Psicothema

Measurement invariance of the Satisfaction With Life Scale (SWLS) by country, gender and age

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Abstract

Background: Although the Satisfaction With Life Scale (SWLS) is the most widely used instrument to measure life satisfaction with its validation having been carried out across ages and countries, few studies have analyzed SWLS measurement cross-cultural invariance with adolescents. With respect to Spanish adolescents, measurement invariance across gender has not been found and the one-factor structure has not been confirmed in Mexican adolescents through Structural Equation Modeling. **Method:** The main purpose of this study was to explore the measurement invariance of the SWLS in a sample of 701 adolescents (Mage = 14.93, SD = 1.83), 47.1% boys and 52.9% girls, from two different countries: Spain (74.2%) and Mexico (25.8%). A multigroup confirmatory factorial analysis is performed to test the invariance of the unifactorial structure. of SWLS with respect to the variables country, gender and age. **Results:** Results support a single-factor structure as well as the internal consistency of the SWLS. Similarly, the tests of measurement invariance support its strict invariance regarding country and gender, and strong invariance regarding age. **Conclusions:** These results suggest that the SWLS is a useful single-factor measure of life satisfaction in Spanish and Mexican adolescents.

Keywords: Life satisfaction, measurement equivalence, confirmatory factor analysis, cross-cultural studies.

Resumen

Invarianza de la Escala de Satisfacción con la Vida (SWLS) en función del país, del sexo y la edad. **Antecedentes:** aunque la Escala de Satisfacción con la Vida (SWLS) es el instrumento más utilizado para medir la satisfacción con la vida y su validación se ha llevado a cabo en diferentes edades y países, pocos estudios han analizado la invarianza intercultural del SWLS en la adolescencia; con respecto a los adolescentes españoles, no se ha confirmado la invarianza en función del sexo y la estructura unifactorial no ha sido confirmada en adolescentes mexicanos a través de modelos de ecuaciones estructurales. **Método:** el objetivo principal de este estudio fue explorar la invarianza del SWLS en una muestra de 701 adolescentes (M = 14,93, DT = 1,83), 47,1% varones y 52,9% mujeres de dos países: España (74,2%) y México (25,8%). Se realiza un análisis factorial confirmatorio multigrupo para probar la invarianza de la estructura unifactorial. de SWLS. **Resultados:** los resultados apoyan la estructura de un solo factor, así como la consistencia interna del SWLS. Del mismo modo, los resultados apoyan la invarianza estricta respecto al país y el sexo, y la invarianza fuerte respecto a la edad. **Conclusiones:** estos resultados sugieren que el SWLS es una escala unifactorial útil para la medida de la satisfacción con la vida en adolescentes españoles y mexicanos.

Palabras clave: satisfacción con la vida, invarianza, análisis factorial confirmatorio, estudios transculturales.

In defining subjective well-being (SWB), two main aspects have been distinguished: *affective* and *cognitive* (Lucas, Diener, & Suh, 1996). The *affective* aspect of SWB refers to the emotional component, whereby levels of positive and negative affect are used to indicate the level of SWB. People who experience more positive affect than negative affect are regarded as having higher SWB. On the other hand, the *cognitive* aspect of SWB refers to a conscious cognitive judgment of life in which individuals compare their life circumstances with a self-imposed standard; it is operationalized as *life satisfaction* (Diener, Emmons, Larsen, & Griffin, 1985). Individuals report high life satisfaction if their

perceived life circumstances are in line with their own standards. Life satisfaction is the ultimate goal of human development and is important to subjective well-being and adaptive psychosocial functioning (Suldo & Huebner, 2006) as a positive indicator of psychological well-being (Seligman & Csikszentmihalyi, 2000). Due to this central role in human functioning, well-being assessment is a critical task and, simultaneously, a major scientific challenge. To measure the cognitive aspect of SWB, Diener et al. (1985) developed the Satisfaction With Life Scale (SWLS).

