



# Development and validation of the Perceived Influences on Sport and Study Assessment Scale

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## ABSTRACT

The objective of this cross-sectional study was to develop and validate an Assessment Scale for Perceived Influences in Sport and Study (EIPE). The validation process was carried out with specialists and athletes of both sexes, from team and individual sports, aged between 13 and 18 years old and who attended secondary and high school Education in Santa Catarina/Brazil. Five steps were taken in order to validate the instrument: content validity; clarity of language; pilot test; construct validity; internal consistency; and reliability. Results showed that the final version of the EIPE (two factors and 49 items) showed satisfactory adjustment indices ( $\chi^2/df=1.751$ ; GFI=.85; AGFI=.82; CFI=.90; SRMR=.059; RMR=.046; RMSEA=.042; CFI=.90; TLI=.89), high internal consistency ( $\alpha>.70$ ) and reliability ( $\alpha>.91$ ). It is concluded that the EIPE has satisfactory psychometric properties that provide evidence of scientific validity and reliability.

*Keywords:* athletes; students; psychometrics; factor analysis.

## RESUMO – Desenvolvimento e Validação da Escala de Avaliação de Influências Percebidas no Esporte e no Estudo

O objetivo desse estudo foi desenvolver e validar uma Escala de Avaliação de Influências Percebidas no Esporte e no Estudo (EIPE). O processo de validação foi realizado com especialistas e atletas de ambos os sexos, com idade entre 13 e 18 anos e que cursavam a Educação Básica em Santa Catarina/Brasil. Cinco etapas foram realizadas para validar o instrumento: validade de conteúdo; clareza de linguagem; teste de piloto; validade do construto; consistência interna; e fidedignidade. Os resultados mostraram que a versão final da EIPE (dois fatores e 49 itens) apresentou índices de ajuste satisfatórios ( $\chi^2/df=1,751$ ; GFI=0,85; AGFI=0,82; CFI=0,90; SRMR=0,059; RMR=0,046; RMSEA=0,042; CFI=0,90; TLI=0,89), alta consistência interna ( $\alpha>0,70$ ) e fidedignidade ( $\alpha>0,91$ ). Conclui-se que a EIPE possui propriedades psicométricas aceitáveis que fornecem evidências de validade e confiabilidade científica.

*Palavras-chave:* atletas; estudantes; psicometria; análise fatorial.

## RESUMEN – Desarrollo y validación de la Escala de Evaluación de Influencias Percibidas en el Deporte y en el Estudio

El objetivo de este estudio fue desarrollar y validar una Escala de evaluación de las influencias percibidas en el deporte y el estudio (EIPE). El proceso de validación se llevó a cabo con especialistas y atletas de ambos sexos, con edades entre 13 y 18 años, que estudiaban Educación Básica en Santa Catarina/Brasil. Se dieron cinco pasos para validar el instrumento: validez de contenido; claridad del lenguaje; prueba piloto; validez de constructo; consistencia interna; y fiabilidad. Los resultados mostraron que la versión final del EIPE (dos factores y 49 ítems) mostró índices de ajuste satisfactorios ( $\chi^2/df=1.751$ ; GFI=.85; AGFI=.82; CFI=.90; SRMR=.059; RMR=.046; RMSEA=.042; CFI=.90; TLI=.89), alta consistencia interna ( $\alpha>.70$ ) y fiabilidad ( $\alpha>.91$ ). Se concluye que el EIPE tiene propiedades psicométricas aceptables que proporcionan evidencia de validez y confiabilidad científica.

*Palabras clave:* atletas; estudiantes; psicometría; análisis factorial.

## Perceived Influences on Sport and Study

In the scenario of scientific research conducted with young athletes, it is important to understand both

personal and social factors capable of influencing the developmental processes in sports and school. The use of valid questionnaires, that allow a broad understanding of specific contexts, is a well-known technique to obtain

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reliable data. Because of that, assessment instruments need to follow a process that goes from constructing their dimensions and components to ascertaining their validity and reliability (Drost, 2011; Hernández-Sampieri et al., 2014) before being applied to the target population (Collet et al., 2019).

Millions of children and adolescents around the world are involved in sports (Ramey, & Rose-Krasnor, 2012), while going through the schooling process. The simultaneous influence of sports activities with school duties is a subject that has aroused the research interest over the years (Carreres-Ponsoda et al., 2012), mainly because both sports and school can play significant roles in human development (Milistedt et al., 2008).

In the youth sport context, because the athletes need to adapt themselves to new environments and deal with simultaneous challenges in sports and school, they should develop specific skills that support their trajectories. Holt and Dunn (2004) suggest four competencies capable of influencing the athlete's personal engagement in sporting activities, which can be equally extended to school activities: discipline (displaying disciplined behaviours and dedication to deal with challenges in practices and routines); commitment (displaying intrinsic motivation that supports the pursuit of a sports career); resilience (recovering from personal and contextual adversity and obstacles); and social support (perceiving and using available sources of support).

As athletes progress in their sporting career, the support of those closest to them – such as family members, coaches, and teammates – is critical to sport engagement (Côté et al., 2003) since they correspond to the athlete's main motivators and influencers in sport and school. Athlete-student life has additional demands that require extra attention (O'Neill et al., 2015) and unique forms of support such as motivation (emotional support) – perceived incentive in interpersonal relationships; guidance (informational support) – advices, tips and guidance for problem-solving; and concrete assistance (tangible support) – financial and logistical help to deal with problems and difficulties) (Cutrona, & Russel, 1990; Holt, & Dunn, 2004).

