Research Article

Received: 21 December 2022 / Accepted: 6 February 2023 / Published: 5 March 2023

Factorial Equivalence of the Social Skills Scale in the Lambayeque University Context According to Sex

Willan Antonio Ruiz Coronado[1]

Silvia Georgina Aguinaga-Doig[1]

Ronald M. Hernández[2]

Miguel A. Saavedra-López[3]

Yen Marvin Bravo Larrea[1]

Lizzeth Aimee Garcia Flores[1]

Karel Llopiz-Guerra[4]

[1]*Universidad Católica Santo Toribio de Mogrovejo, Chiclayo, Peru*
[2]*Universidad Privada Norbert Wiener, Lima, Perú*
[3]*Universidad Nacional de Tumbes, Tumbes, Perú; Universidad Continental, Huancayo, Perú*
[4]*Universidad Central "Marta Abreu" de Las Villas, Santa Clara, Cuba.*

DOI: https://doi.org/10.36941/ajis-2023-0034

Abstract

This study aimed to show whether the theoretical model of the social skills construct, proposed by Gismero (2000), is invariant in male and female samples of Peruvian university students from Lambayeque. In order to meet the proposed objective, a non-experimental, cross-sectional, comparative psychometric design by hierarchical confirmatory procedures was chosen. Two samples of university students were used, one of 1,084 female students and the other of 1,043 male students. Both groups were applied the self-report of social skills (EHS). With the data obtained, a confirmatory factor analysis of the first-order factor structure of the social skills construct was performed in each group, based on the polychoric correlation matrix. The invariance of the scale according to sex was evaluated on the basis of the second-order factor structure, by means of multigroup confirmatory factor analysis of nested models. No significant differences in the fit to the data were found between the two-factor second-order factor structure and the alternative one-factor model. Consecutive tests of configurational invariance, disturbance, and first- and second-order metrics gave evidence, respectively, that the model structure, second-order factor errors, and first- and second-order loadings are equivalent in the two study samples. With the data from the study, it is concluded that the structure of the EHS scale is invariant to the sex variable in the Lambayeque context.

Keywords: *Social Skills Scale, invariance, university students*

1. Introduction

According to the Organization for Economic Cooperation and Development (OECD, 2015) social skills (HHSS, by its Spanish initials) are one of the necessary competencies to be developed in students to achieve the learning required by the new millennium. Social researchers agree their importance. Since the 1990s to date, interest in them has increased the number of studies carried out in Spain and Latin America, with emphasis on the university level. Examples of this are the studies by Caballo (1993); Gismero (2000); García-Rojas (2010); Letussi, Freytes, López & Olaz (2012); Miranda-Zapata, Riquelme-Mella, Cifuentes-Cid, & Riquelme-Bravo (2014); Muñoz & Rodrigo (2014); Caballo, Salazar, Olivares, Irurtia, Olivares & Toledo (2014); del Barco, Castaño, Lázaro & Gallego (2015), etc. Most of the studies conducted on HHSS have focused on their evaluation and on the construction and validation of instruments, and a smaller number of studies have focused on the effectiveness of HHSS training programs. (Mendo- Lázaro, León del Barco, Felipe-Castaño, Polo del Río & Palacios García, 2016).

Inglés, Méndez, Hidalgo, Rosa & Estévez (2003) after reviewing studies on scales to measure HHSS, they identify the use of exploratory factor analysis as a strategy for the analysis of the latent structure of the scales, the acceptance by the researchers of the assumption that the underlying factors are orthogonal, the generalized use of the varimax method as a rotation procedure, and eigenvalues equal to or greater than one as a factor selection criterion. Likewise, they find that the different factorial solutions of the different questionnaires reveal that the HHSS construct is multidimensional and warn that, although there are different instruments to measure social skills, systematic evaluation studies on their psychometric properties in different contexts are scarce, especially for recently formulated scales, such as the social skills scale (EHS, by its Spanish initials).

