

## Article

# Testing the Psychometric Properties and Measurement Invariance of the Perceived Motivational Climate in Sport Questionnaire (PMCSQ-2): Online Assessment

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**Abstract:** Athletes' perception of competence and success can be influenced by the motivational climate created by the coach. The Perceived Motivational Climate in Sport Questionnaire (PMCSQ-2) assesses this. Although its reliability and validity have been analyzed in previous studies, this has never been done for the online version. This type of evaluation can be beneficial for data collection, sustainability, speed, and generating larger samples. Therefore, the aim of this study is to analyze the psychometric properties of the PMCSQ-2 in its online version. The sample consisted of 1637 participants (37.8% men and 62.2% women) from 18 to 68 years of age ( $M = 24.39$ ,  $SD = 6.51$ ) who practiced physical-sport activities regularly. A second-order confirmatory factor analysis (CFA) model and its invariance for gender were studied from a 24-item version obtained from the MenPas 1.0 platform. The analyses provided an adequate fit for the CFA ( $CFI = 0.91$ ,  $TLI = 0.90$ ,  $RMSEA = 0.07$ ,  $SRMR = 0.07$ ,  $df = 224$ ,  $B-S p = 0.02-0.07$ ) when an alternative model was realized ( $\chi^2 = 1858.89$ ,  $\chi^2/df = 8.30$ ), as they also did for the women ( $\chi^2 = 1356.90$ ,  $\chi^2/df = 6.06$ ), men ( $\chi^2 = 883.58$ ,  $\chi^2/df = 3.95$ ) individual sports ( $\chi^2 = 1153.55$ ,  $\chi^2/df = 5.15$ ), and team sports ( $\chi^2 = 1008.92$ ,  $\chi^2/df = 4.05$ ) items. The data were also suitable for invariance analysis. Similarly, appropriate values were obtained for convergent and discriminant validity and for composite reliability. Therefore, the results obtained show appropriate psychometric properties for the online version of the PMCSQ-2 using an alternative model, suggesting that its use is suitable for research and showing the importance of the subscales.

**Keywords:** motivation; data collection; digital questionnaire; subscales; sustainable assessment



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## 1. Introduction

Motivation is relevant in areas such as education, sport, or work [1–9]. In education, for example, Ames and Archer [1], in the framework of achievement goal theory, observed that the level of motivation and behavior of students could vary depending on the environment created in the classroom by teachers for a perception of competence in the activity (motivational climate). In other words, the criteria students use for defining competence are influenced by the climate created by their teachers. Likewise, university students who are future physical education teachers [2] experienced different climates according to whether the activity in which they participated is competitive or professionalizing. In a sports context specifically, the motivational climate created by the coach plays an important role in athletes' conception of competence and success [3]. Several studies have related variables, such as well-being, amount of fun, psychological functioning, or intrinsic motivation within different populations such as swimmers [4], tennis players [5], beach volleyball

players [6], football players [7], or handball players [8,9]. These studies show the importance of generating an appropriate motivational climate by people of significance, whether they be coaches or teachers, in order to increase interest [6], fun [4,6,7], engagement [7], or competition results [6,8,9].

Drawing their ideas from classroom research [10], Duda and her students developed the Perceived Motivational Climate in Sport Questionnaire, or PMCSQ [11]. This involved designing two dimensions: the task-involving climate and ego-involving climate. On the one hand, in the task-involving climate, competence is related to effort, self-improvement, the promotion of cooperation, and the importance of the role played in the sport. On the other hand, the ego-involving climate focuses on the result and favors comparison and rivalry with others because the criterion of success is based on doing as well as or better than others or the same as others but with less effort [12].

When the task-involving climate prevails, effort within sports training is promoted, and the focus is usually centered on improving sports skills, valuing the effort and the search for personal development, and understanding mistakes as a source of learning [5,12,13]. Moreover, the task-involving climate is positively related to the amount of fun produced by the activity being performed, as well as a positive attitude, resilience, effective emotion regulation, and a better concept of the self [14–18]. In contrast, when the motivational climate is ego-involving, the athletes are systematically compared with others, and greater skill is demanded of them, with their mistakes highlighted. The coach rewards talent and sports outcome more by focusing primarily on performance. It also favors rivalry among peers and increases the likelihood of generating unsavory emotions [4,5,12,13,18].