In the sports literature, there are some valid instruments that aim to analyse factors that may affect the athletes' developmental process, such as the Social Provisions Scale (Cutrona, & Russell, 1987); the Social Support Questionnaire (Sarason et al., 1987); and the PASS-Q: The Perceived Available Support in Sport Questionnaire (Freeman et al., 2011). There are also instruments aimed to understand the athletes' perceptions regarding the influence of other social agents, such as the Peer Motivational Climate in Youth Sport Questionnaire (Ntoumanis, & Vazou, 2005); the Parental Behaviours in Sport Questionnaire (Gomes, & Zão, 2007); Parental Involvement in Sport Questionnaire (Lee, & MacLean, 1997); and the Coach-Athlete Relationship Questionnaire (Jowett, & Ntoumanis, 2004).

In the Brazilian context, there is a lack of research on the analysis of the social agents' influence on the athletes' lives, as well as regarding the observation of sports and academic elements together, with few validated and published instruments. Most of these instruments were built only for specific research purposes (Peserico et al., 2015; Soares et al., 2015; Maciel et al., 2017; O'Neill et al., 2015), making its applicability to other contexts very limited. Thus, considering the absence of contextually specific and psychometrically adequate instruments for collecting information that consider the young athletes' perceptions on the influences of personal sickness and the support of social agents, the objective of our investigation was to develop and validate a scale for the assessment of perceived influences in sport and study for athletes from sports training categories.

## Method

### Initial scale construction

The Perceived Influences in Sport and Study Assessment Scale, originally (Portuguese) named *Escala de Influências Percebidas no Esporte e no Estudo* (EIPE; supplement A) aims to analyse the athletes' perceptions regarding the influence of both personal and social agents' engagement in sports and study. The theoretical references that support the development of EIPE were the Theory of Psychosocial and Environmental Competences, proposed by Holt and Dunn (2004), and the social influences suggested by Côté et al. (2003).

The scale includes the perceived influences on sport and school from two factors: 1. Involvement in sports training and sports performance in competitions; and 2. Involvement in studies and school performance. The scale was initially composed of 64 items. The items were built based on indicators linked to personal engagement and the influence of social agents (family members, coaches, teammates). Each of these factors was composed of 16 items, answered according to a scale ranging from 1 (very negative influence) to 5 (very positive influence).

The indicators (items) regarding personal engagement corresponded to: (a) discipline (dedication, responsibility); (b) commitment (goals, the pursuit of sports and school career); and (c) resilience (recovery from adversity and obstacles). The indicators related to the influence of social agents (family members, coaches, and teammates) (Côté et al., 2003) were based on three types of social support: emotional (incentive, motivation); informative (tips, guidelines); and tangible (transportation, materials) (Holt, & Dunn, 2004). Additionally, the development of EIPE was also supported by literature such as original articles conducted with the help of questionnaires designed specifically for studies on sport and school involvement (Machado et al., 2007; Peserico et al., 2015; Soares et al., 2015; Maciel et al., 2017), as well as measurement instruments (questionnaires and

interviews) used in theses and dissertations on this topic (Azevedo, 2014; Correia, 2014).

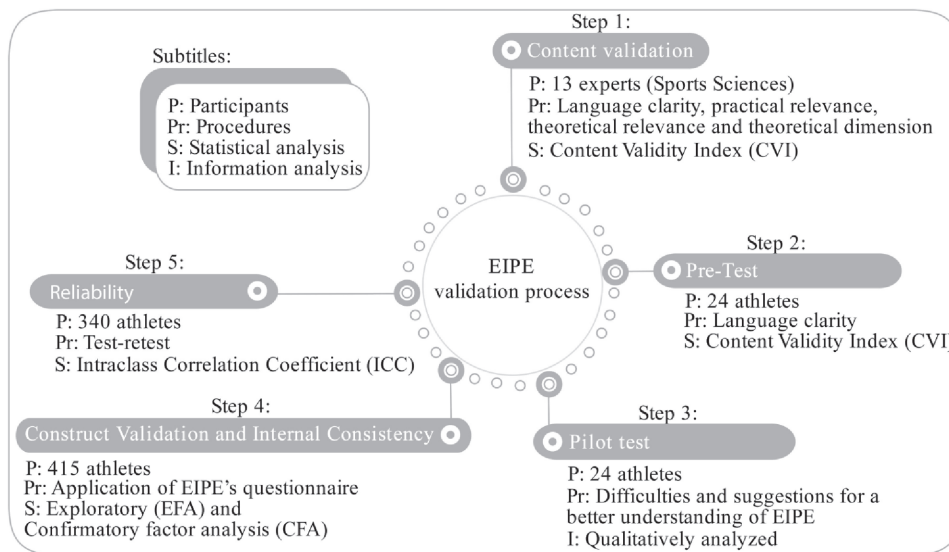
**Ethical aspects**

The study was approved by the Research Ethics Committee of the State University of Santa Catarina (no 2.667.499). All participants were informed about the study objectives and procedures and signed Informed Consent Forms (athletes). The athletes’ guardians also signed Informed Consent Forms.

**EIPE’s validation process**

The EIPE’s validation process (Figure 1) was conducted with athletes (both sexes, 13 to 18 years old, students at the secondary and high school levels) from team (basketball, soccer, futsal, handball, volleyball) and individual sports (artistic gymnastics, judo, karate, swimming, taekwondo, tennis, table tennis, chess). The athletes participated in competitions in the state of Santa Catarina/Brazil at regional, state, national and international levels.

**Figure 1**  
EIPE’s validation process flowchart



**Step 1: Content validation**

**Participants.** Thirteen experts participated in the content validation, selected according to the following criteria: 1. to be a doctor in Physical Education in Brazil; 2. to work or have worked as a professor in Higher Education; 3. to work or have worked as a teacher in School Physical Education and/or in sports clubs; 4. to be a researcher and have publications in the field of sports and/or school education; 5. to have publications related to the development and validation of measurement instruments. Among the experts included, five did not meet the fifth criterion and one did not meet the third criterion. All experts were able to participate in the validation process, corroborating the recommendation that experts should meet at least 80% of the established criteria (Voutilainen, & Liukkonen, 1995).