The EHS was proposed by Gismero (2000) to measure the HHSS of adults and young people in the Spanish context. Its adherence to the psychometric rigor of having the test and its manual have made this instrument one of the most widely used in the Latin American context, especially in Chile and Peru. However, Caballo and Salazar (2017) note, in general for all the scales that measure HHSS and in particular for the EHS, the presence of inconsistency in its factorial structure. This justifies conducting studies along these lines.

Apart from the initial psychometric study of the EHS scale by Gismero (2000) on the factorial structure of the theoretical model of the HHSS construct, studies by Guzmán (2017), Méndez (2016) and Quintana (2015), in the Peruvian context, have been found, and they have evaluated the factorial structure of the EHS scale only in first-order factors. The study conducted by Miranda-Zapata, Riquelme-Mella, Cifuentes-Cid, & Riquelme-Bravo (2014), in the Chilean context, is the only one that evaluates the complete structure of the theoretical model proposed by Gismero. In the last study, an improper value was found among the correlation of the second-order factors. This prompted the authors to evaluate an alternative one-factor second-order model, which obtained better fit indices than the original two-factor second-order model. This suggests testing both models in a context similar to that used by Mirannda-Zapata et al (2014) and comparing both results with those obtained by Gismero (2000).

Another aspect to keep in mind regarding the factorial structure of the EHS is the absence of studies that have evaluated the factorial invariance of the EHS in sample subgroups, for example, in samples of men and women. Although there is controversy regarding sex differences in HHSS (del Barco, Castaño, Lázaro, & Gallego, 2015), comparisons between men and women should not be made if the invariance of the scale with respect to the sex variable is not previously demonstrated. That is, to test beforehand that the HHSS construct, measured with the EHS scale, has the same meaning for men and women. Hypothesis that according to Byrne (2004) and Dimitrov (2010) is rarely taken into account in psychometric studies.

Given the above, the objective of this study is to show whether the theoretical model of the social skills construct, proposed by Gismero (2000), is invariant in male and female samples of university students from Lambayeque in order to provide evidence for the generalization validity of

the EHS scale. To accomplish this, we will first evaluate whether the two-factor second-order factor structure proposed by Gismero better fits the data in both study samples compared to the alternative model with only one second-order factor.

2. Methodology

2.1 Study participants

The populations of women and men, made up of students from 6 universities in the department of Lambayeque, were 21,174 and 23,649, respectively. A minimum sample size of 1016 women and 1,021 men was calculated, with a sampling error of 3%. A total of 2,500 questionnaires were applied. After receiving the questionnaires and applying data suitability tests (missing data and multivariate outliers), we obtained 1,084 questionnaires answered by women (aged 16 to 23) and 1,043 by men (aged 16 to 25). Values that are higher than the minimum sample size required for a confirmatory factor analysis (CFA), according to the criteria of Jackson (2003) and Kline (2005).

2.2 Variables

In this study, Social Skills are understood as:

> *"Set of verbal and nonverbal responses, partially independent and situationally specific, through which an individual expresses in an interpersonal context their needs, feelings, preferences, opinions or rights without excessive anxiety and in an assertive manner, respecting all of this in others, which results in self-reinforcement and maximizes the probability of obtaining external reinforcement." Gismero (2000, p14.).*

Gismero (2000) operationally defines the HHSS as a multifactorial construct of six first-order dimensions, which explain 37.7% of the total variance, and two second-order dimensions. The correspondence between items and dimensions is presented in Table 1.

