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The Factor Structure of the Satisfaction with Life Scale (SWLS): A Meta-Analytic Structural Equation Modeling

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Abstract

This study aims to determine the most appropriate factor structure for the life satisfaction scale by using the meta-analytic structural equation modeling (MASEM) approach. For this purpose, we extracted 41 correlation matrices from 33 primary studies (N = 49316) in accordance with the inclusion criteria. Results of the heterogeneity test indicated that the matrices were heterogeneous. Therefore, in the first step of MASEM, we created the total correlation matrix according to the random-effects model. At this stage, we determined that there was a large and statistically significant relationship between the scale items. In the second phase of MASEM, we established four models of SWLS (original single-factor model, modified single-factor model, two-factor model, and the first three-item model). As a result of the analysis, we determined that although the goodness-of-fit indices of the original single-factor model were at a "good" level, the model-data fit of the modified-single-factor model and the two-factor model was better. However, we determined that the modified-single factor model was the most appropriate one since there was a high correlation (r = .92, p < .01) between the factors in the two-factor model, and its divergent validity could not be ensured. We determined that the first three-item model is a saturated model. Therefore, it is not possible to compare the statistically obtained findings for this model.

Keywords: life satisfaction, SWLS, meta-analysis, two-stage structural equation modeling

Introduction

Variables play a critical role in the effort of trying to understand how they are causally associated, which is the main purpose of science in scientific research processes. In education, social sciences, and psychology, the characteristics that are subject to measurement are tried to be defined through indirect measurements. In these definitions, measurement tools are used to measure these variables. The psychometric qualities of the measurement tools used to measure these constructs, which are the subject of the measurement, have a critical role. One relevant construct in psychology is "life satisfaction ", which is one of the study subjects that are the focus of attention of researchers (Appleton & Song, 2008; Dağli & Baysal, 2016; Vassar, 2008). Life satisfaction is defined as a judgmental process in which individuals evaluate their quality of life according to their own criteria (Shin & Johnson, 1978). Therefore, the judgment of life satisfaction depends on the comparison of the conditions in which the individuals are living with the standards they think are appropriate (Diener et al., 1985). As a result of

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this comparison, as long as the conditions comply with the standards, the person reports a high level of life satisfaction (Pavot & Diener, 1993).

There are different scales in the literature to measure individuals' life satisfaction. These scales; Satisfaction with Life Scale (Diener et al., 1985), Quality of Life Inventory (Frisch, 1994), Riverside Life Satisfaction Scale (Margolis et al., 2018) can be given as examples. The most preferred of these scales is the Satisfaction with Life Scale (SWLS) developed by Diener et al. (1985). Thus, a Google Scholar search of Diener et al.'s (1985) study that introduced SWLS yielded 36582 citations until 2022, which provides information about the potential of the SWLS. This scale can be preferred in many large national surveys (e.g., General Social Survey, German Socio-Economic Panel, and World Value Survey) for its high reliability and validity instead of single-item measurements. Therefore, having a valid, concise, and easy-to-understand measurement tool is of great significance.

Diener et al. (1985) used the principal axis factoring method to explain the structure of the scale and obtained a one-factor, five-item structure that explained 66% of the variability. These items are; *(i)* In most ways my life is close to ideal, *(ii)* The conditions of my life are excellent, *(iii)* I am satisfied with my life, *(iv)* So far, I have gotten the important things I want in life, and *(v)* If I could live my life over, I would change almost nothing. The SWLS items are global rather than specific in nature, allowing respondents to weigh domains of their lives in terms of their own values. The Cronbach's alpha coefficient, showing the internal consistency of the measurements obtained in the scale development study, and the test-retest reliability coefficients obtained in two months related to its stability were reported as .87 and .82, respectively. Pavot and Diener (1993, 2008) reported in their review studies that the coefficient alpha for the SWLS ranged from .79 to .89, indicating that the scale has high internal consistency. In support of this, a meta-analysis of 60 studies that assessed SWLS reliability reported an average Cronbach alpha coefficient value of .78, with confidence intervals of 95%, ranging from .76 to .80 (Vassar, 2008). Similarly, Busseri (2018) calculated the reliability of the scale as .82, 95% CI [.75, .89] in his meta-analysis study. At the same time, the psychometric findings of the SWLS scale, which has been adapted to many cultures (France, Germany, Russia, Korea, Turkey, Portugal, and Romania), show that the scale is widely used to measure life satisfaction in psychological research.

The Debate on the Factor Structure of the SWLS

The purpose of this studyis to determine the most appropriate factor structure for the SWLS. For this reason three confirmatory factor analysis (CFA) models of the SWLS were evaluated and specified in the present study based on findings in previous research: Model 1: The original single-factor model with all SWLS items loading onto a single factor of life satisfaction (Pinto da Costa & Neto, 2019; Dahiya & Rangnekar, 2020; Dirzyte et al., 2021; Espejo et al., 2022; Gadermann et al., 2009; Galanakis et al., 2017; Garcia et al., 2021; Jovanovic, 2019; Lopez-Ortega et al., 2016; Marcu, 2013; Sachs, 2003; Sagar & Karim, 2014; Sancho et al., 2014; Silva et al., 2014; Wu et al., 2009; Wu & Wu, 2008). Model 2: The modified single-factor model, allowing for correlated errors between items 4 and 5 (Clench-Aas et al., 2011; Cazan, 2014; Dahiya & Rangnekar, 2020; Jovanovic, 2019; Mishra, 2019; Moksnes et al., 2013; Sachs 2003). Model 3: The two-factor model with two correlated factors; present satisfaction (items 1, 2, and 3) and past satisfaction (items 4 and 5) (Dahiya & Rangnekar, 2020; Hultell & Gustavsson, 2008; Jovanovic, 2019; Sachs 2003; Slocum-Gori et al., 2009; Wu et al., 2006).

Studies on the construct validity of the scale confirmed the one-factor structure (Arrindell et al., 1991; Atienza et al., 2000; Diener et al., 1985; Glaesmer et al., 2011; Swami & Chamorro-Premuzic, 2009). Although Model 1 was supported in some studies (Gouveia et al., 2009; Jovanović, 2016), the goodness-of-fit of this model was "poor" in other studies (Fabio & Gori, 2015; Wang et al., 2017). Pavot and Diener (1993) reported weak convergence of the last two items with the other three items based on item-total score correlations and factor loadings. In this respect, in other studies, Model 2 showed a better model-data fit than Model 1 (Clench-Aas et al., 2011; Dahiya & Rangnekar, 2020; Moksnes et al., 2014; Pavot & Diener, 2008; Sach, 2003). In some studies, Model 3 was used (Hultell & Gustavsson 2008; Wu & Yao, 2006). In these studies, in which a multifactorial structure is suggested, the first three items are generally related to present life, and the last two items are based on emphasizing past life. However, in studies where models are compared or examined together, although Model 3 produces similar goodness-of-fit values to Model 2 (Jovanović, 2019), it is not recommended due to the high correlation between factors (Dahiya & Rangnekar, 2020; McDanold, 1999; Sachs, 2003).