The PMCSQ was created to assess athletes' perception of the motivational climate in their team [19]. In the first stages of the development of the questionnaire, Walling et al. [20] investigated its psychometric properties, finding high indices for standardized root mean residual mean square (SRMR = 0.108). They therefore performed a second confirmatory factor analysis (CFA); this time for the two motivational climate dimensions (task-involving and ego-involving), divided, in turn, into six subscales, thereby achieving an improvement in the index (SRMR = 0.091). The task-involving climate included the following subscales: effort/improvement (when reinforcement of hard work and personal development is perceived), important role (each player has an important role or mission in the team), and cooperative learning (the perception of mutual help in the team), whereas the ego-involving climate included the following subscales: unequal recognition (perceived to give more importance to the more talented players), punishment for mistakes (when a failures receive a negative response), and intra-team member rivalry (the perception of conflicts within the team) [5].

The version of the questionnaire developed by Newton et al. [12], the PMCSQ-2, has become one of the most widely used questionnaires for assessing motivational climates [21]. The psychometric properties of the Spanish version for individual sports were first analyzed by Balaguer et al. [5]. The validity, reliability, and structure of this questionnaire were evaluated in a sports context, providing appropriate scores when applied to American volleyball and basketball players [12], as well as to Spanish tennis players [5]. Galván et al. [22] also obtained good fits when analyzing the psychometric properties within a Mexican population aged 9–23 years for individual and team athletes. Likewise, Zurita et al. [23] developed structural equation models for a Spanish population aged 15–17 years, comparing them according to gender, with the results of the psychometric analysis adjusted appropriately.

Although the PMCSQ-2 has been tested for fit on various occasions, less work has been done on invariance analysis. Invariance is a psychometric analysis that is used to demonstrate the equivalence (or lack thereof) between groups with different characteristics. Regarding gender, the published literature shows that, in some studies, women perceived a more task-involving climate than men [17,23], whereas in Galván et al. [22], no significant differences were found. Invariance has only been analyzed by González-Cutre et al. [24], who examine the psychometric properties of the PMCSQ-2 in students aged between 12

and 16 years, showing a good fit for gender. The PMCSQ-2 has been evaluated in several sports such as tennis [5] and basketball [12], and also among participants in the National Junior Olympiad which includes various individual and team sports [22]. However, no invariance analyses for sport have been performed for this questionnaire, so it has not been demonstrated that its measurement properties are independent of population characteristics such as gender or type of sport.

One of the most important aspects of our study is the way in which the questionnaire is evaluated. Data collection for assessment and research is always an arduous and time-consuming process. Therefore, in recent years the use of new technologies for data collection has proliferated [25,26]. There are platforms dedicated to online assessment, including MenPas 1.0 ([www.menpas.com](http://www.menpas.com), accessed on 8 January 2021), which offers benefits, such as speed of assessment for both athletes and organizations and immediacy of the results, as well as being useful for obtaining databases for the instrument validation [25,27]. Online data collection has some drawbacks, such as less control of variables, which can affect reliability [25,28]. In this regard, there is no way of knowing what the user is doing while taking the questionnaire, and if a participant has a question about an item, for example, it cannot be answered. However, the anonymity in online evaluation can help to improve reliability, and through the MenPas platform, there are ways of controlling certain variables, such as the order or time of response to the item, which mitigate the problem of lack of control of variables [28,29]. In addition, as we have seen over the last two years during the crisis caused by COVID-19, evaluation under certain circumstances can be difficult or impossible, and consequently research is impeded [26]. This is a problem that could arise more frequently in the future; indeed, as Mark Honigsbaum comments in his book *"The Pandemic Century"*, the history of epidemics shows that the question is not whether there will be more pandemics, but when they will occur [30]. In addition, some studies have highlighted the importance of physical activity during the COVID-19 pandemic and the increase in MenPas users at this time [31,32]. Considering the need to increase online tools and the possible changes in their psychometric properties, this study could provide these advances in motivation in sport.

Therefore, given the importance of developing more efficient data collection and evaluation processes, it is of interest to make progress in the construction of digital resources for this purpose. Furthermore, given the frequent use of specific questionnaires in the sports context, as occurs when researching motivational issues, it would be useful to have digital versions of certain questionnaires, such as the PMCSQ-2. Accordingly, the main objective of this study was to analyze the psychometric properties of the PMCSQ-2 in its digital format, which is hosted on the online psychosocial assessment platform MenPas 1.0, and validate a questionnaire that both individual and team sports can use. In addition, in order to ascertain the consistency of this questionnaire in different populations, as a secondary objective of the study, we analyzed invariance as a function of gender and type of sport.