Table 1: Correspondence between first and second order dimensions of the EHS scale

N° items	First order dimension	Second order dimension
8	Self-expression in social situations (Fa)	Assertive behavior (F1)
5	Expression of anger or disagreement (Fc)	
6	Say no and cut off interactions (Fd)	
5	Initiate positive interactions with the opposite sex (Ff)	
4	Making requests (Fe)	Hetero-social skills (F2)
5	Defense of one's rights as a consumer (Fb)	

Notes: Prepared according to the study path of Miranda-Zapata et al. (2014)

2.3 Instrument

The study data were obtained using the EHS questionnaire developed by Gismero (2000), which measures the presence or lack of HHSS in specific situations. According to the respondent's selection among one of the following four Likert-type response options:

A: I don't relate to it at all. Most of the time it doesn't happen to me or I wouldn't do it.
B: It's not really about me although it does happen to me sometimes.
C: Roughly describes me although I don't always act or feel that way.
D: Very much agree and I would feel or act that way in most cases.

The instrument has 33 items. Twenty-eight are written in reverse, that is, agreement with their content will indicate a lack of HHSS, so they should be scored as follows: A=4, B=3, C=2 and D=1. The

remaining five items have been phrased positively, that is, answering yes would show the presence of socially skilled behavior and should be scored as follows: A=1, B=2, C=3, D=4.

Before giving the questionnaires, the respondent was asked verbally to confirm their voluntary acceptance in the study and was informed that anonymity of their personal data was guaranteed.

2.4 Data Treatment

Testing the research hypothesis under study required us to conduct three confirmatory factor analyses (CFA). The first two were aimed at testing an adequate fit of the second-order EHS model, nested within the first-order model (Marsh, 1987), in the two study groups and independently and separately, since this is a prerequisite for invariance analyses. Finally, a hierarchical confirmatory factor analysis (HCA, by its Spanish initials) of multiple groups according to sex was performed to evaluate the invariance of the parameters included in the second-order model. The estimation method used for the analysis of the theoretical model was maximum likelihood using the AMOS 23 program.

The evaluation of the fit between the theoretical models and the observed data was performed using absolute, incremental and parsimony goodness-of-fit measures. The fit indices of these measures are detailed in Table 2.

Table 2: Measurement fit indices by type of goodness-of-fit

Goodness of fit	**Adjustment index**	**Values for a good fit**	**Reference**
Absolute	Likelihood ratio (**χ2**)	P>0,5	Cea (2002)
	root mean square error of approximation (**RMSEA**)	RMSEA<0.4	
	Goodness-of-fit index (**GFI**)	>=0.90	
	Expected cross validation index (**ECVI**)		Hair, Black, Babin, Anderson & Tatham (2010)
Incremental	Adjusted goodness-of-fit index (**AGFI**)	AGFI > 0.9	Kline (2005)
	Comparative fit index (**CFI**)	CFI>0.95	Hu & Bentler (1999)
	Tucker Lewis Index (**TLI**)	ITL > 0.9	Lévy & Varela (2006)
Parsimony	Parsimony Normed Fix Index (**PNFI**)	PNFI close to 1	Ruiz, Pardo & San Martín (2010)
	Chi-square difference over degrees of freedom (**CMI/df**)	1< CMI/df <3	Schermelleh-Engel, Moosbrugger, & Müller (2003)
	Akaike information criteria (**AIC**)		Byrne (2004)

The factorial invariance analysis was performed using 4 models with progressive equality restrictions on the structural components of the theoretical model. The sequential invariance analysis started with the configuration invariance in model Mo (equal number of factors and items in both groups), then the metric invariance was evaluated in model M_1 (equality between the first-order factor saturations of both groups) and model M_3 (equality between the second-order factor saturations of both groups). Before calculating the factorial invariance of the M_3 model, the invariance of the latent errors of the first-order factors in the M_2 model was evaluated.

The likelihood ratio test (LRT) is often used for the test of measurement invariance of a scale (Vandenberg & Lance, 2000). The LRT evaluates the difference in chi-square ($\Delta\chi2$) per degree of freedom between the initially developed model and a more restricted model that includes equality restrictions. Using the LRT, a nonsignificant $\Delta\chi2$ indicates that the equality-constrained parameters are not significantly different between groups. However, researchers have shown that $\Delta\chi2$ depends on sample size (Vandenberg & Lance, 2000). An alternative to this limitation is the use of the CFI

difference, which is recommended by Cheung & Rensvild (2002) as a robust statistic for testing between-group invariance. Specifically, a ΔCFI ranging from -0.01 to -0.02 would indicate that differences between the groups may exist. In this study, both tests were used (LRT & ΔCFI).

