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# Satisfaction With Life Scale: analysis of factorial invariance, mean structures and reliability

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## Abstract

The purpose of this study was to test the factorial invariance of the Satisfaction With Life Scale (SWLS) across sexes. After establishing an appropriate baseline model a hierarchy of successively restrictive models relating to the measurement properties of the scale were specified and estimated. In addition, tests of intercept and factor mean differences were conducted. Data from 258 undergraduates from two British universities (173 males and 85 females) was analysed using the multi-sample procedures in LISREL8. Factor loadings, unique variances and factor variance were found to be invariant across the sexes and no differences were found for the intercepts and factor means. In addition, the scale was found to have high reliability. © 1998 Elsevier Science Ltd. All rights reserved.

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## 1. Introduction

The construct of subjective well-being has been the focus of a growing body of research over recent years (Diener and Larsen, 1992; Pavot and Diener, 1993). Instruments such as the Affectometer (Kammann and Flett, 1983) and the Positive and Negative Affect Schedule (Watson et al., 1988) have generally been used to measure the affective component of subjective well-being. The Satisfaction With Life Scale (SWLS) was developed to measure levels of global life satisfaction (Diener et al., 1985) which is the cognitive component. The scale consists of five items and uses a Likert type response format.

Exploratory factor analytic studies have suggested that the scale is unidimensional. Using principal axis factor analysis Diener et al. (1985) found a single factor accounting for 66% of the variance, and similar findings have been reported by Pavot et al. (1991). A single factor structure

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was also found for translations in French (Blais et al., 1989) and Dutch (Arrindell et al., 1991). Confirmatory factor analyses have also supported a unidimensional structure (Shevlin and Bunting, 1994; Lewis et al., 1995). In terms of reliability the SWLS has been found to be internally consistent and temporally stable. Diener et al. (1985) found a coefficient alpha of 0.87 and a test-retest correlation coefficient of 0.82 with a two month interval. Similar findings were reported by Pavot et al. (1991) and Yardley and Rice (1991).

In the aforementioned studies reliability was commonly estimated using Cronbach's alpha (Cronbach, 1951), and dimensionality established by exploratory factor analysis. Such procedures are common in the literature, but have several well documented statistical and theoretical limitations (Bollen, 1989; Pedhazur and Schmelkin, 1991). However, these procedures can be generalised and incorporated into a single statistical model. Tests of factorial invariance within a structural equation framework (Jöreskog, 1971) allow for the simultaneous estimation of a confirmatory factor model across different groups, such as sex. The estimation of a confirmatory factor model allows a test of an a priori factor structure. The fit of the model can be assessed using the chi-square test, or other goodness of fit indices, and the reliability can be estimated from the model parameters (Bollen, 1989). In addition, the degree of similarity of the scale's properties across different groups, factorial invariance, can be statistically tested. As the SWLS aims to measure levels of global life satisfaction as opposed to specific criteria, its content and applicability should be equally relevant for qualitatively different groups. Hoelter (1983) stressed the importance of testing factorial invariance to ensure comparative validity across groups. Furthermore, Cohen and Cohen (1983) discuss the possible moderator effects that can occur when a scale's reliability differs across two groups. For example, if the factor structure of the SWLS is not invariant for males and females it may appear that the relationship with SWLS and other variables differs across sexes. However, the differences in correlation or regression coefficients with another variable may be due entirely to differential item functioning or differences in the scale as a whole.

Factorial invariance indicates that the structure and measurement of the underlying construct are equivalent across groups (Byrne et al., 1989). This study aims to test the SWLS for factorial invariance across sexes and estimate the scale's reliability.