## 2. Materials and Methods

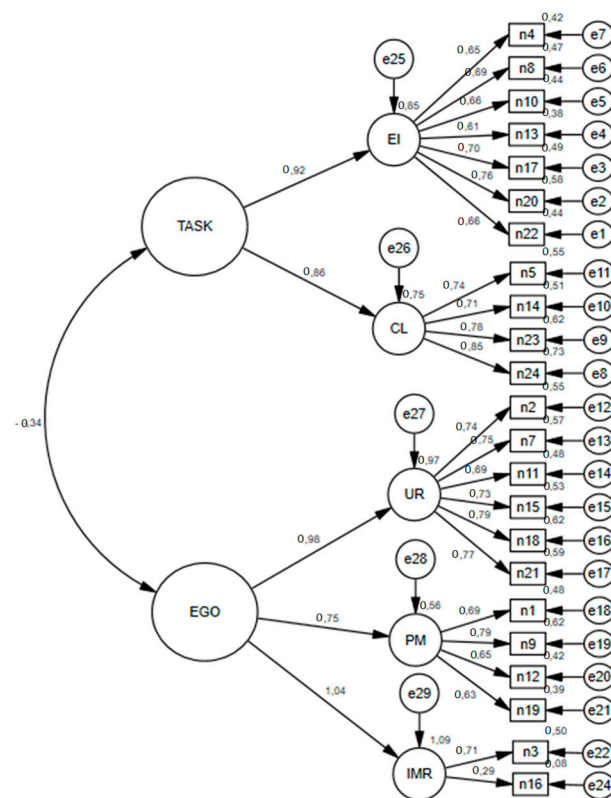
### 2.1. Participants

A total of 1637 Spanish athletes aged from 18 to 68 years ( $M = 24.39$ ,  $SD = 6.51$ ) were included in the sample. All of them were users of the MenPas platform and their data were collected between 13 February 2011 and 8 January 2021. Of these athletes, 37.8% were men and the remaining 62.2% were women. As regards to educational attainment, 80.9% had higher education, 16.2% secondary, 2.4% primary, and 0.5% no education. Overall, the members of the sample practiced sport regularly for various numbers of hours per week ( $M = 6.53$ ,  $SD = 5.21$ ), and 64.6% played individual sports and 5.43% played team sports.

### 2.2. Instrument

The PMCSQ-2 [5,12] is a questionnaire that assesses athletes' perception of the motivational climate created by the coach. In this study, we used the 24-item version validated by Balaguer et al. [5] in a sample of tennis players because this version allows us to compare

individual and team sports using the same questionnaire. It was administered in its digital version using the MenPas platform (Appendix A). Those being evaluated were asked to think about their general training environment and to perceive the way their coach acted (“in my training group . . .”). They were presented with statements describing coaches’ behaviors and asked to respond on a Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. As shown in the model in Figure 1, the PMCSQ-2 presents two climates: task-involving and ego-involving. On the one hand, the task-involving climate, with 11 items, comprises two subscales: effort/improvement, when the coach reinforces the development of skills and personal improvement, whose items are 4, 8, 10, 13, 17, 20, and 22 (e.g., “Players feel successful when they improve”), and cooperative learning, when the coach values collaboration among athletes, with items 5, 14, 23, and 24 (e.g., “Players help each other to learn”). On the other hand, the ego-involving climate, with 12 items, comprises three subscales: unequal recognition, when the coach pays more attention to more talented athletes, composed of items 2, 7, 11, 15, 18, and 21 (e.g., “The coach gives most of his/her attention to the stars”), punishment for mistakes, when the coach responds negatively to mistakes composed of items 1, 9, 12, and 19 (e.g., “The coach gets mad when a player makes a mistake”), and intra-team member rivalry, when the coach promotes competition among the athletes that make up the team with items 3, 6, and 16 (e.g., “The coach praises players only when they outplay the other players”).



**Figure 1.** Standardized individual parameters of PMCSQ-2 for the general sample in the alternative model with two scales and five subscales.

### 2.3. Procedure

The sample data were collected using the MenPas platform [25,27] from 13 February 2011 to 8 January 2021. On this platform, participants recorded their sociodemographic data and completed the PMCSQ-2 in the digital version. Access to the platform and handling of the data collected (apart from personal information) could only be performed by the person responsible for the application (one of the authors). In addition, the ethical principles of the Declaration of Helsinki [33] were respected throughout the research process. The work was approved by an ethics committee of the University of Malaga no. 19-2015-H.