The SWLS has been used extensively since 1985. It is the most widely used instrument; its measurement and validation have been carried out across ages and countries as diverse as Angola (Tomás, Gutiérrez, Sancho, & Romero, 2015), Brazil (Gouveia, Milfont, da Fonseca, & Coelho, 2009; Sancho, Galiana, Gutiérrez, Francisco, & Tomás, 2014; Zanon, Bardagi, Layous, & Hutz, 2014), Canada (Blais, Vallerand, Pelletier, & Briere, 1989), China (Ye, 2007), the Czech Republic (Lewis, Shevlin, Smekal, & Dorahy, 1999),

Germany (Glaesmer, Grande, Braehler, & Roth, 2011), Hong Kong (Sachs, 2004), Israel (Anaby, Jarus, & Zumbo, 2010), Malaysia (Swami & Chamorro-Premuzic, 2009), Netherlands (Arrindell, Heesink, & Feij, 1999; Arrindell, Meeuwesen, & Huyse, 1991), Norway (Vittersø, Biswas-Diener, & Diener, 2005), Portugal (Neto, 1993; Silva, Taveira, Marques, & Gouveia, 2015), Russia (Balatsky & Diener, 1993), Sweden (Hultell & Gustavson, 2008), Taiwan (Wu & Yao, 2006), and Spain (Atienza, Pons, Balaguer, & García-Merita, 2000; Pons, Atienza, Balaguer, & García-Merita, 2002; Vázquez, Duque, & Hervás, 2013).

Internal consistency reliability coefficients range from .79 to .89 (Blais et al., 1989; Diener et al., 1985; Pavot & Diener, 1993). Test-retest reliability coefficients are .83 after two weeks and .84 after one month (Pavot & Diener, 1993); adequate construct, convergent, and discriminant validity have been demonstrated (Arrindell et al., 1999; Lucas et al., 1996; Pavot & Diener, 1993; Sachs, 2004). Although not all items show the same level of fit, confirmatory factor analyses reveal a consistent factor structure explaining between 60-75% of the variance (Pavot & Diener, 1993). The SWLS has good convergent validity, related to but still separate from constructs such as depression, negative and positive affect, self-esteem, anxiety, and psychological distress (Pavot & Diener, 2008).

In addition to these basic psychometric properties, the *measurement invariance* across groups has been examined for the SWLS in recent years.

Gender invariance studies have found strict invariance in British (Shevlin, Brunsden, & Miles, 1998), Taiwanese (Wu & Yao, 2006), and Brazilian (Zanon et al., 2014) undergraduates; Angolan (Tomás et al., 2015) and Norwegian youth and adults (Clench-Aas, Nes, Dalgard, & Aarø, 2011); and Chinese (Bai, Wu, Zheng, & Ren, 2011) and Malaysian (Swami & Chamorro-Premuzic, 2009) adults. Other studies have demonstrated scalar invariance in Swedish undergraduates (Hultell & Gustavson, 2008); and metric invariance in Norwegian adolescents (Moksnes, Løhre, Byrn, & Haugan, 2014) and German youth and adults (Glaesmer et al., 2011). However, Atienza, Balaguer and García-Merita (2003) did not show metric invariance for Spanish adolescents, particularly for items 2 and 5.

A complex issue in the field of subjective wellbeing is how life satisfaction changes across the life-span (Blanchflower & Oswald, 2008), namely, *age* potential differences and factorial invariance. These findings have been inconsistent (Pinquart & Sorensen, 2000) with strict invariance in Angolan (Tomás et al., 2015) youth and adults and partial strict invariance in Taiwanese (Wu, Tsai, & Chen, 2009) university students; partial scalar invariance in Taiwanese adolescent athletes (Wu et al., 2009) and Chinese adults (Bai et al., 2011); and metric invariance in German youth and adults (Glaesmer et al., 2011). Most studies, however, did not found age invariance for the SWLS (Clench-Aas et al., 2011; Daniel & Petter, 2008; Hultell & Gustavson, 2008; Pons, Atienza, Balaguer, & García-Merita, 2000).

Therefore, studies of measurement invariance have generally examined the gender and age factorial invariance of the SWLS. However, analysis of the cross-national or *cross-cultural measurement* invariance of the SWLS is more recent (Dimitrova & Domínguez, 2015; Ponizovsky, Dimitrova, Schachner, & van de Schoot, 2013; Tucker, Ozer, Lyubomirsky, & Boehm, 2006; Whisman & Judd, 2015; Zanon et al., 2014). Cross-culturally four of the five SWLS items evidence differential item functioning in

comparisons between undergraduates from the United States and China (Oishi, 2006), and nonequivalence in the SWLS between undergraduates from the United States and Brazil (Zanon et al., 2014). In contrast, data collected from college students from 41 countries indicated that a single-factor model fit adequately (Vittersø, Røysamb, & Diener, 2002).

