

Refining the short version of the Leadership Scale for Sports: factorial validation and measurement invariance

Pedro Teques
Carlos Silva
António Rosado
Luis Calmeiro
Sidónio Serpa

Teques, P., Silva, C., Rosado, A., Calmeiro, L., & Serpa, S. (2020). 'Refining the short version of the Leadership Scale for Sports: factorial validation and measurement invariance'. *Psychological Reports*.

DOI: <https://doi.org/10.1177/0033294120953560>

© the authors 2020

Information for Users of the Institutional Repository

Users who receive access to an article through a repository are reminded that the article is protected by copyright and reuse is restricted to non-commercial and no derivative uses. Users may also download and save a local copy of an article accessed in an institutional repository for the user's personal reference. For permission to reuse an article, please follow our [Process for Requesting Permission](#).

Running head: LSS SHORT-VERSION

Refining the short version of the Leadership Scale for Sports: Factorial validation and
measurement invariance

Pre-production draft

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

Abstract

The purpose of this investigation was to examine the factorial validity and measurement invariance of the short version of the Leadership Scale for Sports (LSS; Chelladurai & Saleh, 1980): coaches' perceptions of their own behavior, athletes' preferences and athletes' perceptions of their coaches' behavior. This validation will allow researchers to minimize time demands on participants. Three independent samples of athletes ($n_1 = 373$; $n_2 = 817$; $n_3 = 246$) and two samples of coaches ($n_1 = 115$; $n_2 = 351$) were studied to examine the factorial validity and measurement invariance of the 25-item version of the LSS (LSS-25; Chiu et al., 2016). Findings indicated that a 15-item version (LSS-15) fits the data better than the LSS-25. The LSS-15 showed factorial validity and proved to have adequate reliability, convergent validity and discriminant validity. Multiple-group confirmatory factor analysis showed that its factor structure was invariant across two independent samples and across gender for athletes' perceived and preferred versions. Significant relationships between the LSS-15 subscales and athlete satisfaction also demonstrate criterion validity. These findings support a valid and reliable alternative to the original LSS long-form, especially in applied settings when time constraints require a brief measure of leadership or when study designs include multiple variables.

Keywords: confirmatory factor analysis, factorial validity, leadership, multi-group factor analysis, reliability.

20 Refining the short version of the Leadership Scale for Sports: Factorial validation and
21 measurement invariance

22 The aim of this investigation is to test the factorial validity and measurement
23 invariance of a short version of the Leadership Scale for Sports (LSS; Chelladurai &
24 Saleh, 1980) across two independent samples and across gender. Acknowledged as a
25 leading multidimensional leadership measurement instrument (Chelladurai, 2007;
26 Chelladurai, & Riemer, 1998), the original 40-item LSS is composed of three versions,
27 which evaluate the coaches' perceptions of their own behavior, the athletes' preferences
28 of their coaches' behavior and the athletes' perceptions of their coaches' behavior. Each
29 version define five leadership constructs and is composed by 40 items making the LSS a
30 lengthy instrument to be utilized in practice and applied research (see Appendix). To
31 avoid this constraint, recently Chiu, Rodriguez, and Won (2016) validated a short 25-item
32 version (LSS-25) using exploratory structural equation modeling. This was an important
33 contribution to the literature as in many scenarios the use of the full 40-item measures
34 may not be feasible. An LSS short version may be beneficial in applied settings because
35 it reduces the time required for participants to complete the instrument or the total number
36 of items needed to test models that include several variables.

37 Despite the valuable contributions of the 25-item LSS (Chiu et al., 2016), the
38 psychometric development of a scale is an ongoing process. Indeed, Chiu et al.
39 highlighted the relevance of future studies to validate the short version across independent

40 samples and in different genders. Measurement invariance analysis is important for the
41 psychometric development of an instrument as it allows researchers to make suitable
42 comparisons of the data across groups (e.g., gender) (Marsh, Ellis, Parada, Richards, &
43 Heubeck, 2005). Additionally, Chiu et al. examined only the athletes' perceived version
44 of LSS (see Appendix for a description of Chiu et al.'s 25-item LSS). Thus, the present
45 study expands the initial development of the LSS-25 by examining the factorial validity
46 and measurement invariance across gender of the three LSS versions: coaches'
47 perceptions of their own behavior and athletes' preferences and perceptions of their
48 coaches' behavior.

49 **The multidimensional model of leadership**

50 Chelladurai's multidimensional model of leadership provides a framework for
51 understanding leadership effectiveness in sports (Chelladurai, & Saleh, 1980; Chelladurai
52 & Carron, 1983; Chelladurai, 1993, 2007). It contains three domains of the leader's
53 behaviors – required, preferred, and actual – and suggests that leadership effectiveness
54 depends on a series of interactions between the characteristics of the leader,
55 characteristics of the group members and situational constraints. According to the
56 authors, behavior occurs in a dynamic context, where antecedent factors, such as leader
57 and member characteristics, will impact actual leader behaviors and member preferences
58 for leadership behaviors. The model stresses the importance of congruence between

59 actual, required and preferred behaviors in predicting athletes' satisfaction with their
60 sporting experience and performance.

61 The 40-item LSS was developed to estimate leadership behavior and examine the
62 hypothesized associations within the Multidimensional Model of Leadership (MML; e.g.,
63 Chelladurai & Saleh, 1980). This model contains five dimensions of leadership behavior:
64 training and instruction, social support, autocratic, democratic, and positive feedback.
65 Originally, Chelladurai and Saleh (1980) suggested that training and instruction (13
66 items) represents important functions of the coach, such as explaining the techniques and
67 tactics of sport or instructing athletes on how to improve their performance. Social
68 support behavior (8 items) is characterized by the actions of the coach that aim at
69 satisfying the psychosocial needs of the athletes by creating a supportive climate amongst
70 team members. The autocratic behavior (5 items) and democratic behavior subscales (9
71 items) reflect the decision style of the coach: while the autocratic behavior reflects the
72 coach's reluctance in sharing the decision-making with the athletes, the democratic
73 behavior reflects the coach's openness in sharing those same decisions. Finally, positive
74 feedback behavior (5 items) indicates the coach's competence in rewarding the athletes'
75 efforts and performance.

76 The psychometric analysis of LSS (Chelladurai & Riemer, 1998) suggests that
77 internal reliability coefficients vary between .70 and .80 for training and instruction,
78 social support, democratic, and positive feedback behavior subscales. In contrast, internal

79 reliability coefficients below the acceptable value of .70 (Nunnally & Bernstein, 1994)
80 were found in some subscales (e.g., Kwon, Koh, Pyun, & Wang, 2009; Kwon, Pyun, Han,
81 & Ogasawara, 2011). These internal reliability coefficients have been higher for the
82 athletes' perception versions of the LSS, in comparison to the coaches' self-perception
83 and athletes' preference versions of the LSS across various studies.

84 Considering construct validity, studies using confirmatory factor analysis (e.g.,
85 Chelladurai & Riemer, 1998; Fletcher & Roberts, 2013) have found support for the 5-
86 factor structure of the LSS. Specifically, Chelladurai and Riemer (1998) demonstrated
87 that the hypothesized structure of both perceived and preferred versions of the LSS in
88 young athletes had a good model fit (RMSEA = .060 and .062, respectively). However,
89 other indices were less than adequate (e.g., TLI = .83 and .77). Other researchers (e.g.,
90 Fletcher & Roberts, 2013; Kwon et al., 2009) reported lower values than the
91 recommended thresholds for TLI and CFI (< .90) and RMSEA (>.08) indices in the
92 perception version of the LSS. Additionally, Fletcher and Roberts (2013) found partial
93 longitudinal invariance for the 5-factor structure across four time periods, and Kwon et
94 al. (2009) reported unsuitable convergent validity, based on factor loadings lower than
95 the cutoff value of .50.

96 Taken together, this pattern of results suggests a low fit of the factorial structure of
97 the LSS. Thus, we followed recommendations within the recent literature that support the
98 use of more sophisticated approaches combining hierarchical relationships between

99 variables, analysis of measurement models, and larger samples to test the five-factor
100 model of the LSS (Chiu et al., 2016; Fletcher & Roberts, 2013).