#### 2.4. Statistical Analysis

First, the descriptive statistics of the data obtained were analyzed, including means, standard deviation, and bivariate correlations for all variables. In addition, a CFA through maximum likelihood estimation (MLE) was performed, based on the structure presented in the literature reviewed [5,11].

##### 2.4.1. Construct Validity

The model fit was performed through the following indices: chi-square ( $\chi^2$ ), degrees of freedom (df), the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square error of approximation (RMSEA) with its confidence interval (90% CI), and the standardized root mean square residual (SRMR). For CFI and TLI the cut-off point was  $\geq 0.90$  and for RMSEA and SRMR it was  $\leq 0.08$  [34–36]. After that, convergent validity was calculated using average variance extracted (AVE)  $\geq 0.50$  and discriminant validity was calculated using the AVE of each latent variable, which must be greater than the square of the correlation between them. Finally, internal consistency was calculated using Cronbach’s alpha coefficient and the estimate of the composite reliability index, both of which must exceed a value of 0.70 [34]. The analyses were performed using two statistical programs, IBM SPSS Statics, Version 23, and AMOS 23 (both IBM, Armonk, NY, USA).

##### 2.4.2. Multigroup Analysis

An invariance analysis was carried out to test the stability of the psychometric properties across the different groups. Two criteria were contrasted [35,37]; on the one hand, the model should be adjusted for each group and, on the other hand, four types of invariance should be examined: configural (the same item should be associated with the same factor in each group), metric (compares regression slopes or score changes), scalar (the scores of the different groups have the same unit of measurement and the same origin) and residual (group differences in the items are due only to differences in the factors). The values recommended in the literature are [38]: changes of  $\leq 0.01$  for CFI ( $\Delta$ CFI), changes of  $\leq 0.015$  for RMSEA ( $\Delta$ RMSEA), and changes of  $\leq 0.030$  for SRMR ( $\Delta$ SRMR). The AMOS 23.0 statistical program was used to perform the analyses.

### 3. Results

#### 3.1. Preliminary Analysis

No missing data were found in the sample. Further, no problems were found in the univariate normality distribution in the samples being data of  $\pm 2$  for skewness and  $\pm 7$  for kurtosis [35]. The Mardia’s coefficient of multivariate kurtosis analysis showed a violation of the normal distribution where the multivariate coefficient exceeded the value  $> 0.50$ , so a 2000 adjustment was performed on the sample for Bollen–Stine bootstrap [39].

#### 3.2. Construct Validity

Table 1 shows the AVE and convergent and discriminant validity. For AVE it presents a good fit in both task and ego, with AVE  $\geq 0.50$  [34]. Finally, for discriminant validity, the AVE for the factors should be higher than the square of correlations [34]. As shown in Table 1, this model presents discriminant validity since the AVE of each variable is greater than the square of the correlation ( $r^2 = 0.11$ ).

**Table 1.** Descriptive statistics, convergent validity and average variance extracted for the general sample.

Variables	Mean	SD	AVE	TASK	EGO
TASK	29.28	4.38	0.80	-	
EGO	13.61	4.98	0.87	−0.34 *	-

Note. SD = Standard Deviation; AVE = average variance extracted. \*  $p < 0.05$ .

Composite reliability is presented in Table 2 for all the factors and subscales, also, Cronbach's Alpha was carried out showing 0.90 for task and 0.90 for ego. They present good fit for all being  $\geq 0.70$  [34], except for intra-team member rivalry. The latter may be due to the factor loading of item 16; however, this item has been kept in the model for two reasons: its factor loading is significant (Table 2) and to maintain the greatest similarity with the original instrument because the model achieves a good fit without the need to eliminate the item.

