RIDU Revista Digital de Investigación en Docencia Universitaria
E-ISSN: 2223-2516

V. 15, n°1, jan-jun | PERÚ | 2021
https://doi.org/10.19083/ridu.2021.1236

RESEARCH ARTICLE

Psychometric Properties of the Interpersonal Behaviors Questionnaire in Sport in university athletes from Lima

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Received:20/08/20 *Revised:: 22/09/20* *Accepted: 21/10/20* *Published: 3/11/20*

Abstract

The aim of this research was to investigate the psychometric properties of the Interpersonal Behaviors Questionnaire in Sport adapted to Peru. Based on Self-Determination Theory, this questionnaire assess the perception of interpersonal behaviors that support or thwart the basic psychological needs of athletes (autonomy, competence, relatedness) by their coaches. 228 university athletes (M_{age} = 21.24; *SD* = 2.39) of both sexes participated in the study. The results of the confirmatory factor analyzes showed that a six-factor model obtained good fit index and adequate reliability. Correlational analyzes with variables: life satisfaction, positive and negative affect, satisfaction and frustration of basic psychological needs, and burnout showed satisfactory evidence of convergent and discriminant validity. Thus, it was concluded that the IBQD could be used in the university sports Peruvian context to assess the perception of interpersonal behaviors displayed by its trainers.

Keywords: Interpersonal behavior; Supportive and thwarting needs; Basic psychological needs; Psychometric properties; IBQD.

Propiedades Psicométricas del Cuestionario de Comportamientos Interpersonales en el Deporte en deportistas universitarios de Lima

Resumen

Se investigaron las propiedades psicométricas del Cuestionario de Comportamientos Interpersonales en el Deporte (IBQD) adaptado al Perú. Basado en la Teoría de la Autodeterminación, este cuestionario evalúa la percepción de los comportamientos interpersonales de apoyo u obstaculización de las necesidades psicológicas básicas de los(las) deportistas (autonomía, competencia, relación) por parte de sus entrenadores(as). Participaron en el estudio 228 deportistas universitarios (M_{edad} = 21.24; *DE* = 2.39) de ambos sexos. Los resultados de los análisis factoriales confirmatorios mostraron

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que un modelo de seis factores obtuvo buenos índices de ajuste y una adecuada confiabilidad. Los análisis correlacionales con las variables: satisfacción con la vida, afecto positivo y negativo, satisfacción y frustración de necesidades psicológicas básicas, y *burnout* mostraron evidencias de validez convergente y discriminante satisfactorias. Así, se concluyó que el IBQD puede ser utilizado en el contexto deportivo universitario peruano para evaluar la percepción de los comportamientos interpersonales que muestran sus entrenadores(as).

Palabras clave: Comportamiento interpersonal; Apoyo y obstaculización de necesidades; Necesidades psicológicas básicas; Propiedades psicométricas; IBQD.

Propriedades Psicométricas do Questionário de Comportamentos Interpessoais no Esporte em atletas universitários de Lima

Resumo

Foram investigadas as propriedades psicométricas do Questionário de Comportamentos Interpessoais no Esporte adaptado ao Peru. Com base na Teoria da Autodeterminação, este questionário avalia a percepção de comportamentos interpessoais que apoiam ou obstaculizam as necessidades psicológicas básicas dos atletas (autonomia, competência, relacionamento) por seus treinadores. Participaram do estudo 228 atletas universitários (M_{idade} = 21,24; *DP* = 2,39) de ambos os sexos. Os resultados das análises fatoriais confirmatórias mostraram que um modelo de seis fatores obteve bons índices de ajuste e uma confiabilidade adequada. Análises correlacionais com variáveis: satisfação com a vida, afeto positivo e negativo, satisfação e frustração das necessidades psicológicas básicas e *burnout* mostraram evidências satisfatórias de validade convergente e discriminante. Assim, concluiu-se que o IBQD pode ser utilizado no contexto esportivo universitário peruano para avaliar a percepção de comportamentos interpessoais demonstrados por seus treinadores.

Palavras-chave: Comportamento interpessoal; Apoio e obstaculização de necessidades; Necessidades psicológicas básicas; Propriedades psicométricas; IBQD.

How to cite this article:

Cáceres, S., Gargurevich, R., Matos, L., & De La Haza-Gonzales, A. (2021). Psychometric Properties of the Interpersonal Behaviors Questionnaire in Sport in university athletes from Lima. *Revista Digital de Investigación en Docencia Universitaria, 15*(1), e1236. https://doi.org/10.19083/ridu.2021.1236

Introduction

Sports and university life have long been linked, as it was in 1923 that the first World University Student Games were held in Paris (Tomlinson, 2010). In 1949, the university-sports relationship became more formal with the creation of the International University Sports Federation (FISU, by its French acronym) with only eight member countries (FISU, 2018). However, by 2019, it already had 175 member countries in the world, including Peru, with the Peruvian University Sports Federation (Feder-ación Deportiva Universitaria del Perú, FEDUP) since 1987 (FISU, 2018; FEDUP, 2019). These organizations con-tribute to the comprehensive education of university students by complementing academic development with sports. They seek to broadly disseminate and internalize in society the importance of sports and physical activity in higher education (FEDUP, 2019; Haines, 2001; Lower, Turner & Petersen, 2013).