Researchers working on SWLS drew attention to the high factor loadings and item-total correlations of the first three items of the SWLS (Diener et al., 1985, Pavot & Diener, 2009; Vittersø et al., 2009; Kjell & Diener, 2021). Some studies have suggested a one-factor and three-item model by associating the last two items of the 5-item scale weak convergence with the others from a theoretical perspective (Pavot & Diener, 2008). In addition, CFA and Multi-Group CFA (MGCFA) focused studies on the 3-item single factor structure produced findings supporting this suggestion (Espejo et al., 2022; Kjell & Diener, 2021). For this reason, it is considered important to examine the structure of the 3-item single factor model (Model 4) within the scope of the research.

Therefore, it is seen that there is a disagreement in the literature about which is the best model to represent the factor structure of the life satisfaction scale. Based on these cross-cultural findings, many studies emphasize that the in-depth investigation of the factor structure of SWLS, which has a significant potential for use, and the comparison of the relevant factor structure through multi-group applications can contribute to theory and practice (Clench-Aas et al., 2011; Glaesmer et al., 2011; Pavot & Diener, 1993; Pavot & Diener, 2008; Tucker et al., 2006). As a part of the validity studies, questions such as “Do the five items in the scale come together to produce a single implicit feature scoring” or “Are there sub-latent variables in the scale that need to be scored separately?” can arise. The answers to such questions will also affect the decisions to be taken based on the measurements obtained from the SWLS. This study aims to resolve this conflict in the literature based on a meta-analytic structural equation modeling (MASEM) approach. Through this approach, which includes both meta-analysis and structural equation modeling, it is aimed to synthesize the structures obtained regarding life satisfaction by considering the results of MGCFA carried out in different cultures and groups. The main research question covered in the study is: “What is the model that best represents the factor structure of the life satisfaction scale by using the inter-item correlation matrices obtained from SEM-based studies?”

Method

Literature Search

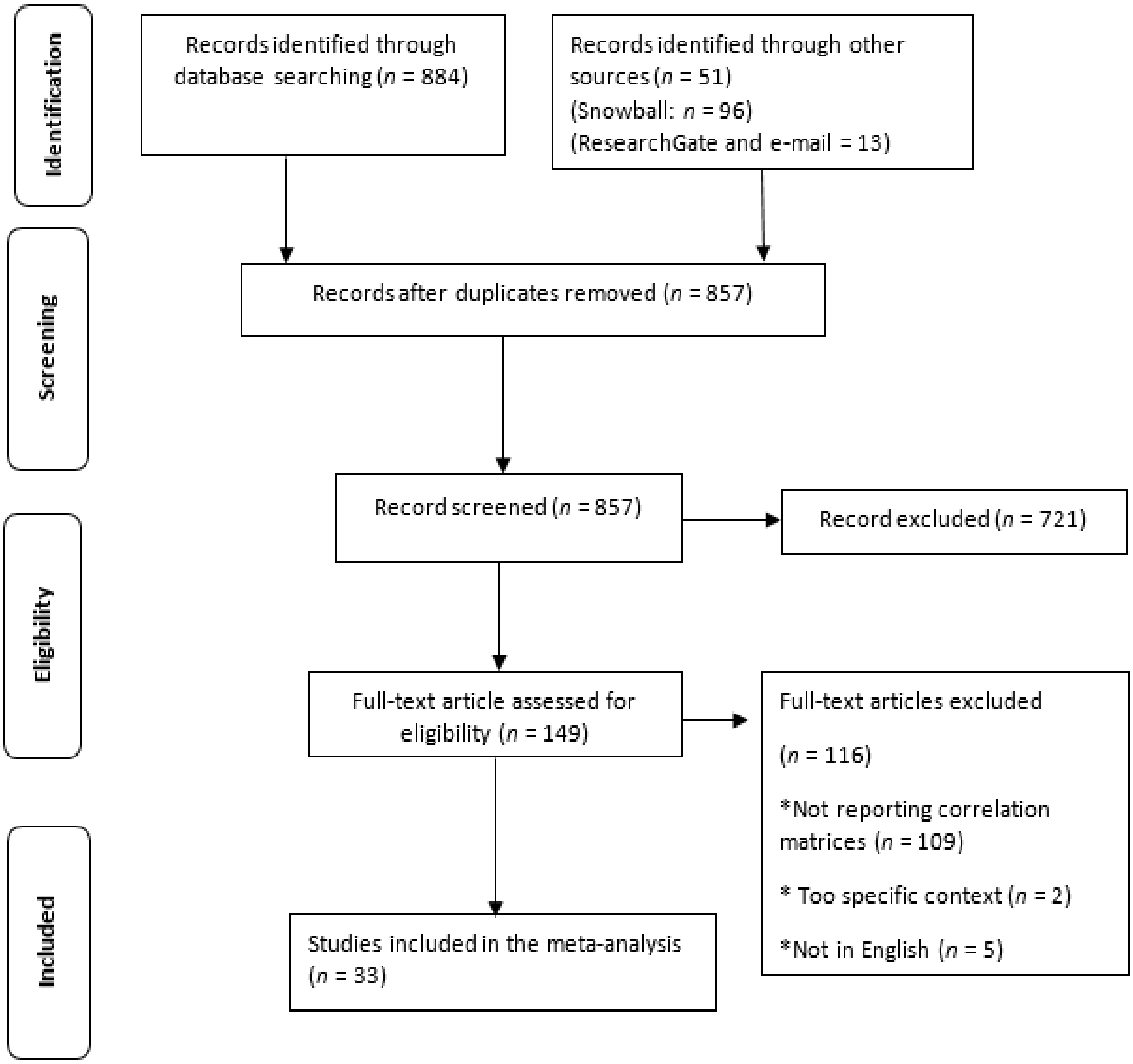
We searched Web of Science, PsycINFO, and Crossref databases to include eligible studies in the meta-analysis. During the scanning, the keywords “Satisfaction with Life Scale” and “SWLS” were scanned together and separately by two different researchers using the Publish and Perish (Harzing, 2007) software and Google Scholar search engine. We tried to determine the appropriate studies by examining (snowball technique) the reference parts of the studies reached. We contacted the study authors via ResearchGate and e-mail for candidate studies whose inter-item correlation was not available but which could potentially be used in the study.

Inclusion Criteria

All studies examining the validity and reliability of the “Satisfaction with Life Scale” are potential candidates for this meta-analysis study. For a potential candidate study to be included in this study, it should meet the following criteria: *(i)* the participants are drawn from a large population (students, adults, society, etc.), *(ii)* the correlation coefficients between the items of the scale or the information necessary for the calculation of these coefficients (covariance coefficients and standard deviations) are reported or obtained by contacting the author, and *(iii)* published in English. We reviewed in detail 35 studies that were planned to be included in the study. As a result of this review, we did not include two studies. The first one was the study by Garcia-Castro et al. (2022) because it conducted with a limited population, such as participants with clinical mental illness and the second one was the study by Silva et al. (2018) because the language of the report was not in English. As a result, we included 33 studies that met the stated inclusion criteria in this meta-analysis. A flowchart of the process of including primary studies in the meta-analysis is given in Figure 1.