**Table 2.** Factor loadings, error, and composite reliability of PMCSQ-2.

	General Sample		Male Sample		Female Sample		Individual Sample		Team Sample	
	$\lambda$	SE	$\lambda$	SE	$\lambda$	SE	$\lambda$	SE	$\lambda$	SE
Task	<i>0.88</i>		<i>0.92</i>		<i>0.87</i>		<i>0.92</i>		<i>0.91</i>	
Effort/improvement	<i>0.86</i>		<i>0.87</i>		<i>0.86</i>		<i>0.86</i>		<i>0.84</i>	
Item 4	0.65 *	0.05	0.65 *	0.08	0.65 *	0.06	0.66 *	0.06	0.62 *	0.09
Item 8	0.69 *	0.05	0.70 *	0.08	0.68 *	0.06	0.70 *	0.06	0.67 *	0.09
Item 10	0.66 *	0.04	0.62 *	0.07	0.69 *	0.05	0.69 *	0.06	0.62 *	0.07
Item 13	0.61 *	0.05	0.61 *	0.08	0.62 *	0.07	0.63 *	0.06	0.58 *	0.10
Item 17	0.70 *	0.05	0.67 *	0.08	0.72 *	0.06	0.70 *	0.06	0.69 *	0.09
Item 20	0.76 *	0.05	0.73 *	0.07	0.78 *	0.06	0.79 *	0.05	0.72 *	0.08
Item 22	0.66 *	0.05	0.71 *	0.08	0.64 *	0.06	0.65 *	0.06	0.69 *	0.09
Cooperative learning	<i>0.85</i>		<i>0.86</i>		<i>0.86</i>		<i>0.86</i>		<i>0.85</i>	
Item 5	0.74 *	0.04	0.70 *	0.07	0.76 *	0.04	0.75 *	0.04	0.72 *	0.07
Item 14	0.71 *	0.04	0.76 *	0.07	0.69 *	0.04	0.73 *	0.04	0.69 *	0.07
Item 23	0.78 *	0.04	0.80 *	0.07	0.78 *	0.05	0.78 *	0.05	0.79 *	0.07
Item 24	0.85 *	0.04	0.84 *	0.07	0.86 *	0.05	0.86 *	0.04	0.85 *	0.07
Ego	<i>0.95</i>		<i>0.95</i>		<i>0.96</i>		<i>0.92</i>		<i>0.91</i>	
Unequal recognition	<i>0.88</i>		<i>0.88</i>		<i>0.88</i>		<i>0.88</i>		<i>0.88</i>	
Item 2	0.74 *	0.03	0.72 *	0.06	0.76 *	0.04	0.75 *	0.04	0.72 *	0.06
Item 7	0.75 *	0.03	0.75 *	0.06	0.75 *	0.04	0.74 *	0.04	0.77 *	0.06
Item 11	0.69 *	0.03	0.71 *	0.06	0.68 *	0.04	0.69 *	0.04	0.69 *	0.06
Item 15	0.73 *	0.03	0.74 *	0.06	0.72 *	0.04	0.75 *	0.04	0.69 *	0.06
Item 18	0.79 *	0.03	0.79 *	0.06	0.79 *	0.04	0.81 *	0.04	0.74 *	0.06
Item 21	0.77 *	0.03	0.77 *	0.06	0.77 *	0.04	0.75 *	0.04	0.80 *	0.06
Punishment for mistakes	<i>0.79</i>		<i>0.77</i>		<i>0.79</i>		<i>0.80</i>		<i>0.73</i>	
Item 1	0.69 *	0.04	0.63 *	0.08	0.73 *	0.05	0.71 *	0.05	0.63 *	0.08
Item 9	0.79 *	0.05	0.76 *	0.09	0.80 *	0.05	0.80 *	0.05	0.72 *	0.09
Item 12	0.65 *	0.04	0.69 *	0.08	0.62 *	0.05	0.68 *	0.05	0.59 *	0.09
Item 19	0.63 *	0.04	0.64 *	0.08	0.62 *	0.05	0.62 *	0.05	0.60 *	0.08
Intra-team member rivalry	<i>0.42</i>		<i>0.48</i>		<i>0.36</i>		<i>0.42</i>		<i>0.41</i>	
Item 3	0.71 *	0.03	0.78 *	0.05	0.66 *	0.04	0.70 *	0.04	0.76 *	0.04
Item 16	0.29 *	0.03	0.32 *	0.05	0.26 *	0.04	0.31 *	0.04	0.21 *	0.03

Note:  $\lambda$  = standardized factor loadings; SE = standardized error; composite reliability coefficient is in italics; \*  $p < 0.01$ .

We performed a CFA to analyze the structure of the questionnaire based on the model already proposed in the literature [5] using model A1, composed of two factors with 11 and 12 items each, which offered a low fit (Table 3).