101 **The present research**

102 This research was designed to examine a short form of the three Leadership Scale
103 for Sports (LSS) versions – coaches' perceptions of their own behavior and athletes'
104 preferences and perceptions of their coaches' behavior. We used the original LSS
105 developed by Chelladurai and Saleh (1980) and the recent 25-item version of the athletes'
106 perceptions of their coaches' behavior version of the LSS by Chiu et al. (2016). To
107 strengthen the psychometric development of the LSS, the present study also analyzes the
108 measurement invariance of the coaches' self-perceptions and the athletes' preferences and
109 perceptions of coaches' behavior scales across gender. Accordingly, we developed three
110 studies. In Study 1, the five-factor structure of the original 40-item (Chelladurai & Saleh,
111 1980) and the short 25-item (Chiu et al., 2016) LSS versions were examined using
112 confirmatory factor analysis (CFA). In Study 2, we cross-validated the factor structure
113 previously demonstrated with an independent sample. We also aimed at determining the
114 degree to which the hypothesized model was invariant between genders. In Study 3, the
115 criterion-related validity was tested by examining the associations between the factor
116 structure of the LSS, defined in the previous studies, and athlete's satisfaction. All
117 analyses were executed for each version of the actual coach behavior, perceived coach
118 behavior, and preferred coach behavior.

119

Study 1

120

121

122

123

124

Following the guidelines for testing short versions (Marsh et al., 2005), we utilized an archive sample of responses to the original 40-item LSS (Chelladurai & Saleh, 1980) to examine the factorial validity of the 25-item versions of LSS (Chiu et al., 2016): actual coach behavior, perceived coach behavior, and preferred coach behavior.

Method of Study 1

125

Participants and procedures

126

127

128

129

130

131

132

133

134

The sample was composed by 373 athletes (224 females, 149 males; $M = 22.67$ years old, $SD = 7.45$, ranged from 10 to 46 years old) and their 115 coaches (62 females, 53 males; $M = 37.41$ years old, $SD = 8.82$, ranged from 23 to 55 years old) who had completed the original 40-item version of the LSS. The sample belonged to an archive of data collected between 2005 and 2011. Participants were from the central coastal region of Portugal, and were involved in different levels of competition, including youth, junior, semi-professional, and professional team sports: soccer (54.4%), volleyball (11%), handball (28.2%), and basketball (6.4%). Participants had been involved with their team for about 2 years ($M = 2.45$ years, $SD = 1.10$).

135

Measures

136

137

138

The Portuguese coach self-perceived, athlete perceived and athlete preferred leader behavior versions of LSS (Serpa, 1993; Serpa, Pataco, & Santos, 1991) were used. All three versions include 40 items divided into five subscales. The Training-Instruction

139 behavior subscale examines coaches' focus on training, skill instruction and sport
140 strategies. The Social Support subscale measures coaches' actions to create a supportive
141 team atmosphere. The Positive Feedback subscale examines coaches' abilities to provide
142 positive and encouraging performance feedback. Finally, the Democratic and Autocratic
143 subscales evaluate the degree to which coaches share sport-related decision-making with
144 their athletes or tend to maintain control of all decisions, respectively. Participants
145 respond on a 5-point Likert scale that range from 0 to 4, i.e., (4) *always* (100% of the
146 time); (3) *often* (75%); (2) *occasionally* (50%); (1) *seldom* (25%), and (0) *never* (0%).

147 **Statistical analysis**

148 A confirmatory factor analysis (CFA) was conducted with AMOS 20 (SPSS Inc,
149 Chicago IL) using maximum likelihood structural modelling procedure. The
150 appropriateness of the data of the overall models was evaluated through recommended fit
151 indexes (Hair, Black, Babin, Anderson, & Tatham, 2014). Specifically, a good model fit
152 was assumed when the comparative-of-fit-index (CFI) and Tucker-Lewis index (TLI)
153 were larger than .90. A root mean square error of approximation (RMSEA) value lower
154 than .06 was indicative of good fit while an acceptable fit was assumed for values between
155 .08 and .10. Reliability was estimated through Cronbach's α coefficients ($> .70$ criterion;
156 Nunnally & Bernstein, 1994). Because the Cronbach's α coefficient tends to
157 underestimate the scales reliability, composite reliability was also estimated (Raykov,
158 1997). Convergent validity was accepted when the average variance extracted (AVE)

159 showed values greater than .50. Finally, discriminant validity was assumed when the
160 squared correlation between constructs were below AVE estimates for each construct
161 (Hair et al., 2014).

162 **Results of Study 1**

163 Preliminary analysis revealed 0.9% of missing data but no apparent pattern was
164 observed. Data imputation was calculated using a maximization algorithm (Graham &
165 Hofer, 2000). As there are concerns about the cognitive ability of participants younger
166 than 12 years of age to understanding the items (Scott, 2008), we tested potential mean
167 differences in the 5-factors of athletes' perceptions and preferences versions of LSS
168 between the age groups of 9 to 12 ($n = 41$) and 13 to 46 ($n = 332$) years old . No significant
169 differences were found in all 5-factors of LSS between these age groups ($p > 0.05$).

170 Additionally, Mardia's coefficients were above the recommended threshold for
171 multivariate normality (Byrne, 2010): 16.19, 18.40, and 62.10 for the coach self-
172 perceived behavior, the athletes' perceived coach behavior, and the athletes' preferred
173 coach behavior versions, respectively. Thus, the Bollen-Stine bootstrap (B-S) on 2000
174 samples was applied to the subsequent analysis.

175 **Construct validity**

176 The original 40-item LSS model demonstrated a poor fit to the data for all scales
177 (Table 1): coach self-perceived behavior (e.g., CFI = .802, RMSEA = .112), athlete

178 perceived coach behavior (e.g., CFI = .854, RMSEA = .096), and athlete preferred coach
179 behavior (e.g., CFI = .862, RMSEA = .093).

180 Following Chiu et al. (2016), we also tested the 25-item model and results revealed
181 an adjustment to the data below the cutoff values: coach self-perceived behavior (e.g.,
182 CFI = .834, RMSEA = .093), athlete perceived coach behavior (e.g., CFI = .886, RMSEA
183 = .091), and athlete preferred coach behavior (e.g., CFI = .891, RMSEA = .082) (Table
184 1). An analysis of the modification indexes revealed items with factor loadings below the
185 recommended values ($< .50$; Hair et al., 2014) in all subscales. Moreover, reliability
186 coefficients for the coach self-perceived and athlete perceived autocratic behavior and
187 social support subscales were also below the recommended values ($< .70$). The
188 readjustment led to a 15-item solution for the three versions with three items in each
189 dimension.

190 The results obtained for the 15-item models indicated an acceptable fit to the data:
191 coach self-perceived behavior (e.g., CFI = .913, RMSEA = .072), athlete perceived coach
192 behavior (e.g., CFI = .967, RMSEA = .046), and athlete preferred coach behavior (e.g.,
193 CFI = .968, RMSEA = .042). In general, both CFI and TLI values met the good fit criteria
194 while RMSEA was indicative of an acceptable fit (see Table 1).

195 [TABLE 1]

196 For each 15-item LSS scales, all items showed moderate to high factor loadings:
197 for the coaches' self-perceived version the factor loadings ranged from .63 (item 2 of

198 Democratic Behavior) to .86 (item 2 of Positive Feedback); for the athletes' perceived
199 coach behavior version, factor loadings ranged from .64 (item 1 of Autocratic behavior)
200 to .91 (item 2 of Training and Instruction), and for the athletes' preferred coach behavior
201 version, factor loadings ranged from .60 (item 3 of Autocratic Behavior) to .93 (item 1 of
202 Positive Feedback), as indicated in the Table 2.

203 [TABLE 2]

204 **Reliability, and convergent and discriminant validity of Study 1**

205 Table 3 shows the descriptive statistics and correlations between the 15-item LSS
206 subscales. Convergent validity was accepted for all subscales as AVE values ranged from
207 .51 (athletes' perceived and preferred autocratic coach behaviors) to .83 (athletes'
208 preferred positive feedback coach behaviors). Discriminant validity was assumed for
209 AVE values greater than the squared correlation between constructs for each LSS short
210 versions. The Cronbach α coefficients of .75 (athlete's perceived and preferred autocratic
211 coach behaviors) and .93 (athlete's preferred positive feedback coach behaviors) support
212 the constructs' reliability. Composite reliability values slightly above those of the
213 corresponding Cronbach's α confirm the subscales reliability, with values ranging from
214 .76 (athlete's perceived and preferred autocratic coach behaviors) to .94 (athlete's
215 preferred positive feedback coach behaviors)

216 [TABLE 3]

217 **Implications of Study 1**

218 The aim of Study 1 was to examine the factorial validity of the 25-item versions
219 (Chiu et al., 2016): actual coach behavior, perceived coach behavior, and preferred coach
220 behavior. For this purpose, an archive sample of responses to the original LSS versions
221 was used to test validity and reliability of the short LSS 5-factor structure. Findings
222 showed that the 25-item version did not fit the data. Based on modification indices, an
223 adjustment was made to the factorial structure, resulting in a 15-item version of LSS (see
224 Appendix). This LSS-15 showed acceptable factorial structure, and the modified solution
225 was consistent with MML (Chelladurai, 2007). Reliability and convergent and
226 discriminant validity estimates provide additional support for the psychometric
227 characteristics of the 15-item LSS. Overall, these results support the need for the
228 structural refinement of the 25-item version in the three versions of the LSS, resulting in
229 a shorter 15-item version with stronger psychometric qualities.