Figure 1

PRISMA Flow Diagram



Characteristics of Included Studies

We coded the 33 studies included in the meta-analysis according to sample size, age range, characteristics of the participants, and the country where the study was conducted (see Table 1). We divided the participants into three categories (Children/Youth/Adult) according to their mean age. The mean age of the two studies was not reported (Mishra, 2019; Tomás et al., 2015) . When the country where the studies were conducted was examined, 19 studies were conducted in different countries, while some studies were conducted in the same settings (e.g., Balgiu et al., 2021; Macovie et al., 2020; Cazan, 2014; Marcu, 2013). In three studies, the sample consisted of more than one country (Berrios-Riquelme et al., 2021; Esnaola et al., 2021; Tucker et al., 2006).

Two separate coders coded the item correlation matrices that we extracted from the 33 studies included in the meta-analysis. Inter-coder reliability was calculated as 100%.We determined that in four of the studies (Jovanović, 2019; Silva et al., 2015; Wang et al., 2017; Wu & Yao, 2006; Wu et al., 2009) more than one independent group was examined. Therefore, more than one correlation matrix was extracted from these studies. In the study by Wu et al. (2009), we determined that repeated measurements were made with two independent groups at different times. Therefore, we extracted initial item correlation matrices for each independent group from this study. In some studies, (Esnaola et al., 2017; Tucker et al., 2006; Wu & Yao, 2006), covariance matrices have been reported instead of correlation matrices. We calculated the correlation coefficients using covariance matrices and standard deviations of the scores for these studies. As a result, we obtained 41 independent item correlation matrices from a total of 49316 participants. The characteristics of the studies included in the meta-analysis is given in Table 1 and the correlation matrices extracted from the studies are given as Supplemental Material.

As seen in Table 1, the total sample size of 33 primary studies included in the meta-analysis was 49316. The age range of the individuals participating in the studies was quite wide and ranged from seven to 80 years old. In the classification made according to the mean age of the participants, 45.4% (*f*=15) were classified as adults, 36.3% (*f*=12) as youth, 6% (*f*=2) as children, and 6% (*f*=2) as mixed. When the countries in which the studies were carried out were examined, it was seen that four studies were conducted in Romania, three in Greece, two in Portugal, Taiwan, India, Colombia and U.K., and the rest in different countries (e.g. Turkey, Canada, Angola, Spain, Peru).

Table 1

Features of the studies included in the present meta-analysis

Authors	Valid *N*	Age range (*M*/*SD*)	Participant	Country
1. Areepattamannil & Bano (2020)	402	– (15.93/0.7)	Youth	India
2. Bacro et al. (2020)	557	8–16(11.12/1.65)	Children	French
3. Caycho-Rodríguez et al. (2018)	236	– (72.8/6.9)	Adult	Peru
4. Cazan (2014)	342	– (20/–)	Youth	Romania
5. Dirzyte et al. (2021)	2003	– (50.67/17.46)	Adult	Lithuania
6. Espejo et al. (2022a)	1255	18–67 (25.62/8.60)	Adult	Colombia
7. Esnaola et al. (2017)**	701	– (14.93/1.83)	Youth	Mixed
8. Gadermann et al. (2010)	1233	9–14 (11.7/–)	Children	Canada
9. Galanakis et al. (2017)	1797	18–67 (38.06/14.12)	Adult	Greece
10. Jovanović (2019) *	2595	14–55 (23.79/9.71)	Youth	Serbia
11. López-Ortega et al. (2016)	13220	50– (64.7/–)	Adult	Mexica
12. Marcu (2013)	285	16–60 (27.35/13.23)	Adult	Romania
13. Mishra (2019)	426	15–70 (–/–)	–	India
14. Moksnes et al. (2014)	1073	13–18 (15/1.62)	Youth	Norway
15. Sancho et al. (2014)	1003	60–90 (73.1/8.8)	Adult	Portugal
16. Silva et al. (2015)*	885	12–21 (17.7/–)	Youth	Portugal
17. Tomás et al. (2015)	5630	14–65 (–/–)	–	Angola
18. Tucker et al. (2006)**	277	17–62 (29.65/–)	Adult	Mixed
19. Wang et al. (2017)*	2178	15–25 (19.32/–)	Youth	China
20. Wu et al. (2009)*	237	15–23 (19.62/1.29)	Youth	Taiwan
21. Balgiu et al. (2021)	200	– (24.03/0.84)	Youth	Romania
22. Macovei (2020)	124	– (20/–)	Youth	Romania
23. Wu & Yao (2006)**	476	18–30 (20.04/1.67)	Youth	Taiwan
24. Anthimou et al. (2021)	341	17–44 (21.63/3.64)	Youth	Greece
25. García-Castro et al. (2022)	7790	– (66.88/9.58)	Adult	U.K.
26. Theodoropoulou (2021)	360	18–65 (23.54/5.96)	Youth	Greek
27. Berríos-Riquelme et al. (2021)	662	– (34.5/–)	Adult	Mixed
28. Singh et al. (2021)	400	21–60 (35.73/6.28)	Adult	India
29. Mª et al. (2021)	199	– (37.53/12.78)	Adult	Spain
30. Lang & Schmitz (2020)	641	9–18(12.44/1.56)	Children	Germany
31. Sagar & Karim (2014)***	210	19–58 (33.48/8.06)	Adult	Bangladesh
32. Espejo et al. (2022b)***	1222	– (25.66/8.66)	Adult	Colombia
33. Kjell & Diener (2021)***	343	– (34.4/11.9)	Adult	U.K.

* Correlation matrix belonging to more than one independent group was extracted.

** The correlation matrix was calculated by subtracting the covariance coefficients and standard deviations from these studies.

*** Correlation coefficients for the first three items were extracted from these studies.

Evaluating the Quality of Studies

We used the "Quality Assessment Checklist for Survey Studies in Psychology" developed by Protogerou and Hagger (2020) to determine the quality of the studies included in the meta-analysis. This checklist evaluates the study included in the meta-analysis according to 20 criteria in terms of introduction (rationale-variables), participants (sampling), data (Collection-measure-analysis-result-discussion), and ethics (consent-briefing-funding). These criteria vary according to the nature of the study (experimental or cross-sectional). According to this checklist, one point is awarded when these criteria are present in a study and zero when not. The quality score is determined by the ratio of the total score of the study to the total number of criteria. Protogerou and Hagger (2020) reported that studies with a quality score of 70% and above have acceptable quality. Two separate coders scored the 20 studies included in the meta-analysis. As a result of this evaluation, we determined that the quality of the studies varied between 70% and 90%, except for one study (Marcu, 2013). We calculated the quality value of Marcu's (2013) study as 59%.

Data Analysis

We used a two-stage structural equation modeling approach (Cheung, 2015; Cheung & Chan, 2005) to test the magnitude of the inter-item relationship and the goodness-of-fit of the established models using 41 correlation matrices extracted from the 33 studies included in the meta-analysis. We used the codes written by Jak (2015) to prepare the data for analysis. In the first step of this approach, we created a pooled correlation matrix using correlation matrices. In the second stage, we built structural equation models using this correlation matrix and examined the model-data fit of these models. In the first step, we combined the correlation matrices according to the random-effects model, as we collected them from the literature (Borenstein et al., 2009). However, we still examined the heterogeneity test. The fact that the heterogeneity test is statistically significant shows that the studies are heterogeneous and therefore the correlation matrices should be created according to the random effects model (Cheung, 2015). At this stage, we determined the effect size of the relationship between the items and the magnitude of the heterogeneity (I^2). We interpreted the calculated correlation effect sizes as “small” up to 0.1, “medium” up to 0.2, “large” up to 0.3, and “very large” up to 0.4 or greater (Funder & Ozer, 2019). Although not an absolute measure, we evaluated the magnitude of heterogeneity as “small” up to 25%, moderate up to 50%, and “high” up to 75% (Higgins et al., 2003).