The importance of practicing sports within the university lies in the benefits that a university student can obtain not only on a physical level, but also on a psychological level. These include, for

example, improved self-confidence and self-esteem, increased academic per-formance, improved cognitive processes related to learning, improved coping strategies for academic stress, decreased negative emotions (e.g., anxiety, anger, tension, etc.), increased vitality, improved interpersonal relationships, and improved motivation (Forrester, 2015; Haines, 2001; Jang, Kim & Reeve, 2016; Weinberg & Gould, 2011). These aspects—among others—have contributed to raising awareness among Peruvian universities of the importance of sports in the university setting, given that FEDUP currently has nearly 40 universities throughout the country participating in its various championships and leagues (FEDUP, 2019).

In the field of sports research, over the years, studies have shown interest in the psychological causes for success or failure of athletes, with special emphasis on the relationship between coaches and athletes (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Hancox, Quested, Ntou-manis, & Thøgersen-Ntoumani, 2017). They both interact on a daily basis, but coaches are those who guide athletes in their sport practice and can have an influence in the motivation of their athletes (Ntoumanis, Guerrero, Gadeke, & Thøgersen-Ntoumani, 2018).

Since people obtain information from others in their environment through social interaction, it is im-portant to understand the effect that coaches have on the motivation of athletes as this affects their sport performance (Deci & Ryan, 1985; Reinboth, Duda, & Ntoumanis, 2004; Behzadnia, Adachi, Deci, & Mohammadzadeh, 2018).

One of the psychological theories that has studied how coaches influence the motivation of athletes is the *Self-Determination Theory* or SDT (Ryan & Deci, 2017). The STD is a theory of human motivation that addresses how coaches influence the quality of their team members' motivation to practice, enjoy, and engage in sports at competitive levels (Hagger & Chatzisarantis, 2007; Ryan & Deci, 2017).

From the SDT perspective, the quality of the athletes' motivation (i.e. autonomous or controlled moti-vation) can be promoted or hindered by the motivational style of their coaches (Reeve, Jang, & Jang, 2018). Thus, when a coach shows a motivating style that supports athletes' autonomy, and it is so per-ceived by them, it results in the development of autonomous motivation, the satisfaction of psychological needs, the commitment to the sport, the achievement of sport goals, and the well-being of the athlete (Cheon & Reeve, 2015; Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013; Jang et al., 2016). This style of supporting autonomy implies taking the other's perspective, creating spaces that allow them to have initiative, solving doubts with logical or rational support, and recognizing and accepting expressions of negative affect as natural and understandable (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015; Reeve, 2009).

On the other hand, when a coach shows a controlling motivating style, and the athlete per-ceives it as such, it results in a controlled motivation of the athlete, the thwarting of psycholog-ical needs, the abandonment of sport practice, and even antisocial behavior (Haerens et al., 2015; Hein, Koka, & Hagger, 2015). The coach's controlling style includes requiring athletes to think, feel, and behave as the coach says (Reeve, 2016), and does not allow the option of opinion, no explanation is given, intimidation is used, and attempts are made to suppress ath-letes' expressions of negative affect (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010; Reeve, 2009). In Peru, there is already some evidence of a relationship between the percep-tion of these styles and the motivation of athletes (Rodríguez, 2017; Garreaud, 2019).

However, the relationship between coaches and athletes is even more complex, and goes beyond the study of styles already researched in Peru (i.e. autonomy and control). For this reason, recent studies (Rocchi, Pelletier, & Desmarais, 2017b; Rodrigues et al., 2019) have fo-cused not only on the motivational climate but also on the type of interpersonal behavior that the coach displays with the athlete concerning each of the psychological needs raised by the SDT (Ryan & Deci, 2017).

The SDT states that all people have three basic psychological needs (BPNs), which are au-tonomy, competence, and relatedness (Deci & Ryan, 1985; Ryan & Deci, 2000). The need for autonomy implies the freedom or will of each person to make decisions, as well as the perception or attribution that the behavior is in

response to one's own interests and values (Deci, La Guardia, Moller, Scheiner, & Ryan, 2006; Ryan & Deci, 2000; Ryan, Patrick, Deci, & Williams, 2008). The need for competence implies being able to perform progressively more complex ac-tions and overcome them successfully (Deci & Ryan, 1985; Ryan & Deci, 2000). The need for related-ness refers to the establishment of a positive emotional connection or close bond to people who can provide a warm and supportive environment (Carpentier & Mageau, 2016; Vallerand, 2001). The satis-faction of these needs in each individual depends not only on personal elements, but also on interper-sonal contexts that support them and do not hinder them as they may be frustrated (Rocchi et al., 2017b).