**Table 3.** Goodness-of-fit indices of the alternative model for the PMCSQ-2.

Model	$\chi^2$	df	$\chi^2/df$	B-S <i>p</i>	SRMR	CFI	TLI	RMSEA	90% CI
Previous models									
Walling et al. [20]	550.75	188	2.93	<0.001	0.11	-	-	-	-
Balaguer et al. [5]	632.11	229	-	<0.001	0.09	0.74	-	-	-
Newton et al. [12]-6 factors	1848	495	-	<0.001	-	0.72	-	0.10	-
Models of this study									
Two scales	2888.59	229	12.61	<0.001	0.07	0.85	0.85	0.08	0.082–0.087
Alternative	1858.89	224	8.30	<0.001	0.07	0.91	0.90	0.07	0.064–0.070
Women	1356.90	224	6.06	<0.001	0.07	0.90	0.89	0.07	0.067–0.074
Men	883.58	224	3.95	<0.001	0.07	0.90	0.89	0.07	0.064–0.074
Individual	1153.55	224	5.15	<0.001	0.07	0.92	0.91	0.06	0.059–0.066
Team	1008.92	224	4.05	<0.001	0.08	0.85	0.87	0.08	0.073–0.083

Note.  $\chi^2$  = chi-square; df = degrees of freedom;  $\chi^2/df$  = chi-normalized square; B-S *p* = level of significance Bollen–Stine bootstrap (2000) significance level samples; SRMR = standardized root mean square residual; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root mean square error of approximation; CI = confidence interval.

However, as cited in Duda and Whitehead [11], the analysis presents a better fit when the six scales (effort/improvement, important role, cooperative learning, unequal recognition, punishment for mistakes, and intra-team member rivalry) are considered because it explains the missing variance. So, adjusting this to the version of the PMCSQ-2 with 24 items instead of 29, a second-order model was proposed, in which two scales and five subscales are presented. This model showed thirteen items for the variable ego variable, distributed in three subscales (unequal recognition: 2, 7, 11, 15, 18, and 21; punishment for mistakes: 1, 9, 12, and 19; intra-team member rivalry: 3, 6, and 16) and eleven items for the task variable (effort/improvement: 48, 10, 13, 17, 20 and 22; cooperative learning: 5, 14, 23, and 24). Item 6 was eliminated because it had a factor weight of 0.27, which is lower than the recommended value (<0.50), as in Balaguer et al. [5]. As shown in Table 3, the analysis with the alternative model showed an adequate fit according to the criteria shown in the literature [34–36]. The final model is shown in Figure 1.

In addition to this, goodness-of-fit indices were also performed with the athletes who practiced team sports separately from those who practiced individual sports. The fit indices improved in the individual sports sample; however, they were significantly worse in the case of team sports, even failing to reach the adequacy level (Table 3).

### 3.3. Multigroup Analysis

All the indices for invariance are shown in the Table 4. The model analyzed presented good fits for invariance according to the indices shown by the authors [38], showing changes  $\leq 0.01$  in CFI ( $\Delta$ CFI),  $\leq 0.01$  in RMSEA ( $\Delta$ RMSEA), and  $\leq 0.015$  in SRMR ( $\Delta$ SRMR). For this purpose, the four types of invariance [38,39] mentioned earlier in the method section were analyzed.

**Table 4.** Goodness-of-fit indices of the gender invariance measures for PMCSQ-2.

Models	$\chi^2$	df	$\Delta\chi^2$	$\Delta df$	<i>p</i>	CFI	$\Delta CFI$	SRMR	$\Delta SRMR$	RMSEA	$\Delta RMSEA$
Men–Women											
CI	2240.50	448	-	-	<0.001	0.90	-	0.07	-	0.05	-
MI	2271.85	466	31.35	18	<0.001	0.90	0.00	0.08	0.01	0.05	0.00
SI	2275.71	469	35.21	21	<0.001	0.90	0.00	0.08	0.00	0.05	0.00
RI	2298.21	472	57.71	24	<0.001	0.90	0.00	0.08	0.00	0.05	0.00
Individual–team											
CI	2162.66	104	-	-	<0.001	0.90	-	0.08	-	0.05	-
MI	2183.95	86	21.29	18	<0.001	0.90	0.00	0.08	0.00	0.05	0.00
SI	2185.14	83	22.48	21	<0.001	0.90	0.00	0.08	0.00	0.05	0.00
RI	2186.19	80	23.53	24	<0.001	0.90	0.00	0.08	0.00	0.05	0.00

Note.  $\chi^2$  = chi-square; df = degrees of freedom;  $\Delta\chi^2$  = differences in chi-square values;  $\Delta df$  = differences in degrees of freedom; CFI = comparative fit index;  $\Delta CFI$  = differences in comparative fit index values; SRMR = standardized root mean square residual;  $\Delta SRMR$  = differences in standardized root mean square residual values; RMSEA = root mean square error of approximation;  $\Delta RMSEA$  = differences in root mean square error of approximation values; CI = configural invariance; MI = metric invariance; SI = scalar invariance; RI = residual invariance.

