 2016; Plumed et al., 2015). Confirmatory Factor Analysis (CFA) fixed for three factors was applied, according to the original model for high-performance athletes; however, the data did not present satisfactory results. Therefore, an Exploratory Factor Analysis (EFA) was performed, and confirmatory factor analyses were tested with two, three, four, five, and six factors. The average variance extracted (AVE) (Fornell & Larcker, 1981), Cronbach's Alpha, McDonald's omega, and composite reliability (CR) were performed. The CFA using oblique

maximum likelihood (ML) estimation, with robust Satorra–Bentler correction (Satorra & Bentler, 2001), was performed to correct the possible absence of multivariate normality. The factorial invariance between the genders was tested to verify whether the instrument's factor structure was equally important for male and female athletes (Rebustini et al., 2016; Valentini & Damásio, 2016).

The goodness of fit coefficients of the proposed models was tested with the non-normed fit index (NNFI), the comparative fit index (CFI), and the incremental fit index (IFI). For these indicators, values $\geq .90$ were considered a good fit (Maccallum & Austin, 2000). To conclude, the root mean square error of approximation (RMSEA) was sampled. These classifications should be $\leq .08$ to be considered a good fit (Browne & Cudeck, 1993). Evidence based on relationships with other variables was verified through convergent validity and analyzed using the CFA results, while the AVE test was used for discriminant validity (Fornell & Larcker, 1981). Subsequently, Pearson correlations between the dimensions of the Self-Efficacy in Volleyball Scale (VSES) and the Collective Efficacy Questionnaire (CEQS) were performed to verify the relationships with other variables. Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences, version 22) and EQS (Structural Equation Modeling Software, version 6.3).

Results

Evidence based on content

The first, second, and third stages, evidence based on content and pilot study, were conducted by different groups, athletes, and experts in the study areas, at different times in the validation of the Self-Efficacy in Volleyball Scale for youth athletes (Escala de Autoeficácia do Voleibol para Atletas de Base [VSES-B]), through the semantic analysis of the items and the pilot study to verify the feasibility of the research.

The terms that the athletes considered difficult to understand during the first stage, semantic analysis of the items, were reviewed by the academic committee in the second stage and modified by consensus to ensure the clarity of the language of the items that composed the pilot instrument (first version).

In the pilot study's third stage, it was verified that the instrument was adequate with modifying the terms reported in the first stage as challenging to understand. The time for completion of the instrument by the athletes was from 10 to 15 minutes. There were no points of difficulty in comprehension regarding the wording of the items in this stage, demonstrating the adequacy of the content of the items for volleyball youth athletes, which allowed the instrument to proceed to the next stage.

Evidence based on the internal structure

Evidence based on the internal structure included item analysis, self-efficacy scores (mean and standard deviation), and factor loadings (Table 1). On average, the items of the original instrument were considered essential for assessing athletes' self-efficacy. They produced

a mean score for Global Self-Efficacy in Volleyball of 63.67, SD = 16.68, range = 58.17–70.38. The factorial structure of the instrument indicated the structure with two dimensions as the best model: Dimension 1, Technical-tactical skills and conditioning (M = 63.05, SD = 18.60), and Dimension 2, Psychological – Cognitive-emotional self-control skills (M = 64.80, SD = 18.34). When comparing the dimensions' scores using the Friedman test, the two dimensions did not show differences between them or with the Global Self-Efficacy in Volleyball dimension ($p < .01$).

Table 1

Mean (M), standard deviation (SD), and factor loadings of the VSES-B

Scale for youth athletes (VSES-B)	M	SD	Factor Loading
Dimension 1. Technical-tactical skills and conditioning			
Q1 Assume the attack responsibility to decide the match.	59.56	26.0	.620
Q3 Make quick decisions to define an action strategy.	62.18	23.47	.626
Q5 Be able to guide your team and command the defensive court zone.	58.17	28.69	.785
Q6 Able to read the defensive court zone.	61.41	25.37	.787
Q8 Save a tipped ball.	65.65	24.80	.619
Q16 Score a difficult point.	61.99	23.99	.625
Q17 Be able to decide the match.	59.88	26.43	.700
Q18 Demonstrate the courage to stand and defend.	68.24	25.15	.742
Q19 Be brave enough to perform actions necessary for the game.	70.38	21.98	.678
Dimension 2. Psychological – Cognitive-emotional self-control skills			
Q9 Be able to adapt your level of concentration at different moments in the match.	66.37	21.56	.653
Q10 Control yourself emotionally to deal with pressure and make quick decisions.	61.96	25.16	.729
Q12 Recover quickly from an error (not caring about the error).	68.03	21.77	.812
Q13 Control your thoughts by focusing on the next move.	64.70	22.25	.789
Q14 Be focused on distinguishing what to do at specific times in the match.	66.18	50.44	.359