It is in this relationship that the coach's interpersonal behaviors become important because they may support or hinder these basic psychological needs (Rocchi et al., 2017b; Ryan & Deci, 2000, 2017). Thus, when coaches' interpersonal behavior supports athletes' BPNs, these needs are met, and positive results will be achieved; whereas, when coaches' interpersonal behavior hinders athletes' BPNs, these needs are frustrated, and negative results will be achieved (Deci & Ryan, 1985; Rocchi et al., 2017b; Rodrigues et al., 2019; Ryan & Deci, 2000).

Thus, Rocchi et al. (2017b) developed the Interpersonal Behavior Questionnaire in Sport (IBQ-S). Based on the Interpersonal Behavior Questionnaire (IBQ; Rocchi, Pelletier, Cheung, Baxter, & Beaudry, 2017a)—an IBQ version adapted to Sport—it shows evidence of validity and reliability in Canadian uni-versity athletes, it measures the degree to which athletes perceive that the coaches' interpersonal be-havior is either supporting or thwarting their BPNs on six subscales of interpersonal behavior:

1. Autonomy-Supportive (AS): The coach provides options, explains reasons for tasks, recognizes others' perspectives, provides opportunities for initiatives, and promotes the commitment to activities;
2. Competence-Supportive (CS): The coach raises positive expectations, encouraging learning, consistent and promotion- or change-oriented feedback, he or she acknowledges evolution, believes in the ability of others to achieve goals, and encourages others to improve their skills;
3. Relatedness-Supportive (RS): The coach shows understanding, support, and care for the others, warmth, and interest in their actions;
4. Autonomy-Thwarting (AT): The coach uses conditional rewards, intimidating language, he or she commands without reasonable explanation, and exerts excessive personal control;
5. Competence-Thwarting (CT): The coach highlights mistakes, discourages others from attempting challenges, gives messages of incompetence and doubts about the ability to improve;
6. Relatedness-Thwarting (RT): The coach is distant from others, does not connect emotionally, does not listen, and is not available when needed.

This questionnaire was used for the first time in a sample of university athletes of both sexes (n = 239; n males = 130, n women = 109) from the city of Ottawa (A age = 20.15; SD = 3.16), and Rocchi et al. (2017b) found that the six-factor model had an optimal fit (SBSχ^2(237) = 296.23, p < .001, CFI = .95, TLI = .95, RMSEA = .05 [.04, .06], SRMR = .05). They found a factor loading range between .69 and .87, and that the internal con-sistency of each subscale is adequate because Cronbach's alpha coefficients were between .84 and .90. In addi-tion, he presented evidence of con-vergent and discriminant validity by positively correlating (p < .001) the AS, CS, and RS subscales with the satisfaction of the three BPNs (from .43 to .58), and negatively with the frustration of the BPNs (from -.24 to -.40). Likewise, the AT, CT, and RT subscales correlated positively (p < .001) with the frustration of all three BPNs (from .54 to .66) and the con-trolled motivation (from .41 to .51); and correlated negatively with the sat-isfaction of the BPNs (from -.20 to -.44).

On the other hand, Rodrigues et al. (2019) adapted the IBQ in Sport (Rocchi et al., 2017b) to the Por-tuguese language with athletes who do physical exercise in gyms in Portugal (n = 837; n men = 342, n women = 495) with an average age of 34.58 (SD = 11.35). Rodrigues et al. (2019) found that there was an adequate fit of the six-factor model (SBSχ^2(237) = 828.91, p < .001, CFI = .92, TLI = .94,

RMSEA = .05 [.05, .06], SRMR = .04).

They found a factor loading range between .51 and .84, and that the internal consistency of each sub-scale is adequate because the reliability coefficients were between .70 and .82. Likewise, like Rocchi et al. (2017b), the supportive interpersonal behavior subscales for the BPNs (AS, CS, and RS) were positively related to the satisfaction of the three BPNs, and negatively related to the frustration of the BPNs; while the thwarting interpersonal behavior for these BPNs (AT, CT, and RT) was positively related to the frus-tration of the BPNs, and negatively related to the satisfaction of the BPNs.

It is worth mentioning that Rocchi et al. (2017a), although they did not do research with the IBQ version for Sports, they studied the relation between the support and thwarting of the BPNs, and the satis-faction of the same, using variables related to well-being, such as satisfaction with life, positive and negative affect, and subjective vitality, in a sample of university students (n = 534). This study found positive (p < .001) correlations of the supportive subscales of the BPNs (AS, CS, and RS) and the satis-faction of the same (from .32 to .59), positive affect (from .45 to .54), satisfaction with life (from .40 to .45), and subjective vitality (from .39 to .45); and negative (p < .001) with negative affect (from -.30 to -.41). Whereas the AT, CT, and RT subscales correlated positively (p < .001) with negative affect (from .41 to .45), and negatively (p < .001) with the satisfaction of the BPNs (from -.34 to -58), positive affect (from -.31 to -.46), satisfaction with life (from -.33 to -.40), and subjective vitality (from -.37 to -.46).