#### 4. Discussion

The main objective of this study was to analyze the psychometric properties and invariance, between genders and between types of sport, of the PMCSQ-2 in its online version. In addition, internal consistency and convergent and discriminant validity were also analyzed to explore its psychometric properties in greater depth.

##### 4.1. Construct Validity

First, CFA of the data revealed that with the sample in this study, the structure offered by the two-factor model of Balaguer et al. [5] did not provide an adequate fit. Thus, it was necessary to adjust the structure according to the original model offered by Newton et al. [12], dividing each factor into subscales and trying to respect the PMCSQ-2 questionnaire as much as possible. Finally, we obtained a good fit, which validates the online version of the PMCSQ-2 and, in turn, opens up the possibility of giving more importance to the five subscales within the task factor (effort/improvement, cooperative learning) and the ego factor (unequal recognition, punishment for mistakes, and intra-team member rivalry). Then, to improve the model fit, the structure used included the five subscales as in Walling et al. [20]. These results suggest that it may be important to have a more focused perspective, paying more attention to the subscales than to the two main scales.

Convergent validity showed a good fit, indicating that the items were related to their factors. The internal consistency values showed good fit except for the subscale of intra-team member rivalry subscale, which was affected by the factor weight of item 16. Discriminant validity also showed good indicators because the square of the relationship between task and ego was lower than the AVE of each, indicating that each scale is sufficiently different from the other for them to be taken as individual constructs [34]. This same independence factor was also found by Balaguer et al. [5].

The results also showed higher CFIs and lower SRMR and RMSEA fit indices than the previous versions, thus obtaining better fits to the questionnaire. Reliability indices showed higher results too, going from 0.87 for task and 0.83 for ego in the paper version [5] to 0.88 for task and 0.95 for ego in the digital version (this study).

##### 4.2. Multigroup Analysis

Invariance analysis is a very important aspect of the analysis of psychometric properties [37,40], as it shows whether there is variability when the questionnaire is applied to different populations. The analyses showed invariance with adequate fit for the two groups, women and men, and for the individual and team groups. First, the same items were associated with the same factors (configural invariance). Second, the items were



associated with each factor in the same way, with no change in scores (metric invariance). Third, the scores of the two groups had the same unit of measurement and the same origin (scalar invariance). Finally, the differences in the items for each group are due only to the factors (residual invariance). In other words, these analyses indicate that the questionnaire can be used in both female and male populations, as well as in both individual and team sports. In short, it shows that the PMCSQ-2 items have the same meaning for the female sample as for the male sample, as well as for individual and team sports [38]. On the other hand, the analysis showed worse fit for the team sports sample when separated from individual sports. This may be due to the smaller sample of team sports.

#### 4.3. Limitations and Future Research

On the one hand, the limitations of this study were the possible errors in online collection, in which people may not answer honestly, may be doing another task at the same time, or may have doubts about questions in the questionnaire without being able to obtain clarification, or there may be loss of information due to computer failures. However, these limitations are offset by the large number of participants in the study, and they could be solved by using a deeper MenPas analysis, such as item response order/time [28]. Another way of solving this problem could be to add an option in which participants could write doubts or suggestions about the meaning of the questions, so that the examiner could take them into account. On the other hand, another limitation is the difference between the number of participants of each age, with most users being between 20 and 25 years old. This may be due, among other reasons, to the fact that many of the questionnaires are collected at university. Therefore, to avoid sampling bias, it would be advisable to homogenize the sample in future research. Another important limitation, for the purposes of obtaining a more complete view of team sports, is the use of only one questionnaire, which does not include the important role subscale introduced in the 29 item version of the PMCSQ-2 [12]. However, in our present study the use of only one instrument for both samples was also a strength too, because it allowed us to compare the results between two samples with the same questionnaire. Finally, future research could focus on continuing to validate questionnaires in digital versions and continue working along these lines to achieve greater development of data collection and analyze the different variables included in this study related to motivation, such as gender, age, sport, or educational attainment.