The factor structure of the SWLS has been explored as well across groups of different backgrounds with evidence for measurement invariance across immigrants from the former Soviet Union in Israel, Turkish-Bulgarians, and Turkish Germans (Ponizovsky et al., 2013) and configural and metric invariance for adults: the United States, England, and Japan (Whistman & Judd, 2016). Still there was only partial scalar invariance, with the intercept for item 4 varying across countries. Similarly, Dimitrova and Domínguez (2015) provided partial support for measurement invariance in Argentinean, Mexican, and Nicaraguan samples. Conversely, the unidimensional structure of the Malay SWLS was invariant across Malay and Chinese adults (Swarni & Chamorro-Premuzic, 2009). Evidence of measurement invariance of the SWLS was obtained in a comparison of university student groups, but not between community groups from the United States and Russia (Tucker et al., 2006). Responses from adolescents in Argentina, Brazil, Chile, and Spain showed factor invariance for a set of items taken from multiple measures of well-being, including four SWLS items (Casas et al., 2012). Full scalar invariance between Spanish and Portuguese samples was not found, with the intercept for SWLS item 5 varying between countries (Atienza, Balaguer, Corte-Real, & Fonseca, 2016).

In summary, these results show that the SWLS exhibits some cultural sensitivity, suggesting that further research is necessary to analyze its cross-cultural equivalence.

This study is based on three premises: (a) few studies have analyzed SWLS measurement cross-cultural invariance with adolescents; (b) regarding Spanish adolescents, measurement invariance across gender has not been found; and (c) the one-factor structure has not been confirmed in Mexican adolescents through Structural Equation Modeling. Thus, the main purpose of this study was to explore the measurement invariance of the Satisfaction With Life Scale (SWLS) by country, gender, and age.

Method

Participants

The sample analyzed was composed by 701 adolescents (M_{age} = 14.93, SD = 1.83), 47.1% males and 52.9% females from Spain (74.2%) and Mexico (25.8%). Although participants belonged to six academic levels from Grade 7 to Grade 12, the sample was split into three sub-groups to facilitate subsequent analyses: Grades 7-8 (n= 250, 35.7%), Grades 9-10 (n= 240, 34.2%) and Grades 11-12 (n= 211, 30.1%).

Instruments

Satisfaction With Life Scale (SWLS; Diener et al., 1985). Life Satisfaction was measured using the Spanish version (Atienza et al., 2000) of the SWLS, comprised of 5 items rated in a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher values representing greater satisfaction.

Procedure

Ethical permission to conduct the study was obtained from the Committee on Ethics of Research and Teaching (CEID). Schools' participation was requested verbally and in writing. After obtaining schools' authorization, a letter of consent to participate was sent to all families. Subsequently, the battery of questionnaires was administered during school hours. Pupils answered the questionnaires individually in the classroom. Anonymity of the responses and voluntary participation were ensured.

Data analysis

Statistical analyses were carried out with SPSS v23 for preliminary results; some packages of R (Lavaan, SEMPlot, and SEM Tools) for Multiple Group Confirmatory Factor Analysis (MG-CFA), the standard method to analyze measurement invariance across groups (Kline, 2011). Preliminary analysis included the review of means, variances, skewness, and kurtosis of the items. Test reliability estimates were obtained using Cronbach's alpha, Guttman's Lambda, MacDonald's Omega, Omega Hierarchical, Omega H Asymptotic, and Omega Total". As with previous studies (Whisman & Judd, 2015), SWLS unidimensionality took the single-factor model as its basic structure; goodness-of-fit to the sample data was determined on the basis of: Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Root Mean-Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) (Kühne, 2013). The MG-CFA analysis included confirmatory factor analysis to examine the fit of the model to data and to test the measurement invariance of the scale across the groups (country, gender, and age).