230 **Study 2**

231 Following the initial development of the LSS-15, the purpose of study 2 was to test
232 its factor structure measurement invariance across two independent samples and across
233 gender.

234 **Method of Study 2**

235 **Participants and procedures**

236 The sample of Study 2 involved 817 athletes (297 females, 520 males; $M = 17.58$
237 years old, $SD = 7.13$, ranging from 9 to 40 years old) and 351 coaches (102 females, 249

238 males; $M = 28.69$ years old, $SD = 8.58$, ranging from 19 to 64 years old). Participants in
239 study 2 were from the north region of Portugal. They had been part of their current team
240 for an average of 3.1 years ($SD = 1.25$) and represented a variety of competitive team
241 sports: soccer (55%), volleyball (12.1%), handball (12.9%), basketball (12.1%), and rink
242 hockey (7.9%). Most teams practiced 3 or 4 times per week (53%).

243 Following ethical approval from the university's ethical committee, research
244 assistants trained in ethical principles regarding research involving human subjects,
245 contacted several clubs and sport federations. Athletes completed the measures including
246 perceived and preferred coach leadership behavior. Coaches completed the self-perceived
247 version of coach behaviors. Participants completed the questionnaires at the beginning or
248 at end of a training session. Considering concerns about the quality of responses to LSS
249 by children under the age of 12, we followed procedures used in other studies (e.g.,
250 Marcén, Gimeno, & Gómez, 2016; Martin, Jackson, Richardson, & Weiller, 1999) and
251 read them each item out loud ($n = 38$). Data collection took place between 2015 and 2017.
252 Data collection quality control was assured by a randomized post contact to participants
253 through e-mail by the first two authors.

254 **Measures**

255 The self-perceived coach behavior, athlete perceived, and preferred coach behavior
256 15-item versions tested in Study 1 were used in Study 2. All three short versions included
257 five subscales (Training and Instruction, Democratic Behavior, Autocratic Behavior,

258 Social Support, and Positive Feedback), each composed of three items. The response
259 categories ranged from 0 to 4, i.e., (4) *always* (100% of the time); (3) *often* (75%); (2)
260 *occasionally* (50%); (1) *seldom* (25%), and (0) *never* (0%).

261 **Statistical analysis**

262 A multigroup CFA was performed to test the model invariance based on responses
263 to the LSS-15 used in the Study 1 and Study 2 (Byrne, 2010). The chi-square (χ^2) test of
264 significance and CFI difference (Δ CFI) values were used to examine the invariance
265 between nested models (Cheung & Rensvold, 2002). Invariance is assumed if χ^2 for model
266 comparison is not statistically significant; however, χ^2 is influenced by sample size, thus
267 changes in the Δ CFI greater than .01 were also considered when testing the measurement
268 invariance between groups (Cheung & Rensvold, 2002). This test follows a sequential
269 order of nested models, including the Model 1 - unconstrained, the Model 2 - constrained
270 factor loading, and Model 3 - constrained factor variances-covariances. This statistical
271 procedure was used for all three LSS-15 scales.

272 **Results of Study 2**

273 As in Study 1, due to concerns about the cognitive ability of children under 12 years
274 old to understanding the items (Scott, 2008), possible differences between participants
275 aged less or equal 12 years old ($n = 38$) and over 12 years old ($n = 779$) were tested. No
276 statistically significant differences were found in all factors of the LSS-15 ($p > 0.05$).

277 **Cross-validation**

278 We tested whether the 15-item version generalize to a cross-validation sample. In
279 the initial Model 1, the *a priori* factor structure was fitted separately for each version with
280 no invariance constraints and it showed good fit indexes (see Table 1). The Model 2
281 factorial loadings was constrained to be equal across the two samples for the coaches'
282 self-perceived behavior, athletes perceived coach behaviors, and preferred coach
283 behaviors (i.e., $\Delta CFI \leq .01$) versions. In Model 3, the χ^2 results ($p < .05$) suggest that this
284 model exceeds the invariance criterion for coaches' self-perceived behavior, $\chi^2(200) =$
285 543.38 , $p = .000$, athletes perceived coach behaviors, $\chi^2(200) = 578.43$, $p = .001$, and
286 preferred coach behaviors, $\chi^2(200) = 472.35$, $p = .002$. However, in general models fit
287 show no substantial decrease (e.g., $RMSEA \leq .07$), with the exception of the difference
288 between Model 1 and Model 3 of the coaches' self-perceived behavior version, which
289 was significantly worse (Table 1). The relatively small sample of coaches in Study 1 (n
290 $= 115$) may potentiate inaccurate bootstrapped results (Yung & Bentler, 1996).
291 Nevertheless, the factor variance and covariance non-invariance suggest that the results
292 from the coaches' version must be carefully analyzed in future studies.

293 Table 4 shows factor loadings, composite reliability, and average variance extracted
294 of the cross-validation sample. All of the LSS-15 items presented moderate to high factor
295 loadings ranging from .55 (item 1 of autocratic behavior) to .91 (item 1 of democratic
296 behavior). Also, composite reliability values of .73 (coaches' self-perception of
297 Autocratic behavior) and .87 (coaches' self-perception of democratic behavior) provide

298 evidence for the subscales reliability. Average variance extracted (AVE) values
299 demonstrated convergent validity for all LSS-15 subscales ($> .50$; Hair et al., 2014),
300 except for the autocratic behavior subscale of the coach's self-perception version which
301 revealed a marginal value of .48.

302 [TABLE 4]

303 **Gender invariance**

304 To analyze the gender invariance, the samples from Study 1 and Study 2 were
305 combined to obtain a set of female and male athletes (521 and 669, respectively) and
306 coaches (164 and 302, respectively). A multigroup CFA was performed to test gender
307 invariance. The unconstrained model showed very good fit for both female and male
308 groups for the coaches' self-perceived behavior, athletes perceived coach behaviors, and
309 preferred coach behaviors versions. Also, the constrained Model 2 factor loadings was
310 invariant across gender in all three LSS-15 scales (i.e., $\Delta CFI \leq .01$); however, the
311 constrained Model 3 factor variances-covariances revealed significant differences across
312 gender in the coaches' self-perceived behavior and athletes preferred coach behaviors
313 models (i.e., $\Delta CFI \geq .01$). Table 1 shows the information pertaining to gender
314 measurement invariance in all three LSS-15.

315 **Implications of the Study 2**

316 The aim of Study 2 was to test the measurement invariance of the 15-item version
317 of LSS across two independent samples (i.e., cross-validation) and across gender. This

318 study provides a first to verify the LSS-15 measure invariance of the self-perceived coach
319 behavior, athlete perceived, and preferred coach behavior. Findings support the factor
320 loadings invariance of all versions across two independent samples and across gender,
321 which suggests that the factors are assessed similarly by participants in both groups.
322 However, the constrained factor variances-covariances revealed differences across
323 independent samples in the coaches' self-perceived behavior version, and across gender
324 in the coaches' self-perceived behavior and athletes preferred coach behaviors versions.
325 This means that one group tends to answer systematically with higher or lower values to
326 certain items in comparison to the other group. In general, these psychometric findings
327 show that athletes perceived version of LSS-15 operates equally across all groups, but
328 precautions should be taken with eventual score bias in the responses of coaches' self-
329 perceived and athletes preferred scales of the LSS-15.