**Procedures.** The experts assessed the EIPE based on the following dimensions: (a) language clarity; (b) practical relevance; (c) theoretical relevance; and (d) theoretical dimension (Cassepp-Borges et al., 2010). The experts assigned values (1 – inadequate, 2 – unsuitable, 3 – acceptable, 4 – adequate and 5 – very adequate) to

assess each item on language clarity, practical relevance, and theoretical relevance. In the theoretical dimension, they assigned letters corresponding to their opinion about the items and the dimension to which they were linked (A – personal influences, B – family influences, C – coach influences, D – teammates influences). If an item needed to be reformulated, the expert should detail some suggestions for its improvement.

**Statistical analysis.** The Content Validity Index (CVI) was determined through Aiken’s V coefficient, based on the equation modified by Penfield and Giacobbi (2004), with the aid of the Visual Basic Program (version 6.0), developed by Merino and Livia (2009). The minimum acceptable value for content validation was determined from the number of experts (.67;  $p=.48$ ) (Aiken, 1985) using the 95% confidence interval (CI) (Merino, & Livia, 2009). The measure of agreement among the experts regarding the EIPE’s theoretical dimensions was obtained from the Kappa’s coefficient (95% CI for fixed-marginal multirate [.92 – .95]) (Randolph, 2005; Warrens, 2010), using the Gwet (2010) variation formula.

### Step 2: Pre-Test (language clarity)

**Participants.** To assess the EIPE's language clarity, 12 athletes from team sports and 12 athletes from individual sports (six boys and six girls from 13 to 18 years old) were randomly selected according to the availability of clubs and the athletes themselves. Athletes should also be secondary or high school students.

**Procedures and data collection.** The athletes assessed the EIPE's items based on a scale from 1 (not clear) to 5 (clear), regarding language clarity. The instrument also provided open spaces for the athletes to indicate possible suggestions for each item. Data collection was performed before or after a typical sports training session. At the time of collection, the main researcher (first author) was available to answer any athletes' questions. The average pre-test completion time was 18 minutes.

**Statistical analysis.** Pre-test CVI was determined by Aiken's *V* coefficient, based on the number of athletes selected (.64;  $p = .35$ ) and 95% CI (Aiken, 1985; Merino, & Livia, 2009).

### Step 3: Pilot test

**Participants.** In this stage, 24 athletes were randomly selected according to the same criteria adopted in step 2 (pre-test). The pilot test was performed with participants who had not yet participated in the previous stage.

**Procedures and data collection.** The pilot test was performed before or shortly after a typical sports training session. The main researcher was available during the instrument completion to answer any athletes' questions. There were blank spaces for the athletes to indicate possible difficulties in understanding the items, as well as suggestions for better clarification.

**Information Analysis.** The results of the pilot test were qualitatively analysed, considering the difficulties and suggestions reported by the athletes.

### Step 4: Construct Validation and Internal Consistency

**Participants.** The sample consisted of 415 intentionally selected athletes, 124 (29.9%) females and 291 (70.1%) males, participating in either team (78.5%) or individual sports (21, 5%). From these, 56.4% were students in secondary school and 43.6% were students in high school, aged between 13 to 18 years old (average = 15.3;  $SD = 1.49$ ).

**Procedures and data collection.** Prior contact was made with the athletes and their respective coaches in order to schedule the application of the EIPE. The application was performed by the researchers responsible for the study, accompanied by other previously oriented researchers, at the sports training sites of each modality. Each athlete answered the instrument individually with the presence of the researchers to answer any questions.

**Statistical analysis.** The EIPE construct validity was performed through exploratory (EFA) and confirmatory factor analysis (CFA), with the aid of IBM SPSS (version 21.0) and AMOS for Structural Equation Modelling (version 23.0) software's. EFA was calculated by using the principal axis factor extraction method, with direct oblique rotation. The Kaiser-Meyer-Olkin (KMO) was used as a sample adequate index for factor analysis, considering scores between .70 and .80 as average, and  $\geq .80$  as optimum (Hair et al., 2005). To verify whether the (co) variance matrix was equal to the identity matrix, Bartlett's sphericity test was used to assess the degree of fit of the model to the sample data (Dziuban, & Shirkey, 1974). To verify the number of factors, the Kaiser-Guttman criteria (eigenvalue  $> 1$ ) (Patil et al., 2007) were used.

The criteria used to maintain the items in the exploratory factor structure were: (a) factor loadings above .30; (b) no items with cross factor; (c) no factor with less than three items (Costello, & Osborne, 2005). These criteria were employed repeatedly until an acceptable factor solution was obtained. Theoretical definitions regarding the perceived influences on sports and school involvement and performance were considered in the instrument constructs and semantic content in order to define which factor structure solution was most satisfactory. The internal consistency of each factor was obtained from Cronbach's Alpha coefficient ( $\alpha > .70$ ) (Bland, & Altman, 1997; George, & Mallery, 2003).