Therefore, given that the psychometric properties of the IBQ in Sport are solid, it is clear that the use of the questionnaire is useful to evaluate the interpersonal styles of coaches with respect to athletes. Thus, the objective of this study is to carry out the linguistic adaptation of the IBQ in Sport in Peru and study the psychometric properties in a context of athletes be-longing to university teams in Lima. In this way, the study hopes to confirm the factorial struc-ture of six factors of the original instrument (Rocchi et al., 2017b), or rather pose alternate models that can better explain the structure of the instrument. In addition, to check the con-vergent and discriminant validity of the scale, correlations will be made with variables previ-ously studied in the IBQ-S (Rocchi et al., 2017b), such as the satisfaction and frustration of basic psychological needs, satisfaction with life, positive and negative affect, and subjective vitality (Rocchi et al., 2017a, 2017b; Rodrigues et al., 2019). Finally, the McDonald's omega co-efficient (McDonald, 1999) will be used to calculate the reliability of the IBQ-S.

Method

Participants

The sample of this instrumental research (Alarcón, 2008) was composed of a total of 228 athletes from 22 universities in Metropolitan Lima from 2nd to 12th semester (M = 6.87; SD = 2.62), whose ages ranged from 17 to 29 years (M = 21.24; SD = 2.39). In addition, they had about 18 months of training with their coaches (M = 17.79 months; SD = 14.70), and they trained about four times per week on average (M = 3.63; SD = 1.23), and for an average of 2.26 hours per training (SD = 0.59). The distribution of the sample, according to the sociodemographic variables of gender and sport, can be seen in Table 1.

Instruments

Socio-Demographic Data Sheet. Information on age, gender (male, female, other), university, academic level, sport discipline, time (in months) trained with current coach, number of days trained, and duration (in hours) of training was collected.

Interpersonal Behavior Questionnaire in Sport. Developed by Rocchi et al. (2017b), it consists of 24 items that evaluate six factors: (1) Autonomy-Supportive(e.g.,"*Heorshesupportsmydecisions*"), (2) Competence-Supportive (e.g., "*He or she tells me I can achieve things*"), (3) Relatedness-Supportive (e.g., "*He or she takes time to get to know me*"), (4) Autonomy-Thwarting (e.g. "*He or she imposes his views on me*"), (5) Competence-Thwarting (e.g. "*He or she gives me the message that I am incompetent*"), and (6) Relatedness-Thwarting (e.g. "*He or she is distant when we*

Table 1

Distribution of the Sample According to Sociodemographic Variables: Gender and Sport

		N	%
Gender	Female	130	57.02
	Male	98	42.98
Sport	Volleyball	54	23.7
	Futsal	33	14.5
	Soccer	20	8.8
	Basketball	20	8.8
	Swimming	20	8.8
	Taekwondo	13	5.7
	Table tennis	11	4.8
	Wushu	11	4.8
	Rugby	7	3.1
	Baseball	7	3.1
	Athletics	6	2.6
	Judo	6	2.6
	Shooting	6	2.6
	Others	14	6.1

spend time together"). Participants respond how much they agree with each item on a Likert scale from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). As mentioned in the introduction, this instrument has good psychometric properties, carried out through a confirmatory factorial analysis (SBSχ^2(237) = 296.23, p < .001, CFI = .95, TLI = .95, RMSEA = .05 [.04, .06], SRMR = .05), and reliability using Cronbach's internal consistency alpha coefficient (range between .84 to .90).

Before applying the questionnaires, the items, instructions, and questionnaire's response options were translated. The translation and application of the IBQ-S in Peru was approved through personal communication by Rocchi, the first author of the article about the adaptation of the IBQ in Sport (Rocchi et al., 2017b).

The translation was carried out taking into account the recommendations of the Standards for Educational and Psychological Testing (AERA, APA & NCME, 2014), and the International Testing Commission (Hambleton, 1994; Hambleton & Zenisky, 2011; Muñiz, Elosua, & Hambleton, 2013). Thus, a group of expert university professors with knowledge of the English language, with master's degrees or higher, and with research experience, was gathered to evaluate the suitability of the translation of the IBQ. The result of this evaluation was positive (100% consistency among the evaluators) and, in this way, the final version of the instrument was obtained.