330 **Study 3**

331 After the assessment of reliability, factorial, convergent and discriminant validities
332 (Study 1), and measurement invariance (Study 2), Study 3 aims at determining the
333 criterion validity of the LSS by examining its relationships with athletes' satisfaction.
334 Chelladurai (1993; 2007) developed the congruence hypothesis by stating that athletes'
335 satisfaction with their sport experience is stronger when the athletes' perceptions of their
336 coach behaviors match athletes' preferences for their coach's behavior. The congruence
337 hypotheses has been supported significant associations between athletes' satisfaction and

338 their preferences and perceptions of leader behaviors (e.g., Andrew, 2009; Riemer &
339 Chelladurai, 1995). As such, a structural equation model was used to test the extent to
340 which preferences and perceptions of the leader's behaviors are associated with athletes'
341 satisfaction.

342 **Participants and procedures**

343 Participants were 246 male soccer players with ages ranging from 18 to 35 years
344 ($M_{\text{age}} = 22.68$, $SD = 3.58$). The respondents competed in regional leagues of the north
345 region of Portugal. Participants reported 7 to 19 years of experience playing soccer ($M =$
346 13.06 , $SD = 3.94$), and partaking in 4 to 5 training sessions per week.

347 Team managers from 14 soccer clubs were contacted to obtain permission to meet
348 with their athletes. Athletes were then informed about the purpose of study as well as their
349 rights for voluntary participation and confidentiality. Athletes completed the
350 questionnaires at the beginning or at the end of a training session. The data collection was
351 conducted during 2017 and 2018. Procedures of this Study 3 were identical to those used
352 in Study 2.

353 **Measures**

354 **LSS-Short Version.** The athletes' perceived and preferred coach behavior of the
355 LSS-15 developed in Studies 1 and 2 were used in Study 3.

356 **Athlete Satisfaction Questionnaire.** The Portuguese version of the Athlete
357 Satisfaction Questionnaire (ASQp; Borrego, Leitão, Alves, Silva, & Palmi, 2010; Riemer

358 & Chelladurai, 1998) was used in Study 3. The ASQp is a 54-item questionnaire that
359 contains 14 dimensions of athlete satisfaction. Participants indicated the degree of
360 satisfaction with aspects of their sport experience. Answers were provided on seven-point
361 Likert scales ranging from “not at all satisfied” (1) to “extremely satisfied” (7). To limit
362 the length of the questionnaire, we selected four subscales (14 items) of the ASQp:
363 training and instruction satisfaction (three items; e.g., “I am satisfied with the training I
364 receive from the coach during the season”); personal treatment satisfaction (five items;
365 e.g., “I am satisfied with the recognition I receive from my coach”); team performance
366 satisfaction (three items; e.g., “I am satisfied with the team’s win/loss record this
367 season”), and individual performance satisfaction (three items; e.g., “I am satisfied with
368 the degree of which I have reached my performance goals during the season”). According
369 to Riemer and Chelladurai (1998), the first two subscales measure athletes’ satisfaction
370 with coaching behaviors related to training quality, and individual and team development,
371 while the latter two subscales measure athletes’ satisfaction with individual and team
372 outcomes. These 14 items have been used in previous studies (e.g., Riemer & Toon,
373 2001).

374 **Statistical analysis**

375 To further assess the validity of the LSS-15, a structural model was performed to
376 examine the relationships between athletes’ preference and perceived coach behaviors
377 with athletes’ performance satisfaction.

Results of Study 3

378

379 Preliminary analysis revealed 0.5% of missing data without an observed fixed
380 pattern. Thus, missing values were replaced using the maximum likelihood algorithm
381 (Graham & Hofer, 2000). Skewness values ranged from -1.68 to 2.81, while kurtosis
382 values ranged from -1.48 to 4.45. Additionally, the Mardia's coefficient (72.06) for
383 multivariate kurtosis exceeded the value considered adequate for data normality. Hence,
384 a Bollen-Stine bootstrapping was performed in subsequent analysis (Byrne, 2010).

385

386 Table 4 shows descriptive statistics and correlations between all variables.
387 Considering the descriptive statistics, the training-instruction behaviors was the
388 dimension with the highest scores in the athletes' preferred ($M = 4.81$, $SD = .72$) and
389 perceived ($M = 4.18$, $SD = .59$) versions. The Cronbach α coefficients ranged from .68
390 (autocratic behavior preference) to .89 (personal treatment satisfaction). Composite
391 reliability values support all subscales reliability. Average variance extracted (AVE)
392 values were equal to or greater than .50, revealing convergent validity. Discriminant
393 validity was evidenced in all measures for the square of the correlations between the
394 constructs was below the AVE values (Hair et al., 2014).

394

[TABLE 5]

395

396 The goodness-of-fit indices computed to assess the measurement model [$\chi^2(811) =$
397 1075.06, $p < .001$, CFI = .931, TLI = .924, RMSEA = .041 (90% CI = .038, .049), SRMR
= .043] and the structural model [$\chi^2(861) = 1239.51$, $p < .001$, CFI = .919, TLI = .912,

398 RMSEA = .055 (90% CI = .059, .069), SRMR = .054] indicated an acceptable fit to the
399 data.

400 Figure 1 shows the relationships between preferences and perceptions of leader
401 behaviors with athletes' satisfaction. The perception of training-instruction behaviors was
402 associated with satisfaction with individual performance ($\beta = .19$; CI = .10, .38), and
403 quality of training and instruction ($\beta = .18$; CI = .13 .36). Perception of positive feedback
404 behaviors was related with satisfaction with individual performance ($\beta = .36$; CI = .16,
405 .49) and team performance ($\beta = .45$; CI = .21, .59).

406 Also, preference and perception of the coach's democratic behavior were associated
407 ($\beta = .39$; CI = .28, .56); in turn, the perception of the coach's democratic behavior is
408 associated with satisfaction with personal treatment ($\beta = .42$; CI = .28, .51). The results
409 also showed an association between preference and perception of autocratic behavior (β
410 = .41; CI = .22, .46) which, in turn, is negatively associated to satisfaction with individual
411 performance ($\beta = -.19$; CI = -.26, -.09), team performance ($\beta = -.16$; CI = -.22, -.03) and
412 personal treatment ($\beta = -.14$; CI = -.24, -.01). Moreover, preference and perception of
413 social support are associated ($\beta = .48$; CI = .29, .61), which, in turn, is associated with
414 satisfaction with the team performance ($\beta = .47$; CI = .38, .57) and with personal treatment
415 ($\beta = .41$; CI = .26, .53).

416 [FIGURE 1]

417

418 **Common method bias considerations**

419 The complexity of the relationships between variables integrated in the model may
420 lead to common method bias (CMB), that is, the relationships between variables may be
421 determined by the measurement method instead of the actual participants' response
422 intentions (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To access the possibility of
423 CMB, the common latent factor test was performed to examine potential false
424 relationships between variables. The difference between the standardized estimates with
425 and without the common latent factor ranged between 0.074 and 0.001, which leads to
426 the rejection of the possibility of CMB (Williams, Côté, & Buckley, 1989).

427 **Implications of the Study 3**

428 The purpose of the Study 3 was to determine whether perceived and preferred LSS-
429 15 scales were associated with athletes' satisfaction. Findings indicate that the
430 relationships between preference and perception of three of the coach behaviors, i.e.,
431 democratic behavior, autocratic behavior and social support, play an important role in
432 determining athletes' satisfaction. A longstanding history of studies associates these
433 coach behaviors with athletes' satisfaction (Chelladurai, 2007). However, these results
434 challenged this notion, particularly with the assessment of a model including preferences
435 and perceptions of coach's behaviors, and athlete's satisfaction variables, as well as the
436 individual significance of the parameters in a single methodological framework.

437

Discussion

438 In this investigation, we followed the initial attempt of Chiu et al. (2016) to
439 demonstrate the appropriateness of a short version of the widely used LSS, developed
440 over 30 years by Chelladurai and colleagues (Chelladurai & Riemer, 1998; Chelladurai
441 & Saleh, 1980). A 15-item short form of the three Leadership Scale for Sports versions,
442 coaches' perceptions of their own behavior, athletes' perceptions of their coaches'
443 behavior, and athletes' preferences for their coaches' behavior, were validated and its
444 psychometric characteristics were examined in three independent studies.

445 The extensive empirical literature on the Multidimensional Model of Leadership
446 (MML) demonstrates that the LSS is a widely used instrument for the study of sport
447 leadership. Theoretical models should guide psychometric development (Marsh et al.,
448 2005). As such, the theoretical structure of MML was entirely reflected in the LSS-15
449 and supported by factorial validation and measurement invariance. Thus, the
450 development, evaluation and refinement of the short measure was systematically
451 informed by theory and past empirical research. In this study, the LSS-15 also provided
452 an important basis to evaluate and confirm the theory on which the original LSS was
453 grounded.