The CFA was used to investigate the model's adequacy model to the empirical data. Because this is the EIPE's first empirical assessment, loads close to or greater than .50 were stipulated, as indicated by the literature (Browne et al., 2002; Kline, 2012). The final model was tested for the following fit quality indicators: (a) Standardized Root-Mean-Square Residual (SRMR)  $< .06$ ; (b) Chi-Square Ratio ( $\chi^2/df$ )  $< .3.0$ ; (c) GFI (Goodness of Fit Index)  $\geq .90$ ; (d) AGFI (Adjusted for degrees of freedom)  $> .80$ ; (e) CFI (Comparative fit index)  $> .90$ ; (f) TLI (Tucker - Lewis index)  $> .90$ ; (g) RMSEA (Root-square-error of approximation)  $< .06$  (Jackson et al., 2009). Internal consistency was obtained through the Cronbach's Alpha coefficient, with a cut-off point of  $> .70$  (Hair et al., 2010).

### Step 5: Reliability

**Participants.** In this stage, participants were 340 athletes (29.4% female and 70.6% male) from either team (78.8%) or individual (21.2%) sports. From these, 79% studied in secondary school and 21% in high school, aged 13 to 18 years old (average = 15.1;  $SD = 5.85$ ).

**Procedures and data collection.** The EIPE was applied at the training sites in two moments, with an interval of two weeks between the first and second application. Retesting was scheduled immediately after the test. In both applications, leading researchers were present to answer possible questions.

**Statistical analysis.** This stage sought to assess the reliability items' and factors' scores of the instrument, which met the criteria established in the previous steps. For the reliability analysis of the scores, the intraclass correlation coefficient (ICC) close to 1 suggested by Nakagawa et al. (2017) was used, adopting 95% confidence intervals.

## Results

### Content validation

The CVI of each item, determined by Aiken's V

coefficient in the content validity stage (language clarity, practical relevance and theoretical relevance), is summarized in Table 1. All the initial proposed items were maintained when confirmed by expert content validation. All items reached values higher than the proposed (.67), and an overall CVI of .90, indicating a high content validity index. The theoretical dimension analysis, performed using the Kappa coefficient, obtained a general index of 95% and fixed-marginal within the estimated cut-off point (.93), corroborating the satisfactory results at this stage.

**Table 1**  
EIPE's content validation indices

Items	Language clarity			Practical relevance			Theoretical relevance			V
	IC 95%			IC 95%			IC 95%			
	V	Min.	Max.	V	Min.	Max.	V	Min.	Max.	Total
1	.86	.75	.93	.94	.84	.98	.90	.79	.96	<b>.90</b>
2	.81	.68	.89	.67	.54	.78	.73	.60	.83	<b>.74</b>
3	.92	.82	.97	.94	.84	.98	.92	.82	.97	<b>.93</b>
4	.92	.82	.97	.98	.90	.00	.96	.87	.99	<b>.95</b>
5	.92	.82	.97	.86	.75	.93	.84	.72	.92	<b>.87</b>
6	.84	.72	.92	.88	.77	.95	.90	.79	.96	<b>.87</b>
7	.92	.82	.97	.92	.82	.97	.92	.82	.97	<b>.92</b>
8	.90	.79	.96	.96	.87	.99	.94	.84	.98	<b>.93</b>
9	.88	.77	.95	.84	.72	.92	.90	.79	.96	<b>.87</b>
10	.90	.79	.96	.92	.82	.97	.90	.79	.96	<b>.91</b>
11	.90	.79	.96	.94	.84	.98	.96	.87	.99	<b>.93</b>
12	.84	.72	.92	.83	.70	.91	.83	.70	.91	<b>.83</b>
13	.94	.84	.98	.94	.84	.98	.96	.87	.99	<b>.95</b>
14	.77	.64	.86	.83	.70	.91	.90	.79	.96	<b>.83</b>
15	.90	.79	.96	.94	.84	.98	.90	.79	.96	<b>.91</b>
16	.94	.84	.98	.90	.80	.96	.90	.79	.96	<b>.91</b>
17	.94	.84	.98	.92	.82	.97	.90	.79	.96	<b>.92</b>
18	.92	.82	.97	.94	.84	.98	.92	.82	.97	<b>.93</b>
19	.92	.82	.97	.90	.80	.96	.92	.82	.97	<b>.91</b>
20	.96	.87	.99	.96	.87	.99	.94	.84	.98	<b>.95</b>
21	.83	.70	.91	.83	.70	.91	.86	.75	.93	<b>.84</b>
22	.88	.77	.95	.96	.87	.99	.96	.87	.99	<b>.93</b>
23	.73	.60	.83	.70	.56	.80	.81	.68	.89	<b>.75</b>
24	.94	.84	.98	.96	.87	.99	.94	.84	.98	<b>.95</b>
25	.94	.84	.98	.94	.84	.98	.94	.84	.98	<b>.94</b>
26	.92	.82	.97	.96	.87	.99	.96	.87	.99	<b>.95</b>
27	.92	.82	.97	.90	.80	.96	.83	.70	.91	<b>.88</b>
28	.92	.82	.97	.84	.72	.92	.88	.77	.95	<b>.88</b>
29	.79	.66	.88	.79	.66	.88	.84	.72	.92	<b>.81</b>
30	.94	.84	.98	.92	.82	.97	.88	.77	.95	<b>.91</b>
31	.84	.72	.92	.81	.68	.89	.92	.82	.97	<b>.86</b>
32	.88	.77	.95	.86	.75	.93	.84	.72	.92	<b>.86</b>
33	.90	.79	.96	.86	.75	.93	.92	.82	.97	<b>.89</b>
34	.88	.77	.95	.84	.72	.92	.84	.72	.92	<b>.85</b>
35	.94	.84	.98	.94	.84	.98	.92	.82	.97	<b>.93</b>