3. Results

3.1 Confirmatory Factor Analysis

This section first describes the distribution characteristics of the data in order to choose the type of correlation matrix to be used in the CFA and the most appropriate parameter estimation method for the nature of the data. Second, the level of fit of the data to the first-order factor structure of the social skills construct proposed by Gismero will be evaluated.

In both study samples, the 33 items showed a wide variability in the responses (standard deviation values between 0.91 and 1.12), which ensures that the correlations obtained at the first level of the CFA are not attenuated by range restriction (Ferrando & Anguiano-Carrasco, 2010). For all items, the skewness values were less than one (between -0.931 to 0.408). However, 26 items in the female sample and 19 in the male sample obtained kurtosis values greater than one. The range of kurtosis was -0.258 to -1.353. Likewise, the normalized estimate of the multivariate kurtosis coefficient of Mardia was 40.141 in men and 33.303 in women.

Consistent with the previous results, the matrix of polychoric correlations between items was chosen to test the multicollinearity of the data, which is recommended when the kurtosis values are greater than one (Muthén & Kaplan, 1985). This matrix showed a determinant value close to zero (0.025 in men and 0.013 in women). This value together with the result of a good level obtained in the Kaiser-Meyer-Olkin test (0.847 in men and 0.873 in women) indicate a sufficient level of multicollinearity between items and justify the use of the CFA with the data from each sample.

Given that the data are ordinal and differ from normality, the fit of the first-order model (six factors) proposed by Gismero was performed using robust estimation methods of the Factor program (Lorenzo-Seva & Ferrando, 2006), with Promin rotation method and bootstrap resampling. Table 3 shows that, in all sample groups (total sample, male-only sample and female-only sample), the CFI, GFI and NNFI indices reached values above 0.95 and the RMSEA index was less than 0.04. These values indicate a good fit of the empirical data to the first-order theoretical model proposed by Gismero.

Table 3: Fit indices per sample of the first-order model of the EHS scale obtained by the RWLS robust estimation method with the Factor program

Groups	χ2	DF	p	CFI	GFI	RMSEA	NNFI	BIC
Men	241.907	345	0.000	1.001	0.943	0	1.002	1940.301
Women	311.757	345	0.000	0.994	0.955	0.013	0.991	2020.633
Total	372.139	345	0.151	0.994	0.959	0.012	0.991	2214.345

Note. χ2=Likelihood ratio, DF=degrees of freedom, CFI=comparative fit index, GFI=goodness of fit index, RMSEA=root mean square error of approximation, NNFI=non-normed fit index, BIC=Bayesian information criterion.

The six first-order factors explain 40.5% of the total variance in the female sample and 39.1% in the male sample.

3.2 Choice of Base Model

The bootstrap resampling procedure of the AMOS 23 program was used to evaluate the most appropriate estimation method for the data of this study (Arbuckle, 2014). The ML estimation method obtained lower mean discrepancy (1303.897) and lower standard deviation (0.551) than the GLS

(1379.669; 1.936), ULS (1525.04; 1.919) and ADL (2629.277; 3.404) estimation methods, showing itself as the most appropriate for the study of the structure of the theoretical model. The parameters estimated by the ML estimation method for the two second-order models are shown in Figures 1 and 2.

Miranda-Zapata et al. (2014) obtained a better fit of the HHSS construct to the data using a one-factor second-order model (1F Model) instead of the model proposed by Gismero (2F model). When evaluating the fit of both models with the data from this study, by means of CFA, acceptable fit values were obtained for the GFI (values between 0.90 and 0.95), RMSEA (did not exceed 0.4) and CMIN/DF (less than 3). And no difference in fit was found when comparing both models using the ECVI index (see Table 4). Additionally, both models were compared using bootstrapping methods, finding similar values in the mean discrepancy (PD) and BCC index for both models in each sample group. Since no differences in best fit were identified between the one- and two-factor second-order models, it was decided to work with both as the base model (Mo) for the invariance analysis.