Prior to any invariance analysis being carried out it is necessary to establish a well fitting baseline model (Reise et al., 1993). On the basis of previous studies a suitable baseline model is a single factor congeneric measurement model. This specifies that the variances/covariances of the observed items can be explained in terms of a single underlying latent variable, labelled life satisfaction, and uncorrelated unique variances or measurement error. If the single factor model cannot be rejected in each group increasingly restrictive constraints can be imposed on the model. First, the invariance of the factor loadings across the groups can be tested. This tests the hypothesis that the regression coefficients relating the latent variable to the observed variables for males ( $\Lambda^1$ ) is equal to that for females ( $\Lambda^2$ ). Second, additional constraints on the unique variances can be imposed. This tests the hypothesis that, in addition to invariant factor loadings, the unique variances for each item are the same for males ( $\Theta^1$ ) and females ( $\Theta^2$ ). The third restriction imposes an equality constraint on the variance of the latent variable for males ( $\Phi^1$ ) and females ( $\Phi^2$ ). These tests of factorial invariance tests the equivalence of the psychometric properties of the SWLS across sexes. However, they do not provide information regarding the mean levels of life satisfaction across the two groups. Further restrictions in terms of intercepts ( $\tau^1 = \tau^2$ ) and factor means ( $\kappa^1 = \kappa^2$ ) can be imposed to provide information about invariance of mean structures.

Table 1  
Hierarchy of factorial invariance hypotheses

1. $H_{\Lambda}$	$\Lambda^1 = \Lambda^2$					
2. $H_{\Lambda\Theta}$	$\Lambda^1 = \Lambda^2$	$\Theta^1 = \Theta^2$				
3. $H_{\Lambda\Theta\Phi}$	$\Lambda^1 = \Lambda^2$	$\Theta^1 = \Theta^2$	$\Phi^1 = \Phi^2$			
4. $H_{\Lambda\Theta\Phi\tau}$	$\Lambda^1 = \Lambda^2$	$\Theta^1 = \Theta^2$	$\Phi^1 = \Phi^2$	$\tau^1 = \tau^2$		
5. $H_{\Lambda\Theta\Phi\tau\kappa}$	$\Lambda^1 = \Lambda^2$	$\Theta^1 = \Theta^2$	$\Phi^1 = \Phi^2$	$\tau^1 = \tau^2$	$\kappa^1 = \kappa^2$	

Further details on the technical issues involved in the specification and estimation of models of factorial invariance and mean structures can be found in Jöreskog (1971), Sörbom (1974), Alwin and Jackson (1981), Bollen (1989), and Byrne et al. (1989).

## 2. Method

### 2.1. Sample and procedure

The 258 participants in the study were first year undergraduates from two British universities. There were 173 male participants with an age range of 18–57 and a mean age of 20.6 years ( $SD = 5.61$ ) and 85 female participants with an age range of 18–46 and a mean age of 22.9 years ( $SD = 8.06$ ). All participants completed the Satisfaction With Life Scale (Diener et al., 1985). The data was then separated for males and females.

### 2.2. Analysis

All analyses were conducted using LISREL8 (Jöreskog and Sörbom, 1989). The baseline models and hypotheses 1–3 relating to measurement invariance of the SWLS, were tested using a covariance matrix, each model estimated using maximum likelihood. For hypotheses 4–5 an augmented moment matrix was used with maximum likelihood estimation. The models were identified by fixing the first factor loading in each group at unity. Goodness of fit was assessed using the chi-square statistic. The invariance and mean differences of the SWLS were tested using the hypotheses stated in Table 1. The reliability of the scale was calculated from the parameter estimates of the model in hypothesis 3.

## 3. Results

All analyses used the multi-sample procedures in LISREL8. An acceptable baseline model was found for both males and females. A one factor congeneric measurement model was an acceptable

Table 2  
Results of tests of invariance between the sexes

Hypothesis	$\chi^2$	<i>df</i>	<i>P</i>
1. $H_{\Lambda}$	7.23	14	0.93
2. $H_{\Lambda\Theta}$	15.38	19	0.70
3. $H_{\Lambda\Theta\Phi}$	15.42	20	0.75
4. $H_{\Lambda\Theta\Phi\tau}$	17.31	25	0.87
5. $H_{\Lambda\Theta\Phi\tau\kappa}$	17.20	24	0.84

explanation for males ( $\chi^2 = 3.44$ ;  $df = 5$ ;  $P = 0.63$ ) and females ( $\chi^2 = 1.15$ ;  $df = 5$ ;  $P = 0.95$ ). Results of hypotheses 1–5 are reported in Table 2.