According to Timmons (2010), there are four levels of factorial invariance: configural, weak, strong, and strict invariance. These levels of invariance should be viewed as a hierarchy of levels (Meredith & Teresi, 2006), meaning that the existence of one higher-level invariance implies the existence of invariance at lower levels. *Configural* and *weak* invariance are based on observed covariances only, whereas the two last forms deal with observed covariances and means. *Configural* invariance requires the equivalence between the pattern of fixed and free parameters across groups, that is, same loads on same factors; *configural* invariance investigates whether or not examinees from different groups employ the same conceptual framework to answer the test items (Cheung & Rensvold, 2002). With regard to *weak* or metric invariance, it requires factor loadings to be equivalent across groups; for all items, one unit change in the item score is scaled to an equal unit change in the factor score across groups (Wu, Li, & Zumbo, 2007), as the items are measuring the same underlying construct across groups. *Strong* or scalar invariance demands the equivalence of means for the observed items across groups, given that the loadings and intercepts across groups are equal for all items; the existence of strong invariance allows comparison of latent group means because the centers of the latent variables are scaled in the same way across groups or the mean cross-group differences are due to the factors (Wu et al., 2007). *Strict* invariance not only requires the above conditions but also for the residuals to be equivalent across groups; factor loadings, manifest variable intercepts, and manifest variable residuals must be the same. The residual variance is the part of item variance not attributable to factors under study and is considered as error variance of the items. Strict invariance assures that the variance error is the same across

groups. These restrictions mean that, under strict invariance, group differences in variances of observed variables are attributable only to group differences in variances of latent variables, while under strong invariance, group differences of observed variables are attributable to group differences in latent variables and to group differences in error variances. Strict invariance is hard to establish in practice due to the strictness of the criteria (Timmons, 2010).

To test measurement invariance, successive models are compared with increasingly stringent constraints. First, a baseline model is defined with a pattern of loadings similar for all groups, although loadings, intercepts, and other parameters may be different across groups. Next the fit of each model is compared to the fit of the previous model. If model fit does not worsen, the subsequent model is selected (e.g., strong invariance exists if the fit to the data is not worse than the fit of the weak invariance model). Although there are many different statistical methods to decide when model fit worsens, the usual procedure used in Structural Equation Modeling (SEM) is to employ chi-square ($\chi 2$) difference test, and fit indexes, such as, Root Mean Square Error of Approximation (RMSEA), and Comparative Fit Index (CFI); frequently these indexes are combined along with variations among the models through ΔRMSEA and ΔCFI. If the Δ in these indexes is low (usually accepted $\Delta<.01$), it is assumed that invariance exists (Cheung & Rensvold, 2002).

According to Chen's (2007) recommendations for non-invariance (ΔCFI$\geq$.01, supplemented by ΔRMSEA$\geq$.015), and Hirschfeld and von Brachel's (2014) or Hu and Bentler's (1999) suggestions that ΔCFI is the best indicator (when ΔCFI<.01), these indices were used to analyze the invariance of the scales with respect to country, gender, and age. RMSEA (recommended<.08) and CFI (recommended $\geq$.95) were calculated to test model fit.

Results

Means, standard deviations, skewness, and kurtosis for SWLS items and the variance-covariance matrix are presented in Table 1. All values of skewness and kurtosis are within an acceptable range (-2, 2) according to Muthén and Kaplan's (1985) recommendations.

Then a well-fitting baseline model was established. The single-factor SWLS structure with five items underpinned by the previous research showed a reasonable fit (CFI = .987, TLI = .974, RMSEA = 0.076, and SRMR = .024). Likewise, the results of internal consistency and composite reliability of the scale were good (Cronbach's alpha = .86, Guttman = .84, Omega hierarchical = .84, Omega H asymptotic = .95, Omega Total = .88).

Once the baseline model was identified, the equivalence of this model was tested across samples by imposing a series of increasingly stringent constraints between groups. The goodness-of-fit statistics for tests of measurement invariance *of the single-factor model by country, gender,* and *age* are presented in Table 2.