We implemented the two-stage structural equation modeling approach using the *R software* Version 4.1.2 (R Core Team, 2021) and *metaSEM R-package* Version 1.2.5.1 (Cheung, 2015). However, we first built the models with *lavaan R-package* Version 0.6-10 (Rosseel, 2012) and then we converted these models into RAM (Responsibility Assignment Matrix) to create asymmetric (A matrix) and symmetric (S matrix) matrices. Thus, by performing the second stage of the analysis, we examined the model-data fit of the models. We examined RMSEA, SRMR, CFI, and TLI to determine if the model-data fit was achieved. RMSEA $\leq .05$, SRMR $\leq .05$, CFI $\geq .95$, and TLI $\geq .95$ were considered as “good” model-data fit (Hu & Bentler, 1999). We examined the AIC and BIC values to determine which of the established models fitted to the data, and we determined the model with the smaller values was the best model (Schermelleh-Engel et al., 2003).

In addition to AIC and BIC values in model evaluation, we examined the composite reliability (CR), convergent validity (CV), and divergent validity (DV-only for the third model) evidence suggested by Fornell and Larcker (1981) for each measurement model obtained from large populations via MASEM. Convergent validity is a concept that expresses the relationship between the items and the factor (Yaşlıoğlu, 2017). We obtained CR, Average Variance Extracted (AVE), and Maximum Shared Variance (MSV) values by using estimated standardized loading and error variances of measurement models and correlation between factors in multifactorial structures. CR is calculated by dividing the square of the sum of the standardized loadings by the sum of the squared of the standardized loadings and the error variances (Raykow, 1997). We calculated the AVE by dividing the sum of the square of the factor loading to the number of items. We obtained the MSV by squaring the relationship between the factors for the two-factor structural equation model. In order to assess the relevance of the evidence obtained, we used the criteria CR > 0.70 and AVE < CR with AVE values of 0.5 and above for convergent validity, and MSV< AVE for divergent validity (Esposito Vinzi et al., 2010; Hair et al., 2013). We used Egger's regression test to determine whether the raw correlation coefficients are the product of publication bias. This test is used to examine whether the asymmetry in the funnel plot is statistically significant (Egger et al., 1997). The statistically non-significance of the result of this test is accepted as a finding that there is no publication bias.

Results

Summary of the Effect Sizes of Inter-Item Correlations

In the first step of the two-stage MASEM, we combined the correlation matrices collected from the literature according to the fixed-effect model. As a result of this process, we calculated $Q_{(379)} = 8755.8$, ($p < .001$). This result shows that the studies are heterogeneous. Moreover, both the RMSEA (0.136) and SRMR (0.133) are very large, indicating that homogeneity of correlation matrices did not fit the data well. As the assumption of the homogeneity of the correlation matrices has not been met, we group the studies into clusters based on the study’s sample type. If the correlation matrices are homogeneous within the subgroups, the grouping variable may be used to explain the heterogeneity (Cheung, 2015, p.233). In order to determine the source of heterogeneity, we divided the studies included in the meta-analysis into two as "youth" and "adult" according to the mean age of the sample groups. In the context of this study, we combined “children” category with the "youth" category, since the youngest mean age was 11 and there were relatively few studies (n = 2) in this category. We also classified the sample groups whose mean age was over 25 as the "adult" category. Because when the number of studies falling into a category is too small, the test is not powerful enough to reject the null hypothesis of the homogeneity of correlation matrices (Cheung, 2015). The results of the test are given in Table 2.

Table 2

Summary of subgroup analysis

Cluster	Sample	$\chi2$(df)	*p*	RMSEA [95% CI]	SRMR	TLI	CFI
Youth	25079	3621.68(220)	.000	.119 [.116, .123]	.121	.917	.920
Adult	24237	4353.42(149)	.000	.145 [.141, .149]	.129	.921	.927

According to Table 2, the test statistics and goodness-of-fit indices showed that the hypothesis of the homogeneity of the correlation matrices in these two samples was rejected. In other words, the sample type is not sufficient to explain the heterogeneity of the correlation matrices. For this reason, it is more appropriate to combine the effect sizes of the studies according to the random-effects model rather than the fixed-effect model. We calculated $Q_{(379)} = 7150.81$, ($p < .001$) according to random-effects model. This result also shows that the studies’ correlation matrices are heterogeneous. The correlation effect sizes between the items that we obtained as a result of the first stage are given in Table 3.

Table 3

Summary of effect sizes of inter-item correlations (N = 49316)

Associations	***r***	**95% Confidence Interval**		***I^2***
		Lower Limit	**Upper Limit**	
I1&I2	.600	.566	.634	.963
I1&I3	.620	.586	.655	.962
I1&I4	.523	.494	.553	.925
I1&I5	.488	.500	.527	.954
I2&I3	.643	.610	.677	.967
I2&I4	.511	.476	.545	.950
I2&I5	.454	.424	.484	.923
I3&I4	.584	.553	.616	.952
I3&I5	.521	.493	.549	.913
I4&I5	.582	.475	.529	.908

As seen in Table 2, the calculated 10 correlation effect sizes vary between .424 and .629. It can be said that these effect sizes are at a "moderate to high" level according to the Funder and Ozer (2019) classification. These effect sizes indicate a very large and potentially very strong effect size in the short and long term. When the lower and upper limits of the correlation effect sizes are examined, it is seen that all of them are statistically significant ($p < .05$) at the 95% confidence interval. When the heterogeneity of the correlations between the items is examined (I2), it is seen that it varies between 92.3% and 96.6%. In this case, we can say that the heterogeneity of the correlations between the items is at a “high” level according to the Higgins et al. (2003) classification. Therefore, it can be interpreted that the variance between studies is due to the characteristics of the studies (sample group, measurement tool, etc.) other than sampling error.

We performed Egger's regression test to determine whether the raw correlation coefficients were the product of publication bias. As a result of the test, we determined that the asymmetric distributions of the correlation coefficients between the first item and the second item (I1&I2) in the funnel plot were statistically significant ($p<.05$), but statistically insignificant ($p>.05$) in other correlations. According to this results, it can be said that the correlations between the first item and the second item may be the product of publication bias.

Model-Data Fit of Models

We examined the model-data fit of three models in the second stage of the two-stage MASEM. The indices related to the model-data fit of the tested models are given in Table 4.