#### 4.4. Strengths of the Study and Practical Implications

Despite the limitations mentioned above, this study has several strengths that demonstrate its importance. The results offered above could make some differences in the field of evaluation. As mentioned in the introduction, COVID-19 poses new challenges for data collection [26] and online tools could help these problems by saving time and resources and increasing numerical data collection capacity or research sustainability [25,27]. Given that pandemics could appear more frequently [30], validation of the online PMCSQ-2 is likely to offer a future solution. In addition, the study shows rates closer to 1 in terms of reliability compared to previous paper-based studies (from 0.87 in task and 0.83 in ego in the paper version [5] to 0.88 in task and 0.95 in ego in this study), so it may indicate the benefits of its use in an online version. Moreover, the task-involving climate is associated with positive attitude, resilience, effective emotion regulation, and better self-concept [14,16], so the PMCSQ-2 could be useful to help athletes, teams, or coaches in assessing motivation to find higher quality of life and enjoyment in their training. Lastly, the online PMCSQ-2 could be used to improve research speed because of the number of people it can assess, and these results could be used to create different programs to train or motivate skills.

## 5. Conclusions

In conclusion, the questionnaire presents a good psychometric fit for the online sample, with higher fit and reliability indices than the paper version, indicating that it is a good instrument for assessing the perceived motivational climates in a digital form. In addition,

it shows good psychometric properties, and the degrees of fit indicate that the questionnaire can be used to compare both between genders (men and women) and between types of sport (individual and group). These results may be very important to enable us to study how athletes perceive the motivational climates created by their coaches and to propose training programs to teach coaches how to create a task-involving climate, as this will increase the enjoyment and the competence of their athletes, as well as their intention to continue practicing their sport [6,20,23,41]. Moreover, the validation of only one questionnaire for two different types of sport (individual and team sports) makes it easier to use when comparing the two. It is also important nowadays due to the impossibility of gathering large numbers of people in the same space because of the risk of COVID-19. This questionnaire could decrease risk, time, and expense in both research and individual application.

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**Institutional Review Board Statement:** The study was approved by the Ethics Committee of the University of Málaga. It followed the indications of the Declaration of Helsinki [33], the Note for Guidance on Good Clinical Practice for Trials on Medicinal Products in the European Community (document 111/3976/88 of July 1990), and Spanish legal regulation of clinical research in humans (Royal Decree 561/1993).

**Informed Consent Statement:** Informed Consent (Law 15/1999 of December 13 on Personal Data Protection <LOPD>) appears in the conditions accepted when registering on the MenPas platform, so users registered on the platform authorize the incorporation and processing of data as an electronic file owned by MenPas.

**Data Availability Statement:** Data is available on request from the authors.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

CUESTIONARIO DE CLIMA MOTIVACIONAL PERCIBIDO EN EL DEPORTE (PMCSQ-2)  
Las afirmaciones que figuran a continuación describen como trabajan los entrenadores. Piensa sobre cómo es tu ambiente de entrenamiento EN GENERAL e indica a continuación como percibes la forma en la que entrena tu entrenador. Seleccione el número que mejor refleje su opinión, según la siguiente escala:

1. Muy en desacuerdo.
2. En desacuerdo.
3. Neutro.
4. De acuerdo.
5. Muy de acuerdo.

RECUERDE QUE NO HAY RESPUESTAS BUENAS O MALAS, ÚNICAMENTE SE TRATA DE CONOCER SU OPINIÓN  
EN MI GRUPO DE ENTRENAMIENTO . . .

1. El entrenador se enfada cuando falla un jugador
2. El entrenador presta más atención a los jugadores estrella
3. El entrenador solo felicita a los jugadores cuando destacan unos de otros
4. Los jugadores se sienten bien cuando intentan hacerlo lo mejor posible
5. Los jugadores se ayudan entre sí para aprender
6. Se anima a que los jugadores compitan entre sí
7. El entrenador tiene sus jugadores preferidos

8. El entrenador ayuda a mejorar a los jugadores en los aspectos en los que no son buenos
9. El entrenador grita a los jugadores cuando fallan
10. Los jugadores sienten que han tenido éxito cuando mejoran
11. Sólo los jugadores con mejores resultados reciben felicitaciones
12. Los jugadores son castigados cuando fallan
13. Se premia el esfuerzo
14. El entrenador anima a que los jugadores se animen unos a otros para aprender
15. El entrenador deja claro quiénes son los mejores
16. Los jugadores se motivan cuando juegan mejor que sus compañeros
17. El entrenador le da importancia al esfuerzo personal de los jugadores
18. El entrenador solo se fija en los mejores jugadores
19. Los jugadores tienen miedo a fallar
20. Se anima a que los jugadores mejoren en sus puntos flacos
21. El entrenador favorece a algunos jugadores más que a otros
22. El entrenador le da importancia a que los jugadores mejoren en cada partido o en cada entrenamiento
23. Los jugadores trabajan conjuntamente como equipo
24. Los jugadores se ayudan a mejorar y a superarse

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