**Table 1 (continuation)**  
EIPE's content validation indices

Items	Language clarity			Practical relevance			Theoretical relevance			V
	IC 95%			IC 95%			IC 95%			Total
	V	Min.	Max.	V	Min.	Max.	V	Min.	Max.	
36	.90	.79	.96	.86	.75	.93	.90	.79	.96	<b>.89</b>
37	.92	.82	.97	.86	.75	.93	.90	.79	.96	<b>.89</b>
38	.90	.79	.96	.88	.77	.95	.92	.82	.97	<b>.90</b>
39	.83	.70	.90	.92	.82	.97	.92	.82	.97	<b>.89</b>
40	.86	.75	.93	.84	.72	.92	.84	.72	.92	<b>.85</b>
41	.94	.84	.98	.96	.87	.99	.96	.87	.99	<b>.95</b>
42	.92	.82	.97	.84	.72	.92	.92	.82	.97	<b>.89</b>
43	.96	.87	.99	.98	.90	1.00	.98	.90	1.00	<b>.97</b>
44	.94	.84	.98	.88	.77	.95	.92	.82	.97	<b>.91</b>
45	.88	.77	.95	.94	.84	.98	.92	.82	.97	<b>.91</b>
46	.92	.82	.97	.92	.82	.97	.88	.77	.95	<b>.91</b>
47	.94	.84	.98	.96	.87	.99	.94	.84	.98	<b>.95</b>
48	.90	.79	.96	.92	.82	.97	.90	.79	.96	<b>.91</b>
49	.86	.75	.93	.96	.87	.99	.92	.82	.97	<b>.91</b>
50	.92	.82	.97	.94	.84	.98	.96	.87	.99	<b>.94</b>
51	.94	.84	.98	.94	.84	.98	.92	.82	.97	<b>.93</b>
52	.90	.79	.96	.86	.75	.93	.92	.82	.97	<b>.89</b>
53	.90	.77	.96	.92	.82	.97	.88	.77	.95	<b>.90</b>
54	.92	.82	.97	.90	.79	.96	.96	.87	.99	<b>.93</b>
55	.83	.70	.91	.83	.70	.90	.84	.72	.92	<b>.83</b>
56	.90	.79	.96	.88	.77	.95	.90	.79	.96	<b>.89</b>
57	.94	.84	.98	.92	.82	.97	.90	.79	.96	<b>.92</b>
58	.92	.82	.97	.92	.82	.97	.92	.82	.97	<b>.92</b>
59	.92	.82	.97	.92	.82	.97	.92	.82	.97	<b>.92</b>
60	.92	.82	.97	.90	.79	.96	.92	.82	.97	<b>.91</b>
61	.94	.84	.98	.86	.75	.93	.94	.84	.98	<b>.91</b>
62	.96	.87	.99	.96	.87	.99	.94	.84	.98	<b>.95</b>
63	.94	.84	.98	.88	.77	.95	.86	.75	.93	<b>.89</b>
64	.94	.84	.98	.92	.82	.97	.90	.79	.96	<b>.92</b>
Total	<b>.90</b>	.79	.96	<b>.90</b>	.79	.95	<b>.90</b>	.80	.96	<b>.90</b>

Note. V: content validity index; 95% CI: 95% confidence interval

### Pre-test (language clarity)

The results determined by Aiken's V coefficients exceeded the value proposed in all items (.64), obtaining an overall index of .95 (95% CI; min = .88; max = .98) that emphasized athletes' satisfactory understanding regarding the EIPE's content.

### Pilot test

Athletes considered the EIPE easy to understand and answer. Only three athletes considered it necessary to reduce the number of items, as they consider the instrument very extensive. Two athletes indicated that some items were very similar to each other. The average time to complete the pilot test was 15 minutes.

### Construct validation and internal consistency

#### Exploratory Factor Analysis (EFA)

In general, EFA indicated that the EIPE presented a two-factor structure ( $KMO=.919$ ,  $p<.001$ ; explained variance=35.10%;  $\alpha=.943$ ; and correlation matrix ranging from .325 and -.709). The factor 'Involvement in sports training and sports performance in competitions' was composed of 26 items ( $\alpha=.916$ ; eigenvalue=13.24; explained variance=27.02%), while the factor 'Involvement in studies and school performance' had 23 items ( $\alpha=.911$ ; eigenvalue=3.95; explained variance=8.07%). Thus, 15 items were excluded due to

low factor load or cross factor load with similar values (8, 12, 20, 26, 28, 30, 33, 35, 38, 57, 58, 61, 62, 63, 64) and a new analysis was carried out, confirming the final structure presented.

**Confirmatory Factor Analysis (CFA)**

Based on EFA evidence, CFA was carried out. In

the initial model (M1), most items obtained factorial loads close to or above .5. However, the modification indices suggested covariance between the measurement errors of some items. The covariance between errors ( $r < .3$ ) occurred between items of the same factor. The initial and final CFA model (M2) adjustment indices can be seen in Table 3.

**Table 2**  
EIPE's factor loads, and reliability obtained in EFA

Items	Factors	
	Involvement in sports training and performance in sports competitions	Involvement in studies and school performance
1	.435	
2	.392	
3	.629	
4	.476	
5	.625	
6	.475	
7	.686	
9	.690	
10	.335	
11	.325	
13	.636	
14	.440	
15	.621	
16	.549	
17	.471	
18	.434	
19	.462	
21	.453	
22	.516	
23	.672	
24	.548	
25	.572	
27	.440	
29	.637	
31	.562	
32	.571	
34		-.652
36		-.670
37		-.447
39		-.572
40		-.433
41		-.388
42		-.684
43		-.524
44		-.453
45		-.336
46		-.639
47		-.582
48		-.358

**Table 2 (continuation)**

EIPE's factor loads, and reliability obtained in EFA

Items	Factors	
	Involvement in sports training and performance in sports competitions	Involvement in studies and school performance
49		-.510
50		-.790
51		-.567
52		-.678
53		-.550
54		-.380
55		-.593
56		-.350
59		-.660
60		-.657
$\alpha$	.916	.911
Eigenvalues	13.24	3.95
Variance explained	27.02%	8.07%