Table 4

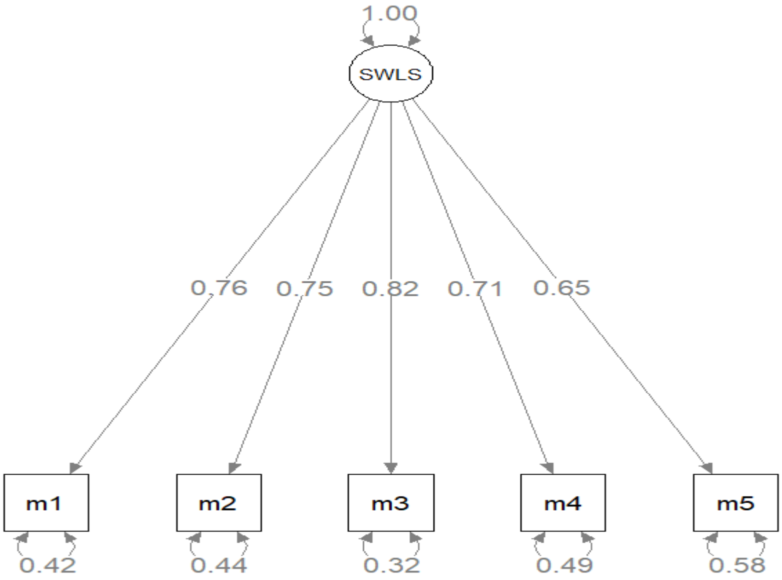
Summary of the indexes of the goodness-of-fit for the tested models (N = 49316)

Models	***χ2(df)***	***p***	**RMSEA [95% CI]**	**SRMR**	**TLI**	**CFI**	**AIC**	**BIC**
Model 1	23.630(5)	.000	.009 [.005, 0.012]	.023	.996	.998	13.63	−30.40
Model 2	5.420(4)	.247	.003 [.000, .008]	.012	.999	.999	−2.58	−37.81
Model 3	5.420(4)	.247	.003 [.000, .008]	.012	.999	.999	−2.58	−37.81
Model 4	.000(0)	.000	.000 [.000, .000]	.000	-Inf	1.00	0.00	0.000

Model 1 (the original model) has a single factor and five-item structure. As seen in Table 4, the chi-square test was statistically significant for the Model 1's 5 degrees of freedom ($\chi 2$ = 23.650, $p < .05$). The RMSEA (.009, 95% CI [.005, .012]), SRMR (.023) TLI (.996), and CFI (.998) values indicated a good fit. When these indices are evaluated together, we can say that the Model 1 fits to the data. The path diagram for Model 1 is given in Figure 2.

Figure 2

The path diagram for Model 1

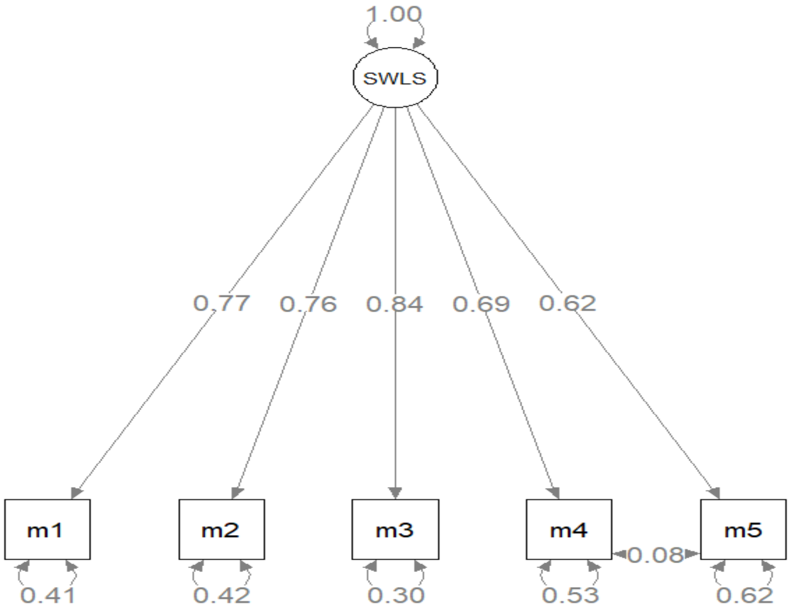


As seen in Figure 2, the standardized factor loadings (effect indicators) of the scale items in a single factor structure vary between .650, 95% CI [.624, .670] and .820, 95% CI [.800, .849]. The error variances of the scale items ranged from .330 to .580. When these variances are taken into account, the variance explanation rate of the latent variable of life satisfaction in the scale items varies between 42% (fifth item) and 68% (third item). When the inter-item residual covariance matrix was examined, we determined that the covariance ranged between -.005 (m1&m3) and .004 (m4&m5). Using standardized loadings and error variances, we calculated CR as .857. This result shows that the model is reliable. In addition, we calculated the AVE as .547. According to these results, we can say that this model satisfies the convergent validity conditions.

The second model is the model (Model 2) in which the correlation between the fourth and fifth items is established. As seen in Table 4, the chi-square test was not statistically significant with the 4 degrees of freedom of the Model 2 (modified original model) ($\chi 2$ = 5.419, *p* > *.05*). According to the results, the RMSEA (.003, 95% CI [.003, .008]), SRMR (.012), TLI (.999), and CFI (.999) values were at a “good” fit level. When these indexes are evaluated together, we can say that the modified original model fits to the data. The path diagram for the Model 2 is given in Figure 3.

Figure 3

The path diagram for Model 2

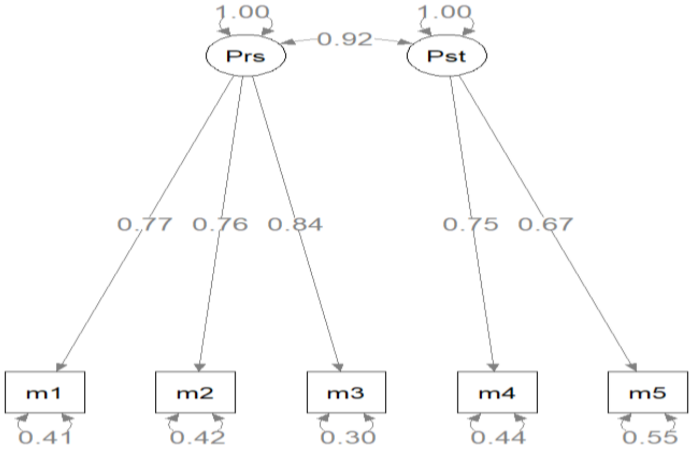


As seen in Figure 3, the standardized factor loadings of the scale items in the modified single factor structure range from .620, 95% CI [.591, .643] to .840, 95% CI [.813, .864]. The error variances of the scale items ranged from .300 to .620. When these variances are taken into account, the variance explanation rate of the latent variable of life satisfaction in the scale items varies between 38% (fifth item) and 70% (third item). The correlation between the fourth item and the fifth item is statistically significant (*p* < *.05*) and small (.08, 95% CI [.043, .115]). When the inter-item residual covariance matrix was examined, we determined that the covariance ranged between -.023 (m1&m3) and .017 (m1&m2). We calculated CR .857 and AVE .547 as additional construct validity evidence for Model 2. These results show that the scale based on this model has a high internal consistency.