The common metric completely standardised factor loadings were all very high ranging from 0.92 to 0.98 with a mean of 0.964. Using the formula presented by Fleishman and Benson (1987) the reliability of the scale was 0.921.

#### 4. Discussion

A single factor congeneric measurement model was an acceptable description of the data for both males and females. This indicates that the SWLS has the same ‘form’ in each group, that is, the dimensionality of the SWLS is the same across the groups. In addition, the more restrictive model with equal factor loadings across groups (Hypothesis 1) was an acceptable description of the data. Factor loadings represent the relative importance of a particular item in terms of the latent variable, or factor. If factor loadings are not found to be invariant across groups, then it cannot be assumed that the same theoretical construct is being measured. In addition the unique variances associated with each item (Hypothesis 2) were also found to be invariant. Hypothesis 3 tested equality of factor variances. If the variance of one factor was found to be statistically higher than the other, this would indicate a more extreme pattern of responses. However, these variances were not found to be statistically different. These results indicate that the SWLS has sound psychometric properties. First, each item and the scale as a whole functions equivalently for males and females. It is necessary to demonstrate this as a prerequisite for combining responses for males and females in any substantive study using the SWLS. Second, the factor loadings and the reliability of the SWLS is high.

Although various components of the model are invariant across males and females, the previous hypotheses do not include any information on the mean differences between the two groups. Therefore it was necessary to test for differences in both the intercepts and factor means. Differences in any of the intercepts would alert the researcher to any mean differences of particular items, indicating a higher degree of agreement or disagreement with their content. No significant differences in the intercepts were found across the sexes (Hypothesis 4). More generally, the factor means were found to be equal (Hypothesis 5) indicating no significant differences in the global level of life satisfaction. The implication of this is that, with similar findings, the SWLS may be

used in experimental or non-experimental investigations involving sex differences whilst minimizing the chance of committing Type I or Type II errors due to measurement artefact.

The procedure of assessing factorial invariance and differences in mean structures need not be confined to differences across sex. It is important to demonstrate that a scale measures the same trait, and in the same way, across two or more qualitatively distinct groups (Reise et al., 1993). For example it is necessary to determine that a scale is factorially invariant across age, race or ethnic groups before routinely combining the scores of these groups.

## References

- Alwin, D. F., & Jackson, D. F. (1981). Application of simultaneous factor analysis to issues of factorial invariance. In D. J. Jackson and E. F. Borgatta (Eds.), *Factor analysis and measurement in sociological research*. Beverly Hills: Sage.
- Arrindell, W. A., Meeuwesen, L., & Huyse, F. J. (1991). The Satisfaction With Life Scale (SWLS): Psychometric properties in a non-psychiatric medical outpatients sample. *Personality and Individual Differences*, 12, 117–123.
- Blais, M. R., Vallerand, R. J., Pelletier, L. G., & Briere, N. M. (1989). L'Échelle de satisfaction de vie: Validation Canadienne-Française du 'Satisfaction With Life Scale' [French-Canadian Validation of the Satisfaction With Life Scale]. *Canadian Journal of Behavioral Science*, 21, 210–223.
- Bollen, K. A. (1989). *Structural Equations with Latent Variables*. New York: Wiley.
- Byrne, B., Shavelson, R. J., & Muthén. (1989). Testing for the equivalence of factor covariance and mean structures: the issue of partial measurement invariance. *Psychological Bulletin*, 105(3), 456–466.
- Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment*, 49(1), 71–75.
- Diener, E., & Larsen, R. J. (1992). The subjective experience of emotional well-being. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions*. (pp. 405–415). New York: Guilford Press.
- Fleishman, J., & Benson, J. (1987). Using LISREL to evaluate measurement models and scale reliability. *Educational and Psychological Measurement*, 47, 925–939.
- Hoelter, J. W. (