Note.  $\alpha$ =Cronbach's Alpha.**Table 3**

Adjustment Indexes for Confirmatory Factor Analysis of EIPE's Factor Models

Two-dimensional model	Adjustment indices							
	$\chi^2/gl$	GFI	AGFI	CFI	SRMR	RMR	RMSEA	TLI
M1	2.988	.72	.70	.72	.068	.052	.068	.71
M2	1.751	.85	.82	.90	.059	.046	.042	.89

**Reliability**

Results confirmed the test-retest reliability and the internal consistency of the EIPE, since all items reached adequate indices ( $p < .01$ ) and  $\alpha = .943$ . The items were

grouped to determine the stability and reliability of each factor of the instrument (Table 4), which presented high rates for the validation sample.

**Table 4**

Correlation and internal consistency of EIPE's factors

Factor	CCI (IC 95%)	$\alpha$
Involvement in sports training and performance in competitions	.953	.956
Involvement in studies and school performance	.927	.932

Note. ICC – Intraclass Correlation coefficient; I95% – 95% Confidence Intervals;  $\alpha$  – Cronbach's Alpha Coefficient**Discussion**

The aim of this study was to develop and validate a scale for identifying young athletes' perceptions of influences on their sport and study practices. The evidence obtained in the performed steps presented satisfactory results of validity, reliability, and stability of the instrument.

For the EIPE to be scientifically reproducible and applicable, four validation steps were performed, as suggested by the literature (Cassepp-Borges et al., 2010; Kim, 2009; Drost, 2011). Similar validation methods were

employed in the development and validation of measurement instruments in the area of Health and Sports Sciences (Freeman et al., 2011; Monteiro et al., 2018; Guillén et al., 2019).

The CVI of all items, obtained in content validation (language clarity, practical relevance and theoretical relevance), exceeded the proposed reference value available in the literature, demonstrating a high level of acceptance regarding the instrument content, as well as its suitability for measuring what is intended (Aiken, 1985). The values found were similar to those found by García-Martín



et al. (2016), Martínez-Abellán et al. (2016) and Collet et al. (2019), where the obtained Aiken's V coefficients exceeded the recommended values.

In the theoretical dimension, results revealed almost perfect levels of agreement among the experts regarding the items' classification and dimensions (Landis, & Koch, 1977; Cassepp-Borges et al., 2010). This result was slightly higher than the one found by Balbim and Vieira (2015), where the indices found revealed substantial agreement between the items and their respective dimensions in the validation of an instrument in the sports context.

The second validation step (pre-test) aimed to expose the instrument to the target population, in order to verify the instrument items could be correctly understood and interpreted by the subjects before its application (Kim, 2009). According to Morgado et al. (2017), the use of methods that consider the opinion of the target audience is fundamental in the process of developing an instrument.

The pilot test is also recommended as an indispensable procedure for the development of measurement instruments (DeVellis, 2016; Morgado et al., 2017). In both stages, no item was modified, and the index obtained was indicative of good internal consistency (George, & Mallery, 2003). This result highlights the importance of developing items that are easy to understand and make sense to respondents (Selau et al., 2020).

The EIPE's construction had the advantage of reconciling qualitative and quantitative methods. In general, the evidence found reinforces the literature recommendations on the importance of carrying out different steps to ensure the most accurate validity of an instrument (Apa et al., 2014; Marôco, 2014). It is important to note that the construction of a scale is a laborious, intense and complex process. This reinforces the importance of all steps adopted to the EIPE's construction, since they contributed to substantial improvements in the instrument preliminary version.

Despite the evidence found in the qualitative stages of the instrument's validation, the initial model with 64 items did not present satisfactory factor validity in EFA, since the individual parameters of some items did not saturate with their respective factors and the minimum factor load indicated in the literature (Costello, & Osborne, 2005). It is important to highlight that the process of building an instrument requires the fulfilment of steps that encompasses the theoretical assumptions of the instrument and the opinion of evaluating judges until the application of different statistical tests. Therefore, the association with other validation processes is crucial for the instrument to produce the expected effect (Medeiros et al., 2015).

In this sense, it is clarified that most of the excluded items were related to the influence of teammates on school involvement and performance (8),

while the other items did not demonstrate a pattern that could be theoretically explained. Thus, the decision of excluding the items was due to the understanding that many athletes may not study with their sporting colleagues and, as a consequence, do not provide answers that could contribute to the final result of the instrument score. In addition, although all items were important, the exclusion of items with low factor loads did not affect the final understanding of the instrument.

Soon after the removal of unsatisfactory items, a version of 49 items was tested, which yielded acceptable results (moderate to strong) of internal consistency and correlation between factors (Hair et al., 2005; Jackson et al., 2009). Similar correlations were observed in the dimensions of the Interpersonal Support Assessment List (Cohen et al., 1985) and the Perceived Available Sport Questionnaire (Freeman et al., 2011).

The evidence found in CFA confirmed the two-factor model, revealing the adequacy of the empirical data to the theoretical model. Similar results were found in other sports configuration instruments (Guillén et al., 2019; Monteiro et al., 2018). Although some indices were not entirely satisfactory, it is understood that the evidence found based on the adjustment indices remained very close to the indices considered adequate.

In this case, as already established by the literature in the area, even if certain indices are not within the cut-off point, there is no reason to be disregarded, as long as they are very close to the indices considered satisfactory (Jackson et al., 2009). Thus, the EIPE adjustment indices reached or approached the values indicated by the literature, demonstrating the general adequacy of the model in two factors and confirmatory factor validity (O'Rourke, & Hatcher, 1994; Hu, & Bentler, 1999; Jackson et al., 2009).