Basic Psychological Needs Satis-faction, and Frustration Scale. Originally, the scale consists of 24 items and was developed in Belgium, China, the United States, and Peru, simultaneously, to measure the satis-faction and frustration of the BPNs (Chen et al., 2015). This scale was adapted to the sport context and reduced to 12 items (Delreu et al., 2019), and was in turn adapted for Peru by Matos and Gargurevich (2020). It has been used in this research to verify the evidence of convergent and discriminant validity of the IBQ-S (Rocchi et al., 2017b). This version evaluates the Satisfaction (e.g., "*I felt that my coach trained me the way I wanted to*"), and Frustration (e.g., "*I felt compelled to do exercises that I would not choose to do*") of BPNs, and it uses a Likert-type scale from 1 *(Totally False*) to 5 (*Totally True*) for response. The main axis factoring analysis (Promax rotation) resulted in a bifactorial structure (Chen et al., 2015) where for factors 1 and 2 (BPNs satisfaction and frustration),

McDonald's omega coefficients of .79 [.74-.82], and .81 [.78-.85] were respectively obtained.

Subjective Vitality Scale. This scale, developed by Ryan and Frederick (1997), measures the feeling of vitality and energy as a reflection of psychological and physical well-being (e.g. "*When I train, I feel alive and energized*") gathered into a single factor of seven items. The response system is a Likert scale ranging from 1 (*Nothing true for me*) to 7 (*Totally true for me*). In this research, the scale was used to evaluate the evidence of convergent and discriminant validity of the IBQ-S (Rocchi et al., 2017b). Main axis factoring analysis resulted in a factor that obtained a McDonald's omega coefficient of .87 [.83-.89].

Athlete Burnout Questionnaire. The *Athlete Burnout Questionnaire* (ABQ; Raedeke & Smith, 2001) consists of 15 items distributed in three factors that have been adapted to Spanish (Arce, De Francisco, Andrade Arce, I., & Raedeke, 2010) as (1) Physical and Emotional Burnout (e.g. "*Practicing this sport leaves me mentally exhausted*"), (2) Reduced Sense of Achievement (e.g. inverted item: "*I think I can reach my goals in sport practice*") and (3) Devaluation of Sport Practice (e.g. "*I think I am not as inter-ested in sport as before*"). This Spanish version was reduced to 9 items and maintains the three sub-scales of the sport burnout (De Francisco, 2015). The response system is a Likert scale that measures the frequency of occurrence of the items, ranging from 1 (*hardly ever*) to 5 (*most of the time*).

For this research, the reduced version was used to evaluate the evidence of convergent and discriminant validity of IBQ-S (Rocchi et al., 2017b). The factor analysis resulted in the three factors originally proposed (De Francisco, 2015). However, since the correlation between the factors found was quite high and the reliability of two factors was low, a second analysis was performed, which resulted in a single factor that presented a McDonald's omega coeffi-cient of .65 [.61-.73]. Katz (2006) indicates that omega values of at least .65 can be accepted, so it was decided to continue with the use of this scale since it would be used to check the ev-idence of convergent and discriminant validity of the IBQ-S.

International Positive and Negative Affect Scale. Also called I-PANAS-SF (Thompson, 2007), it was adapted to Peru by Gargurevich (2010) and it is used in this study to inspect the evidence of convergent and discriminant validity of the IBQ-S (Rocchi et al., 2017b). The test consists of 10 items equally distributed in two factors that assess (1) Positive Affect or PA (e.g., "*Inspired*"), and (2) Negative Affect or NA (e.g., "*Fearful*"). The answers are given in the form of a Likert scale that measures the level of agreement or disagreement with the items, from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). The main axis factoring analysis (Varimax rotation) resulted in two factors (PA and NA) and McDonald's omega coefficients of .84 [.79-.86] and .74 [.68-.79] were obtained for NA and PA, respectively.

Satisfaction with Life Scale. This scale, developed by Diener, Emmons, Larsen, and Griffin (1985), consists of five items (e.g., "*In most things, my life is close to my ideal*") that assess the degree of general satisfaction with life. These items are answered by means of a Likert scale that goes from 1 (*Totally disagree*) to 5 (*Totally agree*). This scale has been adapted in Peru (Martínez, 2004) and has been used in this research to check the evidence of convergent and discriminant validity of IBQ-S (Rocchi et al., 2017b). The main axes factoring analysis gave as a result a factor that obtained a McDonald's omega coefficient of .85 [.81-.88].

Procedimientos

Participants were contacted through institutional social networks of the universities with sports teams, and also personally (directly through athletes' social networks since there was no active institutional contact). In addition, all questionnaires were applied by electronic means (*online*) and, before applying them, participants gave their explicit consent to voluntary and anonymous participation.a.

Data Analysis

Confirmatory factor analyses are performed using Version 8.72 of the Linear Structural Relations pro-gram (LISREL; Jöreskog & Sörbom, 2005). Prior to performing the CFAs, the asymmetry and kurtosis of the test items were inspected, and

none obtained values higher than |2| (Tabachnick & Fidell, 1996; West, Finch, & Curran, 1995). The confirmatory analyses were performed taking into account the nor-mal distribution of scores. In addition, it was considered that the IBQ collected information on a Likert scale of seven response options; the scores were treated as continuous (Jöreskog & Sörbom, 1996; Maydeu-Olivares, 2017; Norman, 2010). In this way, the method of maximum likelihood estimation was used (Jöreskog & Sörbom, 1996).