454 Findings of studies 1 and 2 supported the construct validity of the LSS-15. First,
455 using CFA, we found that the fit of the proposed multidimensional leadership structure
456 of five factors was adequate for the three versions. The results of model fit indexes of the
457 LSS-15 are consistent with previous studies where the LSS original structure was used

458 (e.g., Chelladurai & Riemer, 1998; Fletcher & Roberts, 2013). Second, convergent and
459 discriminant validities of the new short form were explored using the average variance
460 extracted estimates (Hair et al., 2014). This means that although the five factors of the
461 three versions of the LSS are related, they represent theoretically distinct constructs. The
462 scores representing all combinations of the three LSS-15 versions had robust
463 psychometric properties.

464 In general, findings suggest that the LSS-15 performed better in comparison to the
465 25-item version of Chiu et al. (2016). It is important to note that Chiu et al (2016)
466 shortened the original scale to 25 items through consultation with a panel of experts.
467 However, the recommendations suggest that the basis for choosing the items must be the
468 psychometric qualities based on the long form (e.g., Marsh et al., 2005; Smith, McCarthy,
469 & Anderson, 2000).

470 Also, as recommended by Marsh et al. (2005), multiple-group invariance tests
471 between the sample of the Study 1 and the sample of the Study 2 demonstrated that the
472 factor loadings of the 15-item versions were invariant; however, the chi-square and CFI
473 differences in the factor variance covariance suggest measurement non-invariance.
474 Specifically, results revealed differences in factor variances between the two samples and
475 across gender for the 15-item short version of coaches' self-perceived behavior. These
476 differences should be interpreted in light of sensitivity of the chi-square difference to
477 small sample sizes (Cheung & Rensvold, 2002). Thus, future investigations with the 15-

478 item version of coaches' self-perceived behaviors that intend to analyze group differences
479 should consider larger sample sizes.

480 The reliability coefficients of the LSS-15 showed moderate consistency estimates
481 for all subscales. Values below .70 (Nunnally & Bernstein, 1994) were found in the 25-
482 item LSS version in the autocratic behavior and social support subscales showing that
483 some items seem to interfere with the subscale reliability. Moderate internal consistency
484 values were obtained for the autocratic behavior subscales in the 15-item LSS when
485 compared to the 25-item version. This result is relevant because the autocratic behavior
486 subscales have been afflicted with reliability problems in several studies (see reviews by
487 Chelladurai 1993, 2007).

488 As defined by the MML (Chelladurai, 2007), the greater the congruence between
489 preference and perception of current leader behaviors, the greater the satisfaction of
490 athletes. Thus, considering the findings from Study 3, when the coach provides the
491 desired level of democratic behaviors, they tend to influence athletes' satisfaction with
492 their personal treatment, i.e., the athlete's perception of their coach's recognition and the
493 quality of the coach-athlete interpersonal relationship. Also, the association between
494 preferred and perceived social support behaviors tends to determine athletes' satisfaction
495 with team performance and their relationship with their coach (Andrew, 2009).

496 In Study 3, it was also found that autocratic behaviors can negatively influence
497 athletes' satisfaction with individual and team performance, and the quality of the

498 interpersonal relationship with the coach. These results seem to support current
499 knowledge in the area of leadership in sport. For example, using hierarchical regression
500 analysis, Andrew (2009) found that congruence between low levels of preferred and
501 perceived autocratic behaviors significantly increased all variables of athlete satisfaction
502 (i.e., training and instruction, team performance, individual performance, and personal
503 treatment). Nevertheless, due to a sound methodological approach based on SEM, the
504 results of Study 3 strengthen the conclusions of previous studies that used hierarchical
505 regressions to analyze the relationships between preferences and perceptions of coach
506 behaviors with athletes' satisfaction. Indeed, SEM tests the global adjustment of the
507 theoretical model as well as the significance of the relationships between all variables in
508 a single framework.

509 **Practical implications of the 15-item LSS**

510 The 15-item LSS can be applied to the study of coach behavior and used in
511 interventions with a large spectrum of athletic populations, such as children, adolescent
512 and adult athletes of both genders. Also, this short version can be a useful tool to give
513 quick feedback to coaches who are undergoing behavior assessment and professional
514 development action plans. Moreover, the findings regarding the associations between
515 leadership and athletes' satisfaction inform coaches about their efficacy in the use of
516 management strategies to improve athletes' satisfaction with the quality of training and
517 personal relationships. Finally, because the present study supports the validation of short

518 versions of a self-perceived coach behavior scale, and athletes' perceived and preferred
519 coach behavior scales, congruence between these concepts can be empirically examined.
520 Such examination will allow the development of research that may inform specific
521 training schedules in coaching leadership.

522 **Limitations and future research**

523 This investigation has several limitations. First, the main concern of this study was
524 that to examine the psychometric proprieties of the LSS-15 using an independent
525 administration of both short and long versions to the same sample, as recommended by
526 Smith et al. (2000). However, Marsh et al. (2005) argued that this standard guideline "is
527 typically impractical and, perhaps, unnecessary" (p. 98), due to the long instrument
528 administration procedures required. Specifically, for this investigation, considering the
529 three versions of both short and full forms, the administration of the instrument would
530 comprise about 165 items. To overcome this rigorous guideline, as suggested by Marsh
531 et al. (2005), we conducted a CFA multiple-group invariance analysis with two
532 independent samples. Second, given the relatively small sample size of coaches,
533 conclusions from measurement invariance should be taken with caution. Third, future
534 research should explore measurement invariance issues across other sub-groups (e.g., age,
535 sports). Finally, the three studies were developed with three independent Portuguese
536 samples; however, cross-cultural studies are relevant to evaluate whether the LSS-15

537 works equally well across different nationalities and ethnic groups (see reviews by
538 Chelladurai, 2007; Riemer, 2007).

539 In summary, this investigation provides evidence for the factorial validity,
540 reliability and measurement variance of the three versions of the LSS-15 to evaluate and
541 describe leadership behaviors in sport. As noted, this new short version is a valid and
542 reliable alternative to the 25-item LSS (Chiu et al., 2016) and long 40-item LSS
543 (Chelladurai & Saleh, 1980), which is particularly beneficial when researchers need to
544 use a brief measure of leadership in applied settings or when study designs include
545 evaluation of multiple variables with the same sample.

References

- 546
- 547 Andrew, D. P. S. (2009). The impact of leadership behavior on satisfaction of college
548 tennis players: A test of the leadership behaviour congruency hypothesis of the
549 Multidimensional Model of Leadership. *Journal of Sport Behavior*, 32, 261-277.
- 550 Byrne, B.M. (2010). *Structural equation modelling with AMOS: Basic concepts,*
551 *applications, and programming* (2nd ed.). New York: Routledge.
- 552 Chiu, W., Rodriguez, F. M., & Won, D. (2016). Revisiting the Leadership Scale for
553 Sports: Examining factor structure through exploratory structural equation
554 modelling. *Psychological Reports*, 119, 435-449.
- 555 Chelladurai, P. (1993). Leadership. In R. Singer, & L. Tennant (Eds.), *Handbook of*
556 *research on sport psychology* (pp. 647-671). New York: Macmillan.
- 557 Chelladurai, P. (2007). Leadership in sports. In G. Tenenbaum & R.C. Eklund (Eds.),
558 *Handbook of sport psychology* (3rd ed., pp. 113–135). New Jersey: John Wiley &
559 Sons.
- 560 Chelladurai, P., & Carron, A.V. (1983). Athletic maturity and preferred leadership.
561 *Journal of Sport Psychology*, 5, 371-380.
- 562 Chelladurai, P., & Riemer, H.A. (1998). Measurement of leadership in sport. In J.L. Duda
563 (Ed.), *Advances in sport and exercise psychology measurement* (pp. 227-256).
564 Morgantown, WV: Fitness Information Technology.