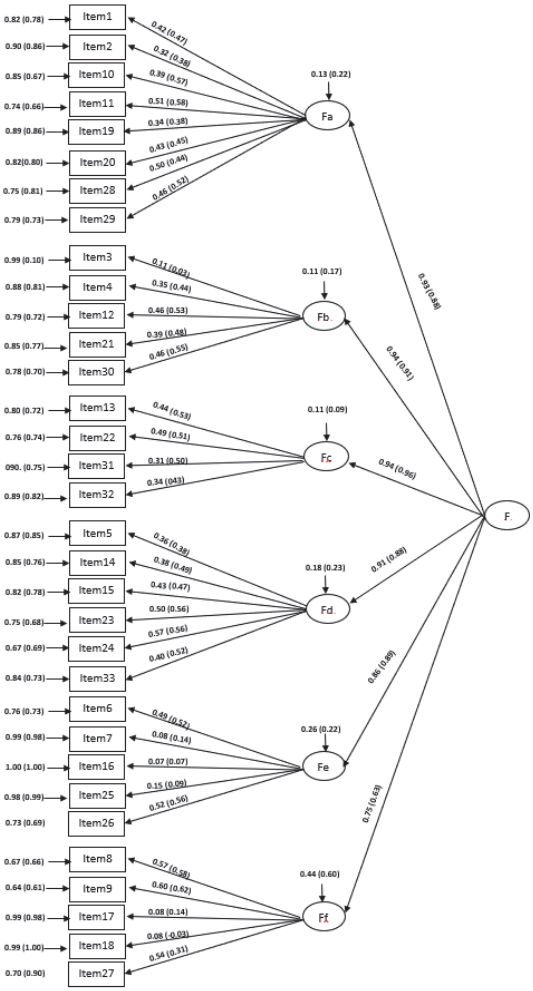

Figure 1: Estimated parameters of the one-factor second-order (1F) model in samples of men and women
Notes: Values without parentheses correspond to the male group. Values in parentheses correspond to the female group.

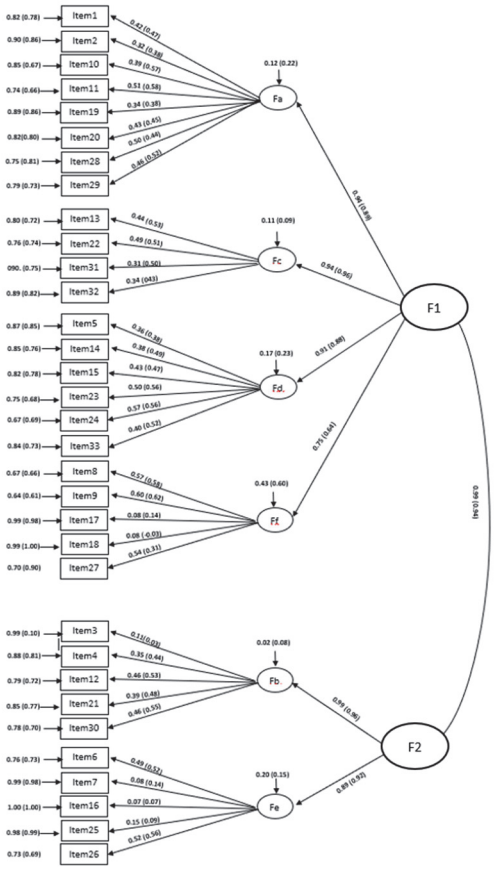

Figure 2: Estimated parameters of the two-factor (2F) second-order model in samples of men and women
Note: Values without parentheses correspond to the male group. Values in parentheses correspond to the female group.