In Model 3, the first three items were placed under the present factor (Prs), and the fourth and fifth items were placed under the past factor (Pst). As seen in Table 4, the chi-square test for 4 degrees of freedom of the Model 3 (two-factor model) was not statistically significant ($\chi 2$ = 5.418, *p* > *.05*). The RMSEA (.003 95% CI [.000, .008]), SRMR (.012), TLI (.999), and CFI (.999) values showed good fit. It should be noted that the goodness-of-fit indexes obtained for the two-factor model are the same as for the modified original model. This is because the two-factor model is mathematically equivalent to the modified one-factor model (Jovanović, 2019). The correlation between the first factor (Prs) and the second factor (Pst) was calculated as .920, 95% CI [.882, .954]. This correlation coefficient shows that there is a high level of relationship between the two factors. The path diagram for the two-factor model is given in Figure 4.

Figure 4

The path diagram for Model 3

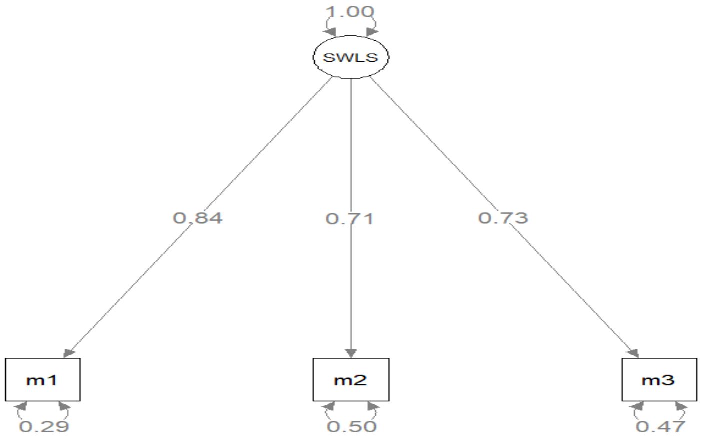


As seen in Figure 4, the standardized factor loadings of the scale items in the two-factor structure range from .670, 95% CI [.647, .698] to .840, 95% CI [.813, .864]. The error variances of the scale items ranged from .300 to .550. When these variances are taken into account, the variance explanation rate of the latent variables of life satisfaction in the scale items varies between 45% (fifth item) and 70% (third item). When the inter-item residual covariance matrix was examined, we determined that the covariance ranged between -.023 (m1&m3) and .017 (m1&m2). The CR and AVE values were .833 and .625 for the first factor but .738 and .585 for the second factor, respectively. According to these results, the conditions for CR and CV were met for both present and past factors. However, another important proof of construct validity calculated based on CFA findings in multifactorial constructs is DV. We calculated the MSV as .846 to obtain evidence for divergent validity. Since this value was greater than the AVE values calculated on the basis of the factor (MSV > AVE), the construct validity became problematic and divergent validity could not be achieved.

In Model 4, we removed the past factor and examined the structure consisting of only the three-item present factor. As seen in Table 4, the chi-square test was statistically significant for the Model 4's 0 degrees of freedom ($\chi 2$ = .000, $p < .05$). As such, the RMSEA (.000, 95% CI [.000, .000]) and SRMR (.000) values indicated good fit. TLI was infinite, and CFI was at a "good" fit with a value of 1.000. This model fits to the data well. The path diagram for Model 5 is given in Figure 5.

Figure 5

The path diagram for Model 4



As seen in Figure 5, the standardized factor loadings of the scale items in a single factor structure vary between .710, 95% CI [.672, .749] and .840, 95% CI [.798, .888]. The error variances of the scale items ranged from .290 to .500. When these variances are taken into account, the variance explanation rate of the latent variable of life satisfaction in the scale items varies between 53% (third item) and 71% (first item). When the inter-item residual covariance matrix was examined, we determined that the covariance ranged between -0.5e-12 (m1&m3) and 1.2e-12 (m2&m3). Using standardized loading and error variances, we calculated the CR value of .868. This result shows that the scale based on this model are consistently measuring the underlying construct. In addition, we calculated the AVE as .604. According to these results, we can say that this model satisfies the CV conditions. However, the goodness-of-fit indexes of the measurement model in Table 3 show that this model is a saturated model. A saturated model has the best fit possible, since it perfectly reproduces all of the variances, covariances, and means (Maruyama, 1997). Since all parameters are calculated in saturated models, these parameters perfectly reflect the covariance matrix of the sample (Sümer, 2000). That's why the saturated model above has a chi-square of zero with zero degrees of freedom. It does matter because the model fit cannot be tested without free *df* and because estimation might fail, but that also depends on the model and data. Thus, this saturated model will produce a GFI of 1, AGFI of 1, CFI of 1 and AIC of 0, BIC of 0, but this is because of the saturated nature of the model and not an indicator of the real perfect fit. Saturated model has no testable implications. Therefore, it is not possible to compare the statistically obtained findings for model 4, considered in this study, with other models. Also, there is no way to know or learn whether Model 4 structure with its directed arrows is correct, partially correct, or complete nonsense.

Which model is the best fit to the data among the three models? AIC (Akaike's Information Criterion) and BIC (Bayesian Information Criterion) indexes are used to determine the fittest model for the data. It is concluded that the model with lower indices than the competitor model is the best fit to the data (Schermelleh-Engel et al., 2003). However, in some cases, while the AIC index of a model is lower than the competitor model, the BIC index may be higher. In such cases, Hyndman and Athanasopoulos (2013) say that using the AIC index is more appropriate than the BIC index. They argue that many statisticians choose the BIC index if there is a real model to test, whereas real models are rare, and even if there is, the model chosen based on the BIC index will not give the best estimate. Accordingly, when the AIC values of Model 1 (original model) and Model 2 (modified-original model), and Model 3 (two-factor model) are compared, the AIC values of Model 2 and Model 3 (−4.980) are lower than that of Model 1 (.680). However, it should be examined whether the decrease in chi-square is statistically significant in choosing the best model (Kline, 1998). The chi-square value of the original model was 10.680 with five degrees of freedom, while the chi-square value of the modified-original model (also in the two-factor model) decreased to 3.020 with four degrees of freedom. As the chi-square value increases, the fit of an overidentified model worsens (Kline, 1998). The difference between the chi-square values of the two models is 7.660 with one degree of freedom. The chi-square table value is 3.840 at the 95% confidence level. Therefore, this decrease in chi-square value is statistically significant (p < .05). Similarly, the RMSA and SRMR values of the modified-single factor model (also the two-factor model) are lower than the original model, and the CFI and TLI values are higher than the original model. Moreover, the residual covariance values of Model 2 are lower than Model 1. As it is known, as the residual covariance of a model decreases, the power of the model to explain the variation in the data increases. When all these values are evaluated together, it can be concluded that the modified model and the two-factor model fit better than the original model. We also calculated the CV for Model 2 as .850. This value is higher than the Cronbach alphas calculated by Vassar (2008) and Busseri (2018) and is consistent with the values reported by Pavot and Diener (1993, 2008). Accordingly, it can be said that the construct reliability of the scale has high internal consistency.