CFA results were evaluated using the adjustment indexes recommended by Hu & Bentler (1999): chi-square (χ^2), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Squared Re-sidual (SRMR), and Comparative Fit Index (CFI). Thus, the chi-squares (χ^2) of the different models were compared, being the best the one with the lowest value (Kline, 2016); the RMSEA and the SRMR, where RMSEA values indicating good model fit are the values close to .07, and it is acceptable if it is less than or equal to .08. Meanwhile, an SRMR less than .08 indicates an excellent fit (Marsh, Hau, & Wen, 2004; Simms, Watson, & Doeb-beling, 2002; Steiger, 2007). The CFI indicates an optimal fit when it is greater than or equal to .95, and it is acceptable when it is around .90 (Hu & Bentler, 1999; Kline, 2016).

The examination of the factorial structure of the test took into account four models. In this matter, the following were evaluated: a single-factor model in which the 24 items of the IBQ-S are grouped around a single latent variable (Model 1); a two-factor model gathering all the support and thwarting items of the BPNs (Model 2); the original model (Model 3) of six factors (AS, CS, RS, AT, CT, and RT) that was proposed by Rocchi et al. (2017b); and a two-factor, second-order Model 4 that brought together the latent variables of the six-factor Model 3, i.e., a supporting factor bringing together the variables AS, CS, and RS, and an impeding factor bringing together the variables AT, CT, and RT.

With respect to reliability, the JASP program version 0.13.1 (JASP Team, 2020) was used. The calculation was there made using McDonald's omega coefficient (1999), which offers a calculation of precise and stable values (Ventura-León & Caycho-Rodríguez, 2017). Finally, Version 25 of the IBM Statistical Package for the Social Sciences (SPSS; IBM Corp., 2017) was used to carry out the descriptive analyses (i.e. means and standard deviations) and the cor-relations between variables to achieve convergent and discriminant validity evidence.

Results

Evidence of Factorial Validity and Reliability of the IBQ-S

The results of the confirmatory factorial analyses of Models 1, 2, and 4 did not show good fit rates (see Table 2). Thus, the six-factor model (i.e. AS, CS, RS, AT, CT, and RT)—proposed by Rocchi et al. (2017b)—turned out to be the best model for IBQ-S in the Peruvian university sport context since it presents adequate and higher adjustment indexes compared to those of the other models ($\chi^2(237) = 546.66$, $p < .001$, CFI = .93, RMSEA = .08 [.07, .08], SRMR = .05).

All factorial loadings were above .40 and obtained commonalities between .21 and .79 (see

Table 2
CFA Model Fitting Rates

Models		χ^2	gl	RMSEA	SRMR	CFI
1	One factor	1373.22***	252	.140	.073	.82
2	Two factors	862.04***	251	.100	.057	.89
3	Six factors	546.66***	237	.076	.050	.93
4	Two factors (second order)	661.09***	245	.086	.054	.91

Nota. ***$p < .001$

Table 3). With respect to IBQ-S reliability, the McDonald's omega coefficient for all six factors reached a range between .81 and .90. The range of item-test correlations was between .51 and .82 (see Table 3). Additionally, the Average Variance Extracted (AVE) is also presented, where the values close to or above .50 show good internal convergent validity (Raykov, 1997).

Likewise, the means and standard deviations of the scales applied are also presented (see Table 4).

Correlations Between Variables: Intercorrelations and Evidence of Convergent and Discriminant Validity

By reviewing the intercorrelations between the factors in IBQ-S Model 3, for the factors AS, CS, and RS, the correlations ($p < .001$) were found to range from .80 to .81, and for the factors AT, CT, and RT, they ranged from .66 to .76. Meanwhile, the correlations between the supportive factors (i.e., AS, CS, and RS) and the thwarting factors (i.e., AT,

Table 3

Factor loading, communalities (R2), Average Variance Extracted (AVE), McDonald's Omega coefficient (ω), confidence intervals (CI), item-test range and descriptive statistics of the IBQ-S six-factor model (Model 3)