Table 4: Indices of fit to the data of the two second-order models of the EHS scale for both samples, obtained by ML estimation of the AMOS program

Samples and models	χ2	df	CMIN/DF	CFI	GFI	RMSEA	ECVI	PD	BCC
Men									
First order model	1298.39	480	2.71	0.75	0.92	0.04	1.4		
Second order 2F model	1348.06	488	2.76	0.74	0.92	0.04	1.43	1458.17	1497.75
Second order 1F model	1348.89	489	2.76	0.74	0.92	0.04	1.43	1458.84	1498.98
Women									
First order model	1197.02	480	2.49	0.83	0.93	0.04	1.26		
Second order 2F Model	1238.87	488	2.54	0.82	0.93	0.04	1.28	1348.43	1389.99
Second order 1F Model	1241.33	489	2.54	0.82	0.93	0.04	1.28	1347.32	1389.60

Note. χ2= Likelihood ratio, DF= Degrees of freedom, CMI/DF= Chi-square difference over degrees of freedom, SRMR= Standardized Root Mean Square Residual, CFI= Comparative fit index, NFI= Normed fit index, GFI= Goodness-of-fit index, RMSEA= Root mean square error of approximation, ECVI= Expected cross validation rate, PD= Average discrepancy, BCC= Browne and Cudeck Criteria (1993).

3.3 Invariance Measurement

The invariance test was performed through the analysis of nested models with progressive restrictions on the parameters of the theoretical model of the EHS scale. Four hypotheses were tested and the two second-order models of the EHS scale were evaluated. First, the model proposed by Gismero (two second-order factors) and then the alternative model of one second-order factor were evaluated.

Hypothesis testing (*Hf*): equivalence of the form of the second-order model in the sample groups of men and women was performed without restrictions on the parameters of the base model (M_0). The results show significant Chi-square values, but because of its sensitivity to sample size, it is not reliable for use in this study (Hair, Black, Babin, Anderson, & Tatham, 2010). As an alternative to the Chi-square for hypothesis testing, the general fit index (GFI= 0.922) and the root mean square were used (RMSEA= 0.028). The values of these indices indicate an acceptable fit and evidence that the Hf cannot be rejected with the study data. Therefore, it can be affirmed that the model proposed by Gismero for the EHS scale has configurational invariance. The same result was observed in the alternative model of a second-order factor (GFI= 0.922 and RMSEA= 0.028).

To test the hypothesis (HΛ1): the indicators of each first-order dimension of the EHS scale are interpreted similarly by men and women. It was necessary to restrict the loadings of each first-order factor, free in the configural model, (M_0), making them equal in the two groups (model M_1). Comparison of the metric model M_1 with the configurational model configural M_0 yielded a non-significant LRT ($\Delta\chi^2$ = 35.435, p> .05) and a small ΔCFI of -0.002 (greater than -0.01). These results indicate that with the data from this study it should be accepted that the loadings of the six first-order factors are equivalent in the two samples (hypothesis $H_{\Lambda 1}$) at an acceptable level of fit (GFI=0.922 and RMSEA=0.028). Likewise, the alternative one-factor model also shows invariance in the loadings of the first-order factors ($\Delta\chi 2$=35.724; p> .05; ΔCFI = -0.001; GFI= 0.922 and RMSEA= 0.028).

Before analyzing the second-order factors, the residual invariance of the first-order factors (*Hr* hypothesis) should be assessed. The lack of invariance of these parameters could lead to erroneous conclusions about the relative importance of each of the six first-order latent constructs in the meaning of the two second-order constructs of the EHS scale for men and women. The disturbance model (M_2) was formed by adding to the metric model M_1 equality restrictions to the errors of the six first-order latent constructs. When comparing the M_1 model with the M_2 model, the LRT value was not significant ($\Delta\chi 2$ (5) = 7.897, p>0.05), and the difference of the CFI was greater than -0.01 (ΔCFI = 0.000), which express invariance of the parameters tested in the model proposed by Gismero. Similar results are obtained for the parameters corresponding to the alternative one-factor model ($\Delta\chi 2$=46.026; p> 0.065; ΔCFI = 0.000; GFI= 0.922 and RMSEA= 0.028).