Discussion and Conclusion

The purpose of present study is to determine the most appropriate factor structure for the SWLS. As a result of the analysis we concluded that the modified model and the two-factor model fit better than the original model. When the studies on the factorial structure of the SWLS scale in the literature were examined (Clench-Aas et al., 2011; Hultell & Gustavsson, 2008; Jovanovic, 2016; Jovanovic, 2019; Slocum-Gori et al., 2009; Wu & Yao, 2006; Vautier et al. , 2004), it was observed that the model-data fit of the single-factor and two-factor structures of the scale was generally confirmed. Just like in this study, Jovanovic (2019) emphasized in his study that Model 2 and Model 3 obtained mathematically equivalent statistical values. In this study, the correlation between the two-factor structure was reported to be quite high. Clench-Aas et al.(2011) support a single-factor solution for SWLS with 74% of the variance explained by a single factor. The study also confirmed that the last two items tended to load on the second less important factor reflecting past experiences. They found a high (r = .930) correlation between factors in the two-factor model. In their study, they emphasized the single-factor structure in which error covariances were associated between the two modified items on the grounds that this correlation was evidence that the two factors could not be easily distinguished and that the single-factor structure overlapped with the theory. Similarly, Sachs (2003) compared models on the SWLS Hong Kong Chinese version and again determined the correlation between the factors of Model 3 as "high" (r = .720) and recommended Model 2. He also based the theory of this proposal as "individuals' current experiences cannot be independent of their past experiences in life satisfaction, past experiences also shape their present lives, and therefore life satisfaction will be a general factor formed by the sum of past and present experiences."

Vauiter et al. (2004) argued that the 5 items of the SWLS should be considered on a single main factor in which the sequential effect is taken into account, rather than the scattered positioning of the 5 items on two different factors, and the overall results should be evaluated with a single dimension since the last items perhaps refer to past achievements rather than current conditions. In the literature, the necessity of investigating and understanding the solutions and existing inconsistencies regarding one- and two-factor models has been emphasized not only from a psychometric point of view but also from a cultural point of view (Diener & Diener, 1995; Oishi, 2002; Oishi & Diener, 2001; Oishi & Diener, 2003). For example, Oishi (2006) found in his study that the items 4 and 5 were identified as different across Chinese and American samples. Accordingly, Chinese participants, unlike American participants, did not endorse of items 4 and 5. One of the reasons, Oishi (2006) argues, is that Chinese's concept of life satisfaction is primarily based on external conditions and the current situation rather than on past achievements. These results may indicate that the structure of the scale differs according to the culture groups. In support of this result, Emerson et al. (2017) determined in their review study that SWLS was rarely invariant beyond the structural measurement invariance (MI) level among cultural groups. Emerson et al. (2017) recommends caution when interpreting cross-cultural comparisons, as the meanings of scale items may change during the translation process and most cultural invariance analyses involve comparisons between different language versions of the SWLS. For this reason, although different language versions of the SWLS consistently preserve the meanings of clauses in translation, factor analysis results cannot be generalized to populations from different cultural backgrounds, and people from different cultures may have different definitions, perceptions, and interpretations of SWLS. In this context, it was revealed that measurement invariance studies carried out in different subgroups were primarily investigated on this factorial inconsistency and that the results obtained from the multiple sample analysis based on the single-factor model had strict factorial invariance (Wu & Yao, 2006).

When the models are compared within the framework of the calculated reliability and validity criteria, highest structural reliability belongs to Model 4. When the AVE values for the calculated CR were examined, the structure corresponding to the present structure in Model 3 (which is the same structure as the model tested in Model 4) had the highest explained mean of variance. Also, Model 4 had the second highest AVE value. It is noteworthy that approximately 60% of the structure to be measured in Model 4 is measured with these three items. As expected, these results coincide with the values of the present factor in the two-factor structure. Unlike the Model 3 present structure, the interesting situation in Model 4 is that the standardized load value for item 1 increases and the error variance in this item decreases. In addition, the inter-item residual covariance of this model is close to zero. This finding is in line with the study by Hanzlová (2022) on the 5-item single-factor (Model 1), 4-item single-factor and 3-item single-factor (Model 4) constructs of the SWLS scale. In the study conducted by Hanzlová (2022), the explained total variance value of the 3-item single-factor model was 78%, the Cronbach alpha reliability value was .860 despite the decrease in the number of items, and for all models, the test information functions drawn in line with the item response theory showed that there was enough information in terms of the feature to be measured confirms the findings of the current study. The increase in the total variance explained despite the decrease in the number of items is an indicator of the increase in the representation power of the structure on which the remaining items are focused. As a matter of fact, studies of MI (Espejo et al., 2022; Kjell & Diener, 2021) also confirm this finding and indicate that when Model 1 is used, the meaning attributed to the relevant variable changes and indicates that it causes bias in different subgroups. In these studies, attention was drawn to the fact that the first three models met the measurement of ideal life and perfect conditions, and it was suggested to use model 4 on the grounds that the measurement invariance only met the conditions of partial invariance when other items were added, and the comparisons made lost their meaning.

Implication

We determined that the proposed one-factor modified model (model 2), based on the findings of this study, is largely compatible with the theory and is more understandable for researchers. Suggesting a generally accepted model for SWLS, which has been the subject of many primary structural equation modeling studies in the literature, and the fact that this model is obtained from a very large population can put an end to the debate about the best-fitting model. It is a known fact that SEM-based studies need large sample sizes. Although the primary studies included in the meta-analysis were carried out in relatively large groups, they are rather weak compared to the sample sizes reached by MASEM and can produce different results. Thanks to MASEM, the data obtained from all these studies came together and allowed generalization to be made in the choice of the most suitable model. The researchers' use of this model in studies examining the structural validity of SWLS (e.g., the adaptation of scale, invariance studies, and structural equation modeling studies) may help them obtain more valid and reliable results. Independent of the statistical implications for Model 4, the use of Model 4 can provide researchers with an alternative and useful way to conduct research in which a large number of psychological variables are addressed. Many studies (Kjell & Diener, 2021; Sandy et al., 2017; Ziegler et al., 2014) emphasize that short scales can be a solution in terms of facilitating applicability in different contexts and populations, and making measurements in people with low education level or people with cognitive problems. This can be seen as a fast, advantageous, and common way of obtaining data in research (Sandy et al., 2017).

One of the limitations of this study is that the correlation coefficient calculated between the first and second items of the scale may have been due to publication bias. Therefore, this should be taken into account when discussing the validity of the models. This may limit the validity of the indices obtained from the models. The second limitation is that in the context of this study, moderator analysis was performed on the subgroups formed according to the mean age (youth/adult) in order to determine the source of the variance. However, it was determined that these subgroups could not explain the variance.

Therefore, in future studies based on moderator analysis, the effect of different subgroups can be examined with a larger sample to explain the variance.

Declarations

Conflict of Interest: No potential conflict of interest was reported by the author.

Ethical Approval: Secondary data were used in this study. Therefore, ethical approval is not required.