- 565 Chelladurai, P., & Saleh, S.D. (1980). Dimensions of leader behavior in sports:
566 Development of a leadership scale. *Journal of Sport Psychology*, 2, 34-45.
- 567 Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing
568 measurement invariance. *Structural Equation Modeling*, 9, 233-255.
- 569 Fletcher, R.B., & Roberts, M.H. (2013). Longitudinal stability of the Leadership Scale
570 for Sports. *Measurement in Physical Education and Exercise Science*, 17, 89-104.
- 571 Graham, J. W., & Hofer, S. M. (2000). Multiple imputation in multivariate research. In
572 T. D. Little, K. U. Schnable, & J. Baumert (Eds.), *Modeling longitudinal and*
573 *multilevel data: Practical issues, applied approaches, and specific examples* (pp.
574 201-218). Mahwah, NJ: Erlbaum.
- 575 Hair, J.F., Jr., Black, W.C., Babin, B.J., & Anderson, R.E. (2014). *Multivariate data*
576 *analysis: A global perspective* (7th ed.). Upper Saddle River, NJ: Pearson.
- 577 Kline, R.B. (2011). *Principles and practice of structural equation modeling* (3rd ed.).
578 New York: Guilford press.
- 579 Kwon, H. H., Koh, K. T., Pyun, D. Y., & Wang, J. (2009). Psychometric properties of
580 leadership scale for sport: The case of Singaporean secondary school athletes.
581 *International Journal of Sport Management*, 10, 367-381.
- 582 Kwon, H. H., Pyun, D. Y., Han, S., & Ogasawara, E. (2011). Testing for factorial
583 invariance of the modified leadership scale for sports: Using a Japanese version.
584 *Asia Pacific Journal of Education*, 31, 65-76.

- 585 Márcen, C., Gimeno, F., & Gómez, C. (2016). Adapting Leadership Scale for Sport (LSS)
586 in a high-performance center coaches and athletes. *Cuadernos de Psicología del*
587 *Deporte, 16*, 21-32.
- 588 Martin, S. B., Richardson, P. A., & Weiller, K. H. (1999). Coaching preferences of
589 adolescent youths and their parents. *Journal of Applied Sport Psychology, 11*, 247-
590 262.
- 591 Marsh, H. W., Ellis, L.A., Parada, R.H., Richards, G., & Heubeck, B.G. (2005). A short
592 version of the self-description questionnaire II: Operationalizing criteria for short-
593 form evaluation with new applications of confirmatory factor analyses.
594 *Psychological Assessment, 17*, 81-102.
- 595 Nunnally, J.C., & Bernstein, I.J. (1994). *Psychometric theory* (3rd ed.). New York:
596 McGraw-Hill.
- 597 Podsakoff, P., MacKenzie, S., Lee, J., & Podsakoff, N. (2003). Common method biases
598 in behavioral research: A critical review of the literature and recommended
599 remedies. *Journal of Applied Psychology, 88*, 879-903.
- 600 Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied*
601 *Psychological Measurement, 21*, 173-184.
- 602 Riemer, H.A. (2007). Multidimensional model of coach leadership. In S. Jowett & D.
603 Lavallee (Eds.), *Social psychology in sport* (pp. 57-74). Champaign, IL: Human
604 Kinetics.

- 605 Riemer, H.A., & Chelladurai, P. (1995). Leadership and satisfaction in sport. *Journal of*
606 *Sport and Exercise Psychology*, 17, 276–293.
- 607 Scott, J. (2008). Children as respondents: The challenge for quantitative methods. In P.
608 Christensen & A. James (Eds), *Research with children: Perspectives and practices*
609 (2nd ed.) (pp. 87-108). New York, NY: Routledge.
- 610 Serpa, S. (1993). Avaliação dos processos de interacção treinador-atleta e liderança no
611 desporto [Evaluation of the processes of coach-athlete interaction and leadership in
612 sport]. *Ludens*, 13, 9-16.
- 613 Serpa, S., Pataco, V., & Santos, F. (1991). Leadership patterns in handball international
614 competition. *International Journal of Sport Psychology*, 22, 78-89.
- 615 Smith, G. T., McCarthy, D. M., & Anderson, K. G. (2000). On the sins of short-form
616 development. *Psychological Assessment*, 12, 102-111.
- 617 Yung, Y-F., & Bentler, P. M. (1996). Bootstrapping techniques in analysis of mean and
618 covariance structures. In G. A. Marcoulides & R. E. Schumacker (Eds.), *Advanced*
619 *structural equation modeling: Issues and techniques* (pp. 195-226). Mahwah, NJ:
620 Erlbaum.
- 621 Williams. L. J., Cote, J.A., & Buckley, M.R. (1989). Lack of method variance in self-
622 reported affect and perceptions of work: Reality or artifact? *Journal of Applied*
623 *Psychology*, 74, 462-468.

Appendix

Summary description of Chelladurai & Saleh's (1980) 40-item LSS for each subscale
Stem: I, as a coach... (coach version) or My coach... (athletes preferred and perceived versions)

Training and Instruction

Sees to it that every athlete is working to his/her capacity (1) *

Explain to each athlete the techniques and tactics of sport (5) *†

Pay special attention to correcting athlete's mistakes (8) *†

Make sure that his part in the team is understood by all the athletes (11)

Instruct every athlete individually in the skills of the sport (14)

Figure ahead on what should be done (17)

Explain to every athlete what he should and what he should not do (20)

Expect every athlete to carry out his assignment to the last detail (23)

Point out each athlete's strengths and weaknesses (26)

Give specific instructions to each athlete as to what he should do in every situation (29)

* †

Sees to it that efforts are coordinated (32) *

Explain how each athlete's contribution fits into the total picture (35)

Specifies in detail what is expected to each athlete (38) *

Democratic Behavior

Ask for the opinion of the athletes on strategies for specific competitions (2) *†

Get group approval on important matters before going ahead (9)

Let his/her athletes share decision making (15) *†

Encourages athletes to make suggestions on conducting practices (18) *

Let the group set its own goals (21)

Lets the athletes try their own way, even if they make mistakes (24) *

Ask for the opinion of the athletes on important coaching matters (30) *

Let athletes work at their own speed (33)

Let the athletes decide on the plays to be used in a game (39)

Autocratic Behavior

Works relatively independent of the athletes (6) *

Does not explain his/her action (12) * †

Refuse to compromise on a point (27) * †

Keeps to himself/herself (34) *

Speaks in a manner not to be questioned (40) * †

Social Support

Helps the athletes with their personal problems (3) *

Helps members of the group settle their conflicts (7) * †

Looks out for the personal welfare of the athletes (13) *

Do personal favors to the athletes (19)

Express affection he feels for his/her athletes (22) †

Encourage athletes to confide in him/her (25) *

Encourage close and informal relations with athletes (31) * †

Invite athletes to his/her home (36)

Positive Feedback

Compliments an athlete for his performance in front of others (4) *

Tell an athlete when he/she does a particularly good job (10) * †

Sees that an athlete is rewarded for a good performance (16) *

Express appreciation when an athlete performs well (28) * †

Give credit when credit is due (37) * †

Note. * Items included in Chiu et al. (2016) 25-item LSS version of athletes perceptions of coach behaviors; † Items included in the 15-item for the three LSS version: coaches' perceptions of their own behavior, athletes' preferences and perceptions of their

coaches' behavior; The numbers in parentheses at the end of each item refer to the number of items of the original 40-item LSS for review.

Pre-production draft

Table 1

Summary of goodness of fit statistics for original LSS and LSS short versions models across two samples and gender.