The Self-Efficacy in Volleyball Scale, composed of 19 items including technical, tactical, conditioning, and psychological aspects of volleyball, was applied to 454 athletes (Group 4). The most important descriptive statistics were calculated for each item, as well as the reliability analysis.

The Cronbach's Alpha (α), Composite Reliability (CR), and Omega (ω) reliability coefficients for each dimension were verified. Factor 1, called Technical-tactical skills and conditioning, obtained $\alpha = .90$; CR = .90 and $\omega = .89$. Factor 2, Psychological – Cognitive-emotional self-control skills, obtained $\alpha = .85$; CR = .85 and $\omega = .85$, above the minimum value ($> .70$), recommended in the literature (Nunnally, 1978), representing evidence of reliability. The overall reliability of the instrument resulted in a coefficient $\alpha = .91$, CR = .94, and $\omega = .92$. The Average Variance Extracted (AVE) indicator was .50 for Factor 1, .54 for Factor 2, and .51 for the total AVE, also presenting values within the recommended range ($> .50$) (Fornell & Larcker, 1981).

After analyzing the items' psychometric properties and the scale's reliability, the instrument's internal validity was tested. The Kaiser-Meyer-Olkin (KMO) sampling adequacy index presented an optimal value (KMO = .94), and Bartlett's test of sphericity was significant ($\chi^2 = 3894.085$; df = 171; $p \leq .000$). Therefore, EFA and CFA were performed. The EFA was performed using principal component analysis with varimax rotation. Exploratory factor analyses were performed for three factors, as proposed in the original instrument; however, this was not the best model. Therefore, they were performed with four and two factors, with the two-factor model being the best. After applying an AFE fixed in both dimensions, it was necessary to eliminate items whose saturations were less than .40 or saturated in more than one factor. As a result, the scale was reduced to 14 items, grouped into two theoretical dimensions that explained 52.43% of the variance. The variance defined by the two dimensions was 43.60% for the first and 8.83% for the second (Table 2).

Table 2
Scores and standard deviation (SD) by dimensions and total VSES-B, Cronbach's Alpha, McDonald's Omega, Composite Reliability, and Average Variance Extracted for the Self-Efficacy in Volleyball Scale for youth athletes

Scale for youth athletes	M	SD	Friedman Test	α	Ω_t	CR	AVE
D 1. Technical-tactical skills and conditioning	63.05	18.60	.01	.90	.89	.90	.50
D2. Psychological - Cognitive-emotional self-control skills	64.80.	18.34	.01	.85	.85	.85	.54
Global Self-Efficacy in Volleyball	63.67	16.68	.01	.91	.92	.94	.51

The final model consisted of 14 items grouped in two dimensions. Dimension 1, Technical-tactical skills (items 1, 3, 5, 6, 8, 16, 17, 18, and 19), and Dimension 2, Psychological - Cognitive-emotional self-control skills (items 9, 10, 11, 12, and 13), presenting good fits (CFA results: $\chi^2 = 2537.383$; df = 91; $S-B \chi^2 = 214.6798$; df = 74; $p < .05$; $\chi^2/df = 2.90$; NNFI = .93; CFI = .94; IFI = .94; and RMSEA = .06).

This model allows the strength of the athlete's self-efficacy (efficacy expectations) to be assessed on a response scale from 0 to 100 points, with 10-unit intervals, where 0 (zero) corresponds to "None" (the athlete does not believe in their ability); 50 "Moderately" (indicating a moderate degree of belief in their ability); and 100 "Completely" (when the player is fully convinced of their ability to play).