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Appendix

Raw Correlation considered for meta-analysis

Research ID	Sample Size	I1&I2	I1&I3	I1&I4	I1&I5	I2&I3	I2&I4	I2&I5	I3&I4	I3&I5	I4&I5	Mean of the Items				
												I1	I2	I3	I4	I5
1.Areepattamannil & Bano (2020)	417	.570	.590	.470	.510	.690	.610	.640	.570	.550	.500	4.28	4.58	4.69	4.71	4.20
2.Bacro et al.(2020)	557	.540	.630	.500	.540	.650	.450	.510	.520	.630	.540	-	-	-	-	-
3.Caycho-Rodríguez et al.(2018)	236	.760	.756	.592	.775	.791	.619	.810	.616	.806	.631	3.58	3.58	3.58	3.55	3.69
4.Cazan (2014)	342	.507	.659	.487	.484	.560	.384	.342	.535	.520	.409	-	-	-	-	-
5.Dirzyte et al.(2021)	2003	.650	.643	.579	.557	.732	.609	.519	.705	.550	.611	3.50	3.70	4.08	4.00	3.64
6.Esnaola et al.(2017)	701	.612	.680	.553	.567	.586	.434	.447	.608	.576	.526	4.88	5.42	5.57	5.23	4.81
7.Espejo et al.(2022)	1255	.539	.59	.587	.435	.571	.514	.458	.658	.513	.437	3.67	4.05	4.00	3.94	3.47
8.Gadermann et al.(2010)	1233	.690	.690	.560	.610	.750	.570	.610	.60	.650	.560	-	-	-	-	-
9.Galanakis et al.(2017)	1797	.620	.630	.460	.450	.640	.470	.440	.570	.490	.450	4.45	4.15	4.80	4.80	4.07
10.Jovanović (2019)(1)	1097	.560	.640	.450	.480	.570	.310	.380	.430	.560	.440	4.42	5.45	5.48	4.01	4.44
11.Jovanović (2019)(2)	998	.570	.710	.530	.550	.550	.360	.370	.510	.570	.550	4.42	4.84	5.28	4.39	4.41
12.Jovanović (2019)(3)	500	.660	.700	.620	.560	.640	.590	.480	.630	.600	.520	3.86	4.06	4.57	4.06	3.78
13.López-Ortega et al.(2016)	13220	.430	.350	.320	.270	.450	.400	.320	.480	.310	.340	1.4	1.5	1.2	1.3	1.5
14.Marcu (2013)	285	.540	.590	.400	.430	.510	.370	.420	.520	.500	.410	4.71	4.66	5.07	5.33	4.38
15.Mishra (2019)	426	.440	.420	.292	.286	.577	.481	.247	.435	.327	.221	4.78	4.77	5.16	4.74	3.88
16.Moksnes et al.(2014)	1073	.610	.600	.500	.440	.720	.580	.490	.700	.570	.590	4.24	4.71	5.04	4.82	4.29
17.Sancho et al.(2014)	1003	.745	.825	.654	.630	.819	.818	.585	.828	.617	.657	3.34	3.06	3.37	3.32	3.60
18.Silva et al.(2015)(1)	461	.480	.440	.510	.520	.440	.440	.360	.380	.380	.530	4.70	5.20	5.30	4.90	4.20
19.Silva et al.(2015)(2)	317	.540	.630	.570	.530	.670	.460	.430	.650	.600	.590	4.50	4.60	5.10	5.0	4.30
20.Silva et al.(2015)(3)	107	.440	.410	.580	.460	.530	.400	.470	.580	.640	.530	4.40	4.70	4.80	4.60	3.60
21.Tomás et al.(2015)	5630	.287	.345	.288	.213	.509	.413	.292	.455	.342	.356	3.36	2.99	3.42	3.12	2.69
22.Tucker et al.(2006)(1)	148	.495	.374	.405	.394	.437	.422	.418	.353	.404	.414	4.65	4.80	5.18	5.07	4.35
23.Tucker et al.(2006)(2)	129	.299	.643	.600	.530	.328	.294	.168	.484	.345	.291	3.63	3.65	4.50	3.79	4.08

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Research ID	**Sample Size**	**I1&I2**	**I1&I3**	**I1&I4**	**I1&I5**	**I2&I3**	**I2&I4**	**I2&I5**	**I3&I4**	**I3&I5**	**I4&I5**	**Mean of the Items**				
												I1	**I2**	**I3**	**I4**	**I5**
24.Wang et al.(2017)(1)	552	.780	.730	.560	.420	.800	.640	.460	.700	.480	.470	3.95	4.06	4.24	4.18	3.34
25.Wang et al.(2017)(2)	566	.770	.730	.640	.560	.790	.700	.570	.710	.570	.570	4.23	4.26	4.46	4.43	3.63
26.Wang et al.(2017)(3)	1060	.740	.710	.620	.520	.810	.650	.530	.700	.560	.590	3.97	3.95	4.13	4.04	3.28
27.Wu et al.(2009)	237	.778	.639	.572	.453	.763	.604	0.466	.628	.480	.577	4.32	4.32	4.52	4.47	3.70
28. Balgiu et al. (2021)	200	.56	.56	.41	.31	.58	.27	.36	.6	.5	.53	4.77	4.88	5.62	5.84	4.62
29. Macovei (2020)	124	.662	.556	.394	.43	.44	.334	.502	.327	.28	.288	-	-	-	-	-
30. Wu & Yao (2006)(1)	207	.708	.692	.631	.683	.739	.611	.545	.677	.664	.661	3.97	4.04	4.42	4.12	3.85
31.Wu & Yao (2006)(2)	269	.733	.759	.612	.86	.708	.567	.436	.641	.537	.521	4.08	4.24	4.49	4.32	3.97
32. Anthimou et al. (2021)	341	.603	.702	.606	.425	.742	.557	.4	.622	.471	.471	-	-	-	-	-
33. García-Castro et al. (2022)	7790	.82	.795	.663	.561	.798	.662	.54	.733	.566	.561	5.09	5.06	5.41	5.57	4.68
34. Theodoropoulou (2021)	360	.767	.774	.67	.585	.809	.642	.6	.717	.647	.664	-	-	-	-	-
35. Berríos-Riquelme et al. (2021)	662	.592	.587	.508	.312	.625	.573	.391	.616	.472	.473	-	-	-	-	-
36. Singh et al. (2021)	400	.5	.454	.496	.429	.622	.524	.389	.539	.429	.547	5.19	5.03	5.12	5.04	4.44
37. Mª et al. (2021)	199	.55	.675	.6	.666	.598	.527	.522	.665	.556	.544	-	-	-	-	-
38. Lang & Schmitz (2020)	641	.58	.59	.38	.47	.77	.39	.49	.39	.54	.46	4.03	4.08	4.38	4.01	3.58
39. Sagar & Karim (2014)	210	.53	.37	.32	.13	.57	.58	.21	NA	NA	NA	-	-	-	-	-
40. Espejo et al. (2022b)***	1222	.59	.539	NA	NA	.571	NA	NA	NA	NA	NA	3.67	4.00	4.05	-	-
41. Kjell & Diener (2021)***	343	.666	.74	NA	NA	.71	NA	NA	NA	NA	NA	4.75	4.93	5.19	-	-

Note. The items of SWLS: (I1)In most ways my life is close to ideal; (I2)The conditions of my life are excellent; (I3)I am satisfied with my life; (I4)So far, I have gotten the important things I want in life; (I5)If I could live my life over, I would change almost nothing