Models	χ^2	df	p	CFI	Δ CFI	TLI	RMSEA (CI _{90%})
<i>Coaches self-perceived behavior</i>							
Study 1 sample (n=115) – 40-item	1489.56	730	.000	.802	-	.799	.112 (.102, .109)
Study 1 sample (n=115) – 25-item	513.67	265	.000	.834	-	.821	.093 (.089, .097)
Study 1 sample (n=115) – 15-item	104.91	80	.032	.966	-	.955	.051 (.016, .076)
Study 2 sample (n=351) – 15-item	166.53	80	.000	.942	-	.924	.069 (.054, .083)
M1 - Unconstrained	271.50	160	.000	.950	-	.934	.045 (.035, .054)
M2 - Factor loadings	283.61	170	.277	.949	≤.01	.937	.044 (.035, .053)
M3 - Factor variances-covariance	543.38	200	.000	.846	≥.01	.838	.070 (.063, .077)
<i>Gender invariance</i>							
Female 15-item model	308.22	80	.000	.934	-	.930	.056 (.051, .058)
Male 15-item model	266.54	80	.000	.955	-	.951	.033 (.030, .036)
M1 - Unconstrained	316.86	160	.000	.932	-	.926	.065 (.059, .068)
M2 - Factor loadings	348.12	170	.082	.925	≤.01	.920	.069 (.063, .071)
M3 - Factor variances-covariance	665.79	200	.000	.840	≥.01	.826	.081 (.078, .085)
<i>Athletes perceived coach behavior</i>							
Study 1 sample (n=373) – 40-item	1108.37	730	.000	.854	-	.844	.096 (.093, .101)
Study 1 sample (n=373) – 25-item	378.66	265	.000	.886	-	.880	.091 (.090, .097)
Study 1 sample (n=373) – 15-item	308.67	80	.000	.923	-	.898	.088 (.078, .089)
Study 2 sample (n=817) – 15-item	140.14	80	.000	.986	-	.982	.041 (.029, .052)
M1 - Unconstrained	448.86	160	.000	.960	-	.948	.047 (.042, .052)
M2 - Factor loadings	460.24	170	.329	.960	≤.01	.951	.046 (.041, .051)
M3 - Factor variances-covariance	578.43	200	.001	.948	≥.01	.951	.048 (.044, .053)
<i>Gender invariance</i>							
Female 15-item model	183.06	80	.000	.979	-	.970	.042 (.032, .044)
Male 15-item model	166.12	80	.000	.981	-	.973	.038 (.033, .040)
M1 - Unconstrained	208.55	160	.000	.966	-	.959	.047 (.041, .051)
M2 - Factor loadings	216.43	170	.282	.965	≤.01	.955	.043 (.039, .048)
M3 - Factor variances-covariance	613.64	200	.000	.943	≥.01	.935	.051 (.046, .058)
<i>Athletes preferred coach behavior</i>							
Study 1 sample (n=373) – 40-item	977.84	730	.000	.862	-	.093	.096 (.092, .098)
Study 1 sample (n=373) – 25-item	288.32	265	.000	.891	-	.888	.082 (.074, .089)
Study 1 sample (n=373) – 15-item	196.08	80	.000	.968	-	.958	.063 (.052, .074)
Study 2 sample (n=817) – 15-item	192.53	80	.000	.977	-	.969	.056 (.046, .066)
M1 - Unconstrained	388.62	160	.000	.973	-	.965	.042 (.037, .047)
M2 - Factor loadings	402.11	170	.198	.973	≤.01	.966	.041 (.036, .046)
M3 - Factor variances-covariance	472.35	200	.002	.968	≤.01	.966	.041 (.036, .046)
<i>Gender invariance</i>							
Female 15-item model	242.89	80	.000	.953	-	.946	.049 (.044, .056)
Male 15-item model	225.72	80	.000	.958	-	.949	.042 (.038, .047)
M1 - Unconstrained	332.45	160	.000	.944	-	.931	.052 (.046, .059)
M2 - Factor loadings	398.06	170	.000	.938	≤.01	.922	.067 (.061, .074)
M3 - Factor variances-covariance	653.87	200	.451	.911	≥.01	.908	.071 (.066, .078)

Table 2
 Factor loadings and items descriptive statistics for each 15-item LSS short version.

Subscales/Items	Coaches self-perceived behavior (n = 115)					Athletes perceived coach behavior (n = 373)					Athletes preferred coach behavior (n = 373)				
	Loadings	M	SD	Sk	Ku	Loadings	M	SD	Sk	Ku	Loadings	M	SD	Sk	Ku
Training and Instruction															
TI1	0.77	3.14	0.87	-0.79	-0.08	0.90	2.83	1.31	-0.91	-0.40	0.83	2.87	1.37	-0.91	-0.45
TI2	0.82	3.26	0.80	-0.96	0.47	0.91	2.86	1.28	-0.95	-0.24	0.90	2.97	1.32	-1.04	-0.21
TI3	0.70	2.97	0.79	-0.53	0.01	0.79	2.79	1.24	-0.79	-0.45	0.89	2.98	1.27	-1.02	-0.17
Democratic Behavior															
DB1	0.78	2.16	0.84	-0.33	0.08	0.78	2.53	1.08	-0.46	-0.41	0.74	2.73	1.24	-0.61	-0.75
DB2	0.63	2.28	0.82	-0.41	0.27	0.72	2.47	1.15	-0.42	-0.55	0.66	2.64	1.20	-0.55	-0.57
DB3	0.79	2.12	0.88	-0.11	0.14	0.73	2.53	1.12	-0.42	-0.56	0.82	2.74	1.18	-0.61	-0.55
Autocratic Behavior															
AB1	0.73	1.77	1.07	0.35	-0.38	0.64	1.91	1.35	0.14	-1.18	0.78	1.93	1.52	0.06	-1.45
AB2	0.79	1.47	1.19	0.64	-0.36	0.79	1.83	1.38	0.17	-1.23	0.76	1.95	1.52	0.06	-1.48
AB3	0.69	1.30	1.13	0.55	-0.49	0.73	1.73	1.50	0.25	-1.40	0.60	1.69	1.61	0.35	-1.36
Social Support															
SS1	0.66	2.74	1.01	-0.54	-0.18	0.81	2.64	1.23	-0.54	-0.72	0.79	2.85	1.26	-0.79	-0.54
SS2	0.71	2.54	0.93	-0.43	-0.17	0.69	2.56	1.18	-0.46	-0.71	0.75	2.59	1.26	-0.47	-0.86
SS3	0.82	2.74	0.95	-0.40	-0.48	0.77	2.71	1.19	-0.60	-0.60	0.90	2.78	1.27	-0.70	-0.67
Positive Feedback															
PF1	0.78	3.20	0.89	-1.20	1.36	0.89	2.88	1.24	-0.95	-0.18	0.93	2.95	1.33	-1.02	-0.30
PF2	0.86	3.25	0.97	-1.49	1.89	0.89	2.95	1.28	-1.05	-0.10	0.91	2.96	1.36	-1.05	-0.27
PF3	0.80	3.27	0.95	-1.55	1.28	0.83	2.91	1.25	-1.01	-0.05	0.90	2.92	1.40	-0.96	-0.52

Note. M = Mean; SD = Standard deviation; Sk = Skewness; Ku = Kurtosis

Table 3

Means, standard deviations, reliabilities, average variance extracted (AVE) and squared correlations among subscales.

Subscales	Correlation matrix															
	TI ^a	TI ^b	TI ^c	DB ^a	DB ^b	DB ^c	AB ^a	AB ^b	AB ^c	SS ^a	SS ^b	SS ^c	PF ^a	PF ^b	PF ^c	
TI ^a	1.00															
TI ^b	.03	1.00														
TI ^c	.07	.74**	1.00													
DB ^a	.12*	.10*	.10	1.00												
DB ^b	.04	.39**	.31**	-.05	1.00											
DB ^c	.05	.50**	.57**	-.04	.53**	1.00										
AB ^a	-.43**	-.03	-.11*	-.12*	.00	-.04	1.00									
AB ^b	-.09	-.24**	-.21**	-.05	.03	-.00	.12*	1.00								
AB ^c	.02	-.24**	-.28**	.00	.06	-.06	.07	.64**	1.00							
SS ^a	.21**	.01	.03	.04	-.03	-.05	.32**	-.00	.02	1.00						
SS ^b	-.01	.42**	.46**	.01	.36**	.41**	.04	.42**	.22**	.05	1.00					
SS ^c	.03	.40**	.44**	.04	.30**	.43**	.06	.28**	.39**	.08	.61**	1.00				
PF ^a	.61**	.04	.01	.00	.06	.03	-.47**	-.13*	-.02	.20**	.08	.01	1.00			
PF ^b	.02	.79**	.76**	-.05	.44**	.55**	-.02	-.23**	-.23**	.01	.45**	.46**	.00	1.00		
PF ^c	-.04	.73**	.78**	.12*	.32**	.57**	.01	-.15**	-.25**	.03	.47**	.49**	.02	.76**	1.00	
AVE	.58	.76	.76	.54	.55	.55	.54	.51	.51	.53	.57	.66	.66	.76	.83	
Mean	3.12	2.82	2.93	2.18	2.50	2.70	1.51	1.82	1.85	2.41	2.41	2.51	3.24	2.91	2.94	
SD	.70	1.17	1.21	.70	.93	1.01	.94	1.16	1.27	.63	.85	.89	.82	1.15	1.29	
CR	.81	.91	.91	.78	.79	.78	.78	.76	.76	.78	.80	.86	.86	.91	.94	
Cronbach α	.81	.90	.90	.77	.78	.78	.77	.75	.75	.76	.80	.85	.85	.90	.93	

Note. TI, training and instruction; DB, democratic behaviour; AB, autocratic behavior; SS, social support; PF, positive feedback; CR, Composite reliability.