Of the 14 items that make up the final model, nine refer to Dimension 1, Technical-tactical skills, which include, for example, statements such as "Be brave enough to perform actions necessary for the game."¹⁴ The five items that makeup Dimension 2, Psychological Skills - Cognitive-emotional self-control, include statements such as "Control your thoughts by focusing on the next move."¹⁴ The Self-Efficacy in Volleyball Scale (VSES) for youth athletes

provides a mean score for each dimension, and a total score for the instrument considered the Global Self-Efficacy in Volleyball. For the libero player, the instrument, which includes dimensions 1 and 3 of the original instrument for high-performance athletes, was applied with youth category athletes of this position. However, despite the data having been collected in the main Brazilian youth competition, considered the biggest match of its type for the youth categories in South America, the total number of respondents for this position was only 37 athletes since there are usually not as many of these athletes as there are in the other positions in which the athletes perform. This made statistical analyses impossible, which require at least 300 participants to be carried out.

Finally, the model's main quality indicators indicate the instrument's invariance between the genders. Factorial invariance and changes in the model's fit, including contrasts, were verified through a significance test between chi-square differences using the robust Satorra-Bentler correction (SB χ^2) (Satorra & Bentler, 2001). The results of the chi-square difference ($\chi^2 = 323.8524$, $df = 163$; $p < .01$) ($p < .001$) indicate the invariance of equal forms but not the invariance of equal factor loadings.

Evidence based on the relationship with other variables

The scale items were significantly correlated with the latent variables expected to be measured. In each case, the t values for the variables ranged from 7.68 to 24.47 ($t > 1.96$). The discriminant validity was evaluated to analyze the relationship between the construct and other variables. It was tested whether all correlations between dimensions were less than .85 (Kline, 2012). Likewise, it was verified whether the square root of the AVE was greater than the correlation between the pairs of dimensions (Fornell & Larcker, 1981), with this criterion met for all dimensions. The significance level for all analyses was $p \leq .05$.

Evidence based on the relationship with other variables was verified through the correlation between the Self-Efficacy in Volleyball Scale for youth athletes - VSES-B and the Collective Efficacy Questionnaire for Sport - Brazilian Version (CEQS-B) (Paes et al., 2021). The VSES-B self-efficacy means correlated positively ($r = .37$; $p = .00$) with the collective efficacy means (CEQS). Relating dimensions 1 and 2 of the VSES-B with the five dimensions of the CEQS-B, there were significant and positive; however, weak correlations ranging from $r = .25$ ($p = .00$), between VSES D2 Psychological Abilities—Cognitive-emotional self-control and Ability, to $r = .34$ ($p = .00$), between VSES D2 Psychological - Cognitive-emotional self-control skills and Preparation.

Discussion

The aim of this study, to adapt and psychometrically test the Self-Efficacy in Volleyball Scale (VSES) (12) constructed for high-performance Brazilian athletes for the Brazilian context of volleyball youth categories (VSES-B), was achieved. This was demonstrated through the statistical results found in the psychometric steps presented below.

Evidence based on content

The evidence based on content regarding the clarity of the language of the items that made up the VSES-B, evaluated by different agents who participated in the validation study (athletes and academics), was considered adequate to assess the self-efficacy of Brazilian volleyball youth athletes. This step is important because it verifies the relationship between the test content (themes, words, and format of items, tasks, or questions in a test) and the construct to be measured (American Educational Research Association et al., 2014).

Bandura (2006) emphasized the importance of constructing and validating self-efficacy assessment scales for the specific domain of assessment, which can be seen in the construction process of the original VSES instrument (Machado, 2018) for high-performance athletes. Both in the original VSES study and in the present study, pilot studies were conducted with samples similar to those that would be part of the study stages, thus reducing evaluative social concerns (Bandura, 2006).

Discussions about evidence based on content are scarce, especially with instruments for evaluating self-efficacy in the context of volleyball (Machado et al., 2014; Machado et al., 2018). One of the reasons for this is the outdated instrument validation practices (Primi et al., 2009), recurrent in Sport Psychology (Gunnell et al., 2014; Zhu, 2012), which leads to unreliable inferences about the construct.

Evidence based on the internal structure

Evidence based on the internal structure of the VSES-B was tested with the initial 19 items of the VSES for high-performance athletes. Cronbach's alpha, Composite reliability coefficients, and McDonald's omega presented values above the minimum recommended ($>.70$) in the literature (Nunnally, 1978). The AVE indicators for two factors also showed values higher than those recommended ($>.50$) (Fornell & Larcker, 1981).