	AS (R2)	AT (R2)	CS (R2)	CT (R2)	RS (R2)	RT (R2)
IBD1	.70*** (.48)					
IBQD7	.83***(.69)					
IBQD13	.88***(.77)					
IBQD19	.89***(.79)					
IBQD2		.62***(.36)				
IBQD8		.56***(.30)				
IBQD14		.64***(.37)				
IBQD20		.88***(.76)				
IBQD3			.79*** (.61)			
IBQD9			.76***(.56)			
IBQD15			.86***(.76)			
IBQD21			.80***(.21)			
IBQD4				.73***(.49)		
IBQD10				.85***(.69)		
IBQD16				.80***(.62)		
IBQD22				.74***(.53)		
IBQD5					.81***(.69)	
IBQD11					.83***(.68)	
IBQD17					.83***(.69)	
IBQD23					.76***(.54)	
IBQD6						.67***(.45)
IBQD12						.60***(.43)
IBQD18						.81***(.66)
IBQD24						.84***(.73)
AVE	.69	.47	.65	.61	.65	.54
Coeficiente ω [IC]	.90 [.87-.92]	.81 [.76-.84]	.88 [.85-.91]	.86 [.83-.89]	.89 [.86-.90]	.81 [.75-.84]
Rango ítem-test	.69-.82	.57-.68	.73-.76	.66-.77	.70-.80	.51-.73
Medias (*DE*)	5.43 (1.16)	3.11 (1.45)	5.84 (1.17)	2.19 (1.38)	5.50 (1.22)	2.55 (1.34)

*Note. ***p < .001; AS = Autonomy-Supportive, AT = Autonomy-Thwarting, CS = Competence-Supportive, CT = Competence-Thwarting, RS = Relatedness-Supportive, RT = Relatedness-Thwarting; SD = Standard deviation*

CT, and RT) ranged from -.50 to -.76 (see Table 4).

On the other hand, the correlations carried out to check the evidence of convergent and discriminant validity turned out to be significant (see Table 4). Thus, the three supportive factors (i.e., AS, CS and RS) were found to correlate positively (between .18 and .73) with the satisfaction of the BPNs, subjective vitality, positive affect, and satisfaction with life, and had negative correlations (from -.25 to -.56) with the frustration of the BPNs, sport burnout, and negative affect. Meanwhile, all three thwarting factors (i.e., AS, CS, and RS) correlated positively (between .32 and .68) with BPNs frustration, sport burnout, and negative affect, and negatively (from -.15 to -.68) with BPNs satisfaction, subjective vitality, positive affect, and satisfaction with life.

Discussion

The aim of this research was to study—for the first time in Peru—the psychometric properties of the Interpersonal Behaviors Questionnaire in Sport (IBQ; Rocchi et al., 2017b) in the Peru-vian context in a sample of university athletes from Metropolitan Lima. The results of confirma-tory factor analyses showed that the original structure of the test (Rocchi et al., 2017b)—with six correlated factors—achieved the best adjustment rates in comparison to three other mod-els. Thus, it is clear that the IBQ S evaluates the coaches' supportive and thwarting interper-sonal behaviors for each of the basic psychological needs proposed in the SDT (Ryan & Deci, 2017).

In addition, the six subscales correlated with each other to the expected direction as agreed with SDT (Ryan & Deci, 2017), and according to previous IBQ in Sport studies (Rocchi et al., 2017b; Rodrigues et al., 2019). In this research, the range of intercorrelations in the IBQ-S subscales was slightly larger than the intercorrelations reported by Rocchi et al. (2017b), which were between .70 and .74 for the supportive ones, and between .60 and .69 for the thwarting ones. The same occurred with the intercorrelations reported by Rodrigues et al. (2019), who obtained a range from .60 to .67 for sup-portive subscales, and from .66 to .71 for thwarting subscales. Rocchi et al. (2017b) mentioned that although the correlations were high, they were not high enough to differentiate the six hypothesized factors and, thus, concluded that the subscales have different constructs. In this research, this phenomenon seems to be repeated since, when comparing the six-factor model with other models with a smaller number of factors, the six-factor model with correlation was the one with the best adjustment.

In addition, all six IBQ-S factors obtained evidence of convergent and discriminant validity, which is also consistent with the previous IBQ findings (Rocchi et al., 2017b; Rodrigues et al., 2019). In both previous studies with the IBQ-S (Rocchi et al., 2017b; Rodrigues et al., 2019), the correlations found between each of the six types of interpersonal behaviors and each of the six corresponding subscales of satisfaction and frustration of basic psychological needs were reported. In this research, these relation-ships were inspected with the total satisfaction and frustration scores of the BPNs, and the findings

Table 4
Mean (M) and standard deviation (SD) of study variables

	M	SD
Satisfaction of Basic Psychological Needs	4.08	0.69
Frustration of Basic Psychological Needs	2.19	0.87
Subjective Vitality	5.72	0.99
Sport Burnout	2.25	0.60
Positive Affect	4.19	0.54
Negative Affect	2.37	0.86
Satisfaction with Life	5.15	1.13