The metric model M3 is obtained by adding equality constraints for the six second-order factor loadings to model M_2. Failure to demonstrate invariance of second-order factor loadings in the sex-formed groups would suggest that some dimensions of the EHS are more important for one group relative to the other. Comparison of the M_3 model with the disturbed M_2 model resulted in a significant LRT ($\Delta\chi 2$ (4) = 10.228 p<0.05) indicating absence of invariance with p-value = 0.038. However, the value of ΔCFI = -0.001 being greater than -0.01 indicated the opposite. Given the sensitivity of the LTR to our size, we chose to use the ΔCFI value as a criterion for accepting invariance in the second-order factor loadings, both in Gismero's theoretical model and in the alternative model ($\Delta\chi 2$=46.026; p value= 0.028; ΔCFI = -0.001; GFI= 0.921 and RMSEA= 0.027).

4. Discussion

This study aimed to show whether the theoretical model of the social skills construct, proposed by Gismero (2000), is invariant in male and female samples of university students from Lambayeque, in order to provide evidence for the generalization validity of the EHS scale. The results showed that the

second and first order structure of the EHS could be assumed to be invariant in male and female samples in the Lambayeque university context.

With respect to the evaluation of the factor structure of the HHSS construct, two models were tested: the two-factor second-order factor structure (2F model) and the one-factor second-order factor structure (1F model). Both models showed an acceptable level of fit and equal values in the fit indices in their respective samples. However, these two models obtained better fit values in the female sample than those obtained in the male sample. It should also be noted that the values of the fit indices in this study are higher than those found by Miranda-Zapata et al. (2014), with the exception of the NNFI index (1.03), which was lower compared to the previous study. The fit values obtained favor that the EHS scale can provide scores for three second-order constructs. Model 1F yields scores for the HHSS construct and model 2F yields scores for the assertive behavior and heterosocial skills constructs.

The first-order six-factor model of the EHS scale would not be accepted from a theoretical point of view, since the values of total variance explained by these factors, in each sample (40.5% in women and 39.1 % in men), is lower than the desired minimum total variance of 60% (Barbero, Vila, & Holgado, 2011). However, these percentages are consistent with those found in other empirical studies. For example, Eceiza, Arrieta and Goñi (2008) report that the scales used to measure social skills show with empirical data percentages of variance explained in an interval between 33% and 50%. And for the particular case of the EHS scale, Inglés et al. (2003) report as acceptable an interval of percentage of variance explained within the range of 38% to 49%.

Regarding the psychometric properties of the EHS, the reliability of the global scores was good in women and acceptable in men. At the factor level, reliability ranged from questionable to poor in both samples. These values are lower than those obtained by Miranda et al (2014) but similar to those obtained by other researchers (e.g. Guzmán, 2017 and Alvarez, 2020).

5. Conclusions

The results of this research do not justify treating men and women differently when studying their cognitions associated with social skills, at least with the questionnaire used in this study. In addition, it may be legitimate to make sex comparisons with the Gismero's EHS questionnaire, either on the overall HHSS score, on the scores of the two second-order factors, or on the six first-order dimensions, since consecutive tests of configurational invariance, disturbance and first- and second-order metrics gave evidence, respectively, that the model structure, second-order factor errors and first- and second-order loadings are equivalent in the two study samples.

6. Limitations and Future Research

In this study, the items of the EHS scale have not been modified in order not to alter the model proposed by Gismero. However, an individualized evaluation of each of these items is necessary to obtain information on the low reliability of the scale in each dimension. This purpose demands that research be carried out to improve the items of the scale by analyzing which factors produce low reliability values in the dimensions.

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