The CFA indicated a final model with 14 items grouped into two correlated dimensions (Technical-tactical skills and Psychological skills – Cognitive-emotional self-control) and Global Self-Efficacy in Volleyball, which explained 52.43% of the variance, showing a good fit, as recommended by the literature (Browne & Cudeck, 1993; Maccallum & Austin, 2000). The VSES-B reliability indices (Cronbach's alpha = .91; McDonald's omega = .94 and CR = .92) are in agreement with the values reported in the literature as the recommended values ($>.70$), which denotes that the instrument is accurate and reliable (Fornell & Larcker, 1981).

The VSES-B makes it possible to assess the strength of the athlete's self-efficacy expectations, measuring the strength of the athlete's belief in their ability to perform the actions necessary to achieve a particular objective in the sport, on a response scale from 0 to 100 points, with 10-unit intervals, in which 0 = "None," 50 = "Moderately," (indicating a moderate degree of belief in their ability), and 100 = "Completely." The Technical-tactical skills dimension includes general technical and tactical aspects common to volleyball athletes inherent to the game. This allows situations related to technical-tactical situations that athletes experience

during matches to be evaluated. The Psychological – Cognitive-emotional self-control skills dimension is mainly characterized by cognitive and emotional self-control skills, particularly in the situations encountered by athletes in a volleyball match, making it possible to assess psychological situations inherent to the volleyball game.

Regarding the validity of the measure, when compared to the original study for high-performance athletes, the values of $\alpha = .92$, $\Omega t = .97$, and $CR = .96$ were high and similar to the values of the original research, which indicates the reliability and precision of the instrument, according to the literature (Fornell & Larcker, 1981). Few studies that used standardized instruments to measure self-efficacy in the volleyball context showed fit indices found for EFA and CFA, which limits the comparison of the present findings with other studies. In the systematic review investigation carried out by Machado et al. (2018) on the measurement instruments used to assess the self-efficacy of volleyball athletes, reference to Cronbach's alpha was found in only three studies, which reported values of $\alpha = .76$, $\alpha = .89$, and $\alpha = .81$, for the Evaluation Form Specific Instrument for Evaluating Self-Efficacy in Sports (Theodorakis, 1996) (Zetou et al., 2012), for The General Self-Efficacy Scale (GSE) $\alpha = .89$ (Luszczynska et al., 2005) (Blecharz et al., 2014) for The Volleyball Multidimensional Self-efficacy Scale (V-MSES) $\alpha = .86$ and $\alpha = .69$ (Guicciardi et al., 2016).

It should be noted that although the results are within the recommended range, these measures alone cannot be seen as the only psychometric property of reliability and precision in validating measurement instruments (American Educational Research Association et al., 2014). Furthermore, studies in recent years in the field of Psychometrics emphasize the importance of more appropriate statistical tests for specific evaluations of the validity of measures, as is the case, for example, of the McDonald's omega test (Cho & Kim, 2015; Cornick, 2015; Dunn et al., 2014; Flake et al., 2017; Peterson & Kim, 2013; Vaske et al., 2017), which was performed only in the original VSES study (Machado, 2018) and in the present study (VSES-B), making it impossible to compare these results with the reliability of the other instruments.

Quality indicators for the final VSES-B model also indicated the invariance of the instrument between the genders, noting that the items that make up the instrument and its factorial structure are the same and have the same importance for both genders of Brazilian youth category volleyball athletes. The original study's results (Machado, 2018) also indicated the invariance of the instrument for both genders, corroborating the present study's findings.

A problem found in studies that have evaluated the self-efficacy of volleyball athletes has been the use of Likert-type response scales (Argudo-Iturriaga et al., 2020; Blecharz et al., 2014; Gilson et al., 2012; Gomes et al., 2012; Guicciardi et al., 2016; Lox, 1992; Zetou et al., 2008, 2012). Such scales are suitable for evaluating phenomena that have positive and negative valences, such as attitudes, opinions, and likes/dislikes, but not self-efficacy, which ranges from zero to a maximum strength of belief, since the judgment of total inability (0) does not have less than a negative gradation, no one can be less than entirely ineffective. Unfortunately, bipolar Likert-type scales are beginning to appear as measures of self-efficacy with distorted meanings.

These limitations compromise the interpretation of results, restrict comparison with other studies, and make the results inaccurate (Bandura, 2012).