^a = self-perception; ^b = perception; ^c = preference

* $p < 0.05$, ** $p < 0.01$

Table 4

Factor loadings, composite reliability (CR), and average variance extracted (AVE) for each 15-item LSS short version of the cross-validation sample

Subscales/Items	Coaches self-perceived behavior (n = 351)			Athletes perceived coach behavior (n = 817)			Athletes preferred coach behavior (n = 817)		
	Loadings	CR	AVE	Loadings	CR	AVE	Loadings	CR	AVE
Training and Instruction		0.76	0.51		0.86	0.67		0.81	0.59
TI1	0.68			0.83			0.75		
TI2	0.83			0.84			0.74		
TI3	0.61			0.78			0.81		
Democratic Behavior		0.87	0.68		0.82	0.62		0.79	0.56
DB1	0.85			0.91			0.78		
DB2	0.81			0.68			0.61		
DB3	0.81			0.74			0.83		
Autocratic Behavior		0.73	0.48		0.75	0.52		0.82	0.62
AB1	0.72			0.55			0.87		
AB2	0.71			0.85			0.78		
AB3	0.64			0.72			0.68		
Social Support		0.85	0.66		0.82	0.61		0.82	0.60
SS1	0.79			0.83			0.68		
SS2	0.77			0.86			0.77		
SS3	0.86			0.62			0.87		
Positive Feedback		0.75	0.50		0.80	0.57		0.86	0.67
PF1	0.61			0.81			0.82		
PF2	0.78			0.69			0.77		
PF3	0.72			0.77			0.86		

Table 5

Means, standard deviations, reliability, squared correlations, convergent and discriminant validity among LSS-15 and ASQ subscales ($n = 246$).

	LSS-15 subscales										Athlete Satisfaction subscales			
	TI ^a	TI ^b	DB ^a	DB ^b	AB ^a	AB ^b	SS ^a	SS ^b	PF ^a	PF ^b	IP	TP	T&I	PT
TI ^a	1.00													
TI ^b	.11	1.00												
DB ^a	.15*	.02	1.00											
DB ^b	.01	.12*	.30**	1.00										
AB ^a	-.26*	-.06	-.18*	-.14*	1.00									
AB ^b	-.05	-.17*	-.01	.58**	.42**	1.00								
SS ^a	.16*	-.01	.14*	.01	-.18*	-.01	1.00							
SS ^b	.08	-.26**	.02	.33*	-.16*	.14*	.39**	1.00						
PF ^a	.25**	.03	.34**	.02	-.32**	-.08	.55**	.23**	1.00					
PF ^b	.08	.26**	.02	-.01	-.01	-.35**	.02	.35**	.12*	1.00				
IP	.35**	.41**	.01	.08	-.12*	-.38**	.43**	.21**	.01	.36**	1.00			
TP	.02	.03	.06	.01	-.40**	-.31**	.16*	.41**	.02	.48**	.56**	1.00		
T&I	.31**	.25**	-.24**	.06	-.01	-.02	.15*	.18*	.26**	.06	.38**	.68**	1.00	
PT	.28**	.15*	.32**	.43**	-.16*	-.42**	.36**	.28**	.02	.42**	.43**	.53**	.42**	1.00
AVE	.54	.63	.56	.60	.68	.55	.66	.62	.71	.55	.59	.71	.66	.66
M	4.79	4.09	3.88	3.21	2.02	2.95	3.71	3.19	4.32	3.91	4.80	4.56	4.61	4.86
DP	.76	.62	.62	.82	.52	.88	.64	.76	.52	.76	.88	.92	1.02	1.18
CR	.78	.84	.78	.83	.72	.76	.85	.85	.89	.78	.82	.89	.88	.91
Cronbach α	.77	.80	.76	.81	.68	.76	.83	.85	.88	.79	.79	.89	.85	.89

Note. TI, training and instruction; DB, democratic behaviour; AB, autocratic behavior; SS, social support; PF, positive feedback; IP = individual performance; TP = team performance; T&I = satisfaction with training and instruction; PT = personal treatment; AVE = variance average extracted; M = mean; SD = standard deviation; CR = Composite reliability; ^a = preference; ^b = perceived.

* $p < .05$, ** $p < .01$.

LSS SHORT-VERSION

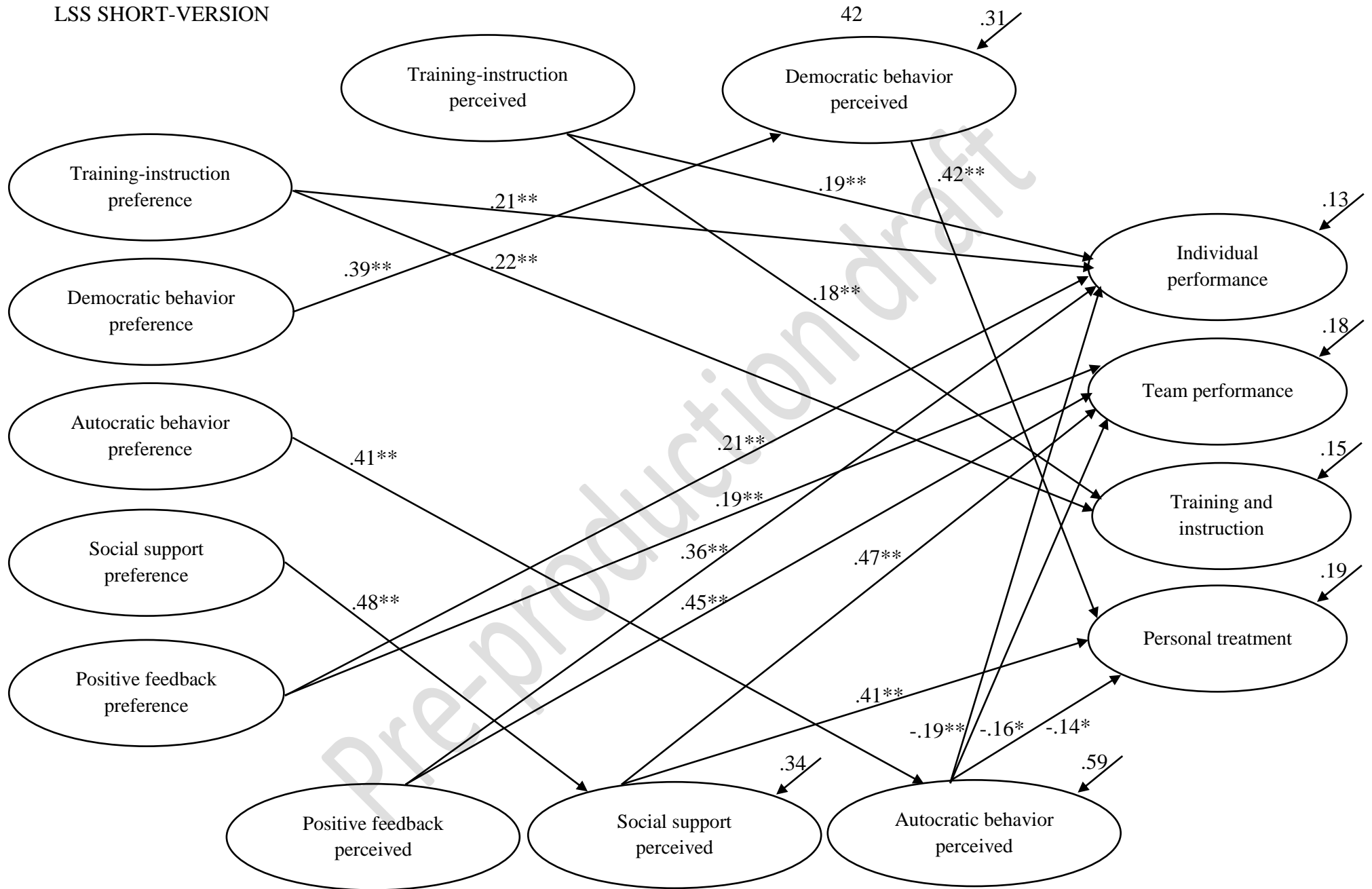


Figure 1. Structural model of relationships between preferences and perceptions of leader behaviors with athletes' satisfaction. Note. * $p < .05$, ** $p < .01$. All variances were significant ($p < .001$). For visual simplicity, non-significant relationships ($p > .05$) were not presented ($n = 246$).