Table 2 shows the fit index and the variations in CFI and RMSEA index between the models; as can be seen, the model comparisons indicate that the factor loadings can be assumed to be equal, since ΔCFI and ΔRMSEA are below the proposed cut-point of 0.01, except for the strict model in age invariance, where ΔCFI is above the cut-point. These results allow analysis of the differences between groups defined by country and gender, according to differences in scale values. Age did not satisfy strict invariance. Strong invariance model was tenable, it allows comparisons of the results of the scale in the three age groups

Table 1
Descriptive analysis and variance-covariance matrix

	M	SD	Sk	Ku	Swls1	Swls2	Swls3	Swls4	Swls5
Swls1	4.88	1.54	-.74	-.16	2.40				
Swls2	5.42	1.4	-1.05	.73	1.32	1.98			
Swls3	5.57	1.5	-1.28	1.25	1.57	1.23	2.27		
Swls4	5.23	1.48	-.91	.23	1.26	0.90	1.35	2.21	
Swls5	4.81	1.98	-.61	-.89	1.73	1.24	1.71	1.54	3.95

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

Table 2
Goodness-of-fit statistics for tests of measurement invariance of a single-factor model by country, gender, and age

Model	$\chi^2(\Delta\chi^2)$	df(ΔDf)	p(χ^2)	RMSEA	ΔRMSEA	CFI	ΔCFI
Country invariance							
Configural	27053			0.070	NA	0.989	NA
Weak	41257	4	0.007	0.075	0.005	0.982	0.007
Strong	51221	4	0.04	0.073	0.002	0.978	0.004
Strict	54217	1	0.08	0.073	0.000	0.977	0.001
Gender invariance							
Configural	30990			0.077	NA	0.986	NA
Weak	31796	4	0.938	0.060	0.017	0.988	0.002
Strong	45005	4	0.01	0.065	0.005	0.982	0.006
Strict	51244	1	0.01	0.070	0.005	0.979	0.003
Age invariance							
Configural	42106			0.068	NA	0.982	NA
Weak	47280	8	0.670	0.068	0.020	0.983	0.001
Strong	58475	8	0.221	0.062	0.006	0.982	0.001
Strict	88383	2	0.000	0.085	0.023	0.963	0.019

analyzed, although differences in them can be affected by the error variance of latent variable scores measuring this scale.

Discussion

Preliminary results from the internal consistency and reliability suggest that the SWLS is a valid and reliable scale for studying satisfaction with life in adolescents from Spain and Mexico. Along with this finding, the single-factor structure has been confirmed. The main purpose of this study was to explore the measurement invariance of the SWLS by country, gender, and age. Country, gender, and age differences in life satisfaction may be attributable to individual life experiences. Conversely, differences across groups with respect to life satisfaction may be attributable to the scale being used and individuals' divergent interpretations of questions according to their country, age, and gender (Veenhoven, 1996). However, results support the strict invariance of the one factor structure of the SWLS across countries, rendering the second possibility unlikely. This result may be the first time that strict invariance is found between countries in adolescent samples, since previous studies did not find full scalar invariance with all the items of SWLS, as item 5 varied across countries (Atienza et al., 2016; Casas et al., 2012). The finding of strict gender invariance accords with previous work done by Tomás et al. (2015), in contrast to other studies that did not find support for strict gender invariance in adolescent samples (Atienza et al., 2003; Moksnes et al., 2014).

Finally, strong invariance was found regarding the three educational sub-groups. Previous findings on the age and life satisfaction relationship have been inconsistent (Pinquart & Sorensen, 2000). Although some studies have found strict invariance comparing different age samples (Tomás et al., 2015; Wu et al., 2009), these studies cannot be directly compared with the present study since only adolescent participants have taken part in this study. Other studies found no age invariance and that the SWLS was sensitive to age (Clench-Aas et al., 2011; Daniel & Petter, 2008; Hultell & Gustavson, 2008; Pons et al., 2000).

Current research has limitations related to the incidental sampling used and the imbalance between Spanish and Mexican adolescents. Another limitation could be the exclusive focus on a unidimensional measure of life satisfaction. Life satisfaction has been seen as a multi-dimensional construct (Huebner, 1994). These multiple dimensions might not have the same invariance for country, gender, and age as found here.

However, while this study has limitations, its findings can make an important contribution to the field: (1) the single factor structure of SWLS has been confirmed in Mexican adolescents through Structural Equation Modeling; (2) Strict invariance regarding gender with Spanish adolescents has been found; and (3) Cross-cultural strict invariance has been found in adolescence samples.

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