Evidence based on the relationship with other variables

Evidence based on the relation between the VSES-B and other variables was determined through the association between self-efficacy and collective efficacy, using the Collective Efficacy Questionnaire, validated for Brazilian athletes – CEQS-B (Paes et al., 2021). The convergent validity of the VSES-B with the CEQS-B showed that, despite being weak, the positive and significant correlations between the scores of the two instruments indicate that the self-efficacy beliefs of Brazilian volleyball players can also corroborate the beliefs of these athletes in the abilities of their team to carry out the necessary actions to achieve a particular objective.

More than supporting validity evidence, these findings emphasize possibilities for future research considering different aspects of self-efficacy in volleyball beliefs and their relations with other variables of the sporting and group dynamics contexts, such as collective efficacy, group cohesion, satisfaction, team performance, etc.

Convergent validity was adequate, according to the results of the Confirmatory Factor Analysis, with the scale items being significantly correlated with the latent variables that are expected to be measured (Machado, 2018). In the study of constructing the original instrument for high-performance athletes, the General Self-Efficacy was used to verify the evidence based on the relationship with other variables, convergent validity through the correlations with the Perceived General Self-Efficacy Scale, and the results of the Confirmatory Factor Analysis. The results showed a moderate correlation between Global Self-Efficacy in Volleyball and Perceived General Self-efficacy. At the same time, Defensive Self-Efficacy in Volleyball and Offensive Self-Efficacy in Volleyball presented a weak correlation with Perceived General Self-efficacy. These correlations align with the Self-Efficacy Theory (Bandura, 1997), which recommends that the construct be evaluated within a specific context (Bandura, 2006) since the individuals may consider themselves effective in a given situation and environment but not have the same self-evaluation in other contexts. Self-Efficacy can even fluctuate in the same environment but under different circumstances. Due to the multidimensional nature of the instrument, this aspect suggests that other variables can also influence the sports self-efficacy of volleyball players, such as years of practice, experience in competitions, practice location, opponent, playing at home or away, and the presence of fans, among others (Machado, 2018; Machado et al., 2021).

Regarding the discriminant validity of the VSES-B, the correlation between the two dimensions was lower than .85, showing good levels (Kline, 2005). Likewise, the AVE was more significant than the correlation between the dimensions (Fornell & Larcker, 1981), in line with what is proposed in the literature. These findings corroborate the original study's findings for high-performance athletes (Machado, 2018), which also found similar results. In short, the

evidence of validity and reliability found for the VSES-B indicates an adequate and reliable measure to assess the strength of the self-efficacy expectation of youth volleyball athletes of both genders.

The VSES-B validation process allows the conclusion that the instrument has good psychometric properties to measure the self-efficacy of young volleyball athletes, considering technical, tactical, and conditioning aspects and psychological skills of emotional and cognitive self-control. It also provides relevant information for developing future psychometric studies based on contemporary references (American Educational Research Association et al., 2014).

Concerning the application of the VSES-B in the sports context, the instrument proved easy to use, facilitating its application in the practical environment. In addition, it provides essential information about athletes' self-efficacy for coaches and professionals who work with youth volleyball.

The advancement of the VSES-B concerning psychometric analysis occurred through the use of robust statistical tests, the study of the construct based on the Self-Efficacy Theory (Bandura, 1997), and the use of the response scale (strength scale 0 to 100 points) based on Bandura's guide (Bandura, 2006). The type of scale from 0 to 100 points for the construction of self-efficacy scales is an essential counterpoint to a problem recurrently highlighted in the literature due to many studies still using Likert-type scales (Bandura, 2006; Machado, 2018).

Even so, the present study has limitations. Regarding the Self-Efficacy Scale for the libero players, it was impossible to perform the statistical analyses due to the low number of respondents (37 athletes). This limitation can be understood as an aspect particularly associated with the position due to the teams not always having athletes of this position in specific categories or because each team has only one athlete acting in this position. The specificity of the role in the game for volleyball athletes who play in this position meant that the minimum number of 300 athletes necessary to evaluate the validity of evidence for the psychometric analyses was not achieved (Goldberg & Velicer, 2006; Laros, 2012).

It is essential to expand the analyses carried out on the VSES-B by including complementary forms of validity evidence (for example, predictive validity, with the comparison of self-efficacy and the study of the athletes' performance) and the inclusion of beach volleyball athletes, as well as validation of the VSES-B for other countries and languages.

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