Table 5

Bivariate correlations between study variables

	AS	AT	CS	CT	RS	RT
Autonomy-Supportive (AS)	1					
Autonomy-Thwarting (AT)	-.64***	1				
Competence-Supportive (CS)	.81***	-.50***	1			
Competence-Thwarting (CT)	-.64***	.67***	-.69***	1		
Relatedness-Supportive (RS)	.80***	-.51***	.81***	-.61***	1	
Relatedness-Thwarting (RT)	-.70***	.66***	-.69***	.76***	-.76***	1
Satisfaction of Basic Psychological Needs	.69***	-.50***	.73***	-.65***	.70***	-.68***
Frustration of Basic Psychological Needs	-.56***	.57***	-.54***	.68***	-.54***	.66***
Subjective Vitality	.49***	-.36***	.50***	-.46***	.44***	-.39***
Sport Burnout	-.34***	.37***	-.35***	.34***	-.28***	.33***
Positive Affect	.30***	-.24***	.32***	-.33***	.27***	-.28***
Negative Affect	-.33***	.35***	-.30***	.41***	-.25***	.32***
Satisfaction with Life	.25***	-.15*	.19**	-.21**	.18**	-.15*

Note. *p < .05, **p < .01, ***p < .001

were consistent with the previous studies, which evaluated the supportive and thwart-ing factors with the satisfaction or frustration of the BPNs in general (López-Walle, Balaguer, Castillo, & Tristán, 2012; Vansteenkiste & Ryan, 2013).

Also, it is worth mentioning that consistent correlations were found in previous research works that have not been carried out with the IBQ, but that have rather studied the variables used in this research, such as the positive correlations between the vari-ables that are considered to be the bright and dark side of the evaluation (Haerens et al., 2015). Those are, on the one hand, the satisfaction of the BPNs, vitality, positive affect, and sat-isfaction with life (Bartholomew et al., 2011; Haerens et al., 2015; Garreaud, 2019; López-Walle et al., 2012; Mageau et al., 2015; Reinboth et al., 2004; Rodriguez, 2017; Sevil, Abós, Sanz, & García-González, 2018); and, on the other hand, the frustration of the BPNs, negative affect, and burn-out (Bartholomew et al., 2011; Haerens et al., 2015 Garreaud, 2019; Mageau et al., 2015; Rodríguez, 2017; Sevil et al., 2018).

Furthermore, the reliability of each subscale of the IBQ-S was quite ac-ceptable, which is consistent with previous studies (Rocchi et al., 2017b; Rodrigues et al., 2019). In addition, this research found coefficients simi-lar to the ones reported by Rocchi et al. (2017b) and Rodrigues et al. (2019), who presented Cronbach's internal alpha consistency coefficients between .84 and .90, and .70 and .82, respectively (however, this study used the McDonald's omega reliability coefficient).

The main relevance of this research focuses on the absence of instruments with evidence of validity and reliability in the context of studying the coach-athlete relationship around the basic psychological needs posed by the SDT. In studies carried out within the sport context, the coach plays a major role as one of the main factors influencing the quality of motivation, well-being, and performance of the athletes (Behzadnia et al., 2018; Hancox et al., 2017; Ntoumanis et al., 2018). Therefore, studying this relationship through instruments adapted to the national context—which specifically measure the coach-athlete interaction—is so important. Until now, various studies have focused generally on the motivational styles of coaches rather than on the specific behaviors they display according to each of the basic psychological needs (Cheon & Reeve, 2015; Gunnell et al., 2013; Jang et al., 2016; Reeve et al., 2018; Rodríguez, 2017). Therefore,

this adaptation of the IBQ-S in the Peruvian sport context may allow the development of future research in university athletes.

Despite the research evidence, there are several limitations and recommendations to be considered. One of the limitations is that this research was conducted only with athletes from universities in Metropolitan Lima and from various sport disciplines. In this regard, a sample of students from various universities in the country would provide a more comprehensive view of the relationship between coaches and athletes; however, this sample would need to have an equal number of participants for each sport since there may be changes in the coach-athlete relationship depending on the sport being played (e.g. team vs. individual sports, etc.). Thus, it is recommended for future research to study the metric equivalence of the IBQ-S in university athletes of other cities of Peru that practice different sports.

Additionally, it is important to consider other groups of athletes who are not university students, such as professional athletes, since in this case, the sport would be their main activity—as opposed to university athletes, who are mainly students who also do sports—. In professional athletes, the coach-athlete interaction and the high performance requirement of being a professional athlete would be different from a coach-athlete relationship at the university level.

Another limitation of this research is that it analyzed the relationship between supportive and thwarting interpersonal behaviors of BPNs, and satisfaction and frustration factors in a global way, so it is suggested to study how the six types of interpersonal behaviors are related to the satisfaction and frustration of each BPNs as carried by Rocchi et al. (2017b), and Rodrigues et al. In this way, we could have a more specific and "refined" view of the relationship between coaches and athletes.

Finally, this study not only opens the doors to research on the athlete-coach interaction from the perception of the athlete, but also on the perception of the coach, since the version of the IBQ of coaches' self-reporting (IBQ-Self) could be adapted to the Peruvian context to analyze the relationship between interpersonal behaviors perceived by athletes and also those reported by coaches, and not only those reported by the former.

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