The reliability analysis, performed through the CCI, showed adequate indices of validity and internal consistency among the instrument's factors (Nakagawa et al., 2017). This data reinforces the significant and positive relationship between the two applications of the instrument and strengthens its reliability. A similar result was found in the test-retest validation of the Youth Motivational Climate Questionnaire in Youth Sports (Ntoumanis, & Vazou, 2005) and the Temporal Invariance of the Utrecht Work Engagement Scale (UWES) (Porto-Martin et al., 2020).

The final EIPE's structure model (49 items) differed from the initial model (64 items) due to the exclusion of 15 items during the factor analysis, making the instrument more coherent and lean for data collection. Based on the evidence found, it can be concluded that the results presented in this article showed good psychometric properties, revealing that EIPE is valid and reliable for identifying young athletes' perceptions of influences in both sports and study practices.

Despite the evidence presented, it is necessary to understand that this is a preliminary EIPE's validation process, so more tests with different types of analysis still need to be performed. In addition, some limitations must be considered, such as the fact that the data was collected only at a certain time of the year.

Future studies may analyse the EIPE's reliability in periods before and after the sports seasons, and in certain semesters and/or academic periods. Likewise, it would be interesting to apply the EIPE in other contexts/countries, since each one has its own sporting and schooling settings. Finally, one should consider the validation of this instrument with a greater number of athletes and other sports, such as cycling, rhythmic gymnastics, beach volleyball and rugby, for example.

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### Author contributions

We declare that all authors participated in the elaboration of the manuscript. Specifically, the authors Larissa FP Maciel, Alexandra Folle, Ricardo T. Quinaud participated in the initial writing of the study – conceptualization, research, visualization. Larissa F.P. Maciel, William das N. Salles, Ricardo T. Quinaud, Mônica C. Flach, participated in the data analysis. The authors Larissa F. P. Maciel, William das N. Salles, Ricardo T. Quinaud, Alexandra Folle, Juarez V., do Nascimento participated in the final writing of the work, proofreading and editing.

### Availability of data and materials

All data and syntax generated and analyzed during this research will be treated with complete confidentiality due to the Ethics Committee for Research in Human Beings requirements. However, the dataset and syntax that support the conclusions of this article are available upon reasonable request to the principal author of the study.

### Conflict of interests

The authors declare that there are no conflicts of interest.

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## Supplement A

EIPE original version

### ESCALA DE AVALIAÇÃO DE INFLUÊNCIAS PERCEBIDAS NO ESPORTE E NO ESTUDO (EIPE)

**INSTRUÇÕES:** Este questionário se refere a como você percebe as influências do seu envolvimento pessoal e dos seus familiares, treinadores e colegas de equipe na sua prática esportiva e nos seus estudos escolares. **POR FAVOR, RESPONDA A TODAS AS QUESTÕES.**

Tenha em mente que as definições abaixo correspondem a:

**Envolvimento com o treinamento esportivo:** dedicação, interesse e concentração nos treinamentos (físico, técnico, tático, psicológico);

**Desempenho em competições esportivas:** resultado de sua participação em jogos, torneios, taças, copas e campeonatos;

**Envolvimento com os estudos:** dedicação, interesse e concentração nos estudos (sua frequência na escola, rotina de estudos fora da sala de aula, realização de cursos de idiomas e informática);

**Desempenho escolar:** notas ou conceitos escolares obtidos por você.

PERCEPÇÕES	Muito negativa	Pouco negativa	Não influencia/ Não acontece comigo	Pouco positiva	Muito positiva
Minha dedicação e responsabilidade (disciplina) com o esporte influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
O apoio que recebo dos meus familiares (transporte, materiais esportivos, dinheiro, alimentação, moradia) influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
As orientações esportivas (dicas e conselhos) que recebo dos meus colegas de equipe influenciam meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo dos meus familiares influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
A cobrança dos meus familiares com relação ao esporte influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
Minha motivação no esporte influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
O apoio que recebo por meio do meu treinador (transporte, materiais esportivos, dinheiro, alimentação, moradia) influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )



**Supplement A (continuation)***EIPE original version*

O incentivo (motivação) que recebo do meu treinador influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
As cobranças do meu treinador com relação ao esporte influenciam meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
Minhas metas no esporte influenciam meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
Minha capacidade de superar as dificuldades enfrentadas no esporte (lesões, derrotas, não convocação, cobranças exageradas) influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
As orientações esportivas (dicas e conselhos) que recebo do meu treinador influenciam meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo dos meus colegas de equipe influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
O convívio (treinos, momentos de lazer) com meus colegas de equipe influencia meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
As orientações esportivas (dicas, conselhos) que recebo dos meus familiares influenciam meu envolvimento com o treinamento esportivo de forma...	( )	( )	( )	( )	( )
Minha dedicação e responsabilidade (disciplina) com o esporte influencia meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
O apoio que recebo dos meus familiares (transporte, materiais esportivos, dinheiro, alimentação, moradia) influencia meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
Minha motivação no esporte influencia meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
O apoio que recebo por meio do meu treinador (transporte, materiais esportivos, dinheiro, alimentação, moradia) influencia meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
As cobranças do meu treinador com relação ao esporte influenciam meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
Minhas metas no esporte influenciam meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
A cobrança dos meus familiares com relação ao esporte influencia meu desempenho em competições esportivas de forma...	( )	( )	( )	( )	( )
As orientações esportivas (dicas e conselhos) que recebo do meu treinador influenciam meu desempenho nas competições esportivas de forma...	( )	( )	( )	( )	( )
As orientações esportivas (dicas, conselhos) que recebo dos meus familiares influenciam meu desempenho nas competições esportivas de forma...	( )	( )	( )	( )	( )
As orientações esportivas (dicas e conselhos) que recebo dos meus colegas de equipe influenciam meu desempenho nas competições esportivas de forma...	( )	( )	( )	( )	( )
O apoio que recebo dos meus familiares (transporte, materiais escolares, dinheiro, alimentação, moradia) influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
A cobrança dos meus familiares com relação aos estudos influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
A bolsa de estudos que recebo com apoio (consentimento) do meu treinador influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
Minhas metas escolares influenciam meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo dos meus familiares influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
As cobranças do meu treinador com relação aos estudos influenciam meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
Minha capacidade de superar as dificuldades enfrentadas na escola (notas baixas, reprovação, cobranças exageradas) influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
As orientações nas tarefas escolares que recebo dos meus familiares influenciam meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo do meu treinador influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo dos meus colegas de equipe influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
As orientações escolares (dicas, conselhos) que recebo do meu treinador influenciam meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
O apoio no deslocamento (carona) que recebo dos meus colegas de equipe influencia meu envolvimento com os estudos de forma...	( )	( )	( )	( )	( )
Minha dedicação e responsabilidade (disciplina) com os estudos influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
O apoio que recebo dos meus familiares (transporte, materiais escolares, dinheiro, alimentação, moradia) influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo do meu treinador influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
Minha motivação para os estudos influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
A bolsa de estudos que recebo com apoio (consentimento) do meu treinador influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo dos meus colegas de equipe influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
A cobrança dos meus familiares com relação aos estudos influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )

**Supplement A (continuation)***EIPE original version*

As orientações escolares (dicas, conselhos) que recebo do meu treinador influenciam meu desempenho escolar de forma...	( )	( )	( )	( )	( )
Minha capacidade de superar as dificuldades enfrentadas na escola (notas baixas, reprovação, cobranças exageradas) influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )
As orientações nas tarefas escolares que recebo dos meus familiares influenciam meu desempenho escolar de forma...	( )	( )	( )	( )	( )
As cobranças do meu treinador com relação aos estudos influenciam meu desempenho escolar de forma...	( )	( )	( )	( )	( )
O incentivo (motivação) que recebo dos meus familiares influencia meu desempenho escolar de forma...	( )	( )	( )	( )	( )

**Supplement B***EIPE score calculation*

Considering the 196 variabilities of the possible scores, as a function of the minimum (49) and maximum response values (245) for the 49 items of the EIPE, this variability was divided by three ( $196/3=65.34$ ). From the sum of the lowest possible score (49) and the result of the division of variability (65.4), the first cut-off's index ( $49+65.4=114.4$ ) was obtained. The second cut-off index was established from the result of the first cut-off index (114.4) plus the division of

variability ( $114.4+65.34$ ), which resulted in the 179.8 score. Thus, it was determined that scores lower than 114, obtained from the sum of the instrument items, are considered as negative influence, while scores between 115 ( $114+1$ ) and 180 are considered indifferent and scores above 181 ( $180+1$ ) are considered as positive influence. These calculations were performed for the factors and dimensions, generating the following scores (Tables 1 to 5).

**Table 1***EIPE general calculation (49 items)*

Calculation	Scores	Classification
$49 + 65,4 = 114,4$	<114	Negative influence
$114,4 + 65,4 = 179,8$	entre 115 e 180	Indifferent
$180 + 1$	>181	Positive influence

Note. study data

**Table 2***Calculation by factor (sport – 26 items; study – 23 items)*

Classification	Scores			
	Calculation	Sport	Calculation	Study
Negative influence	$26 - 135 = 109/3 = 36 + 23$	<63	$23 - 110 = 88/3 = 29 + 23$	<51
Indifferent	$63 + 36$	between 64 and 99	$51 + 29$	between 52 and 81
Positive influence	$99+1$	>100	$81 + 1$	>82

Note. study data

**Table 3***Calculation by factor (sport and study)*

Dimensions / Items	Scores			
	Calculation	Negative	Indifferent	Positive
Personal (14)	$14 - 70 = 56/3 = 18 + 14$	<32	between 33 and 51	>52
Families (12)	$12 - 60 = 48/3 = 16 + 12$	<28	between 29 and 44	>45
Coaches (13)	$13 - 65 = 52/3 = 17 + 13$	<30	between 31 and 48	>49
Teammates (10)	$10 - 50 = 40/3 = 13 + 10$	<13	between 14 and 17	>18

Note. study data



**Table 4**  
Calculation by factor (sport)

Dimensions	Scores			
	Calculation	Negative	Indifferent	Positive
Personal (7)	$7 - 35 = 28/3 = 9 + 7$	<16	between 17 and 26	>27
Families (7)	$7 - 35 = 28/3 = 9 + 7$	<16	between 17 and 26	>27
Coaches (5)	$5 - 25 = 20/3 = 7 + 5$	<12	between 13 and 18	>19
Teammates (8)	$8 - 40 = 32/3 = 11 + 8$	<19	between 20 and 29	>30

Note. study data

**Table 5**  
Calculation by factor (study)

Dimensions	Scores			
	Calculation	Negative	Indifferent	Positive
Personal (7)	$7 - 35 = 28/3 = 9 + 7$	<16	between 17 and 26	>27
Families (5)	$5 - 25 = 20/3 = 7 + 5$	<12	between 13 and 18	>19
Coaches (8)	$8 - 40 = 32/3 = 11 + 8$	<19	between 20 and 29	>30
Teammates (2)	$2 - 10 = 8/3 = 3 + 2$	<5	between 6 and 7	>8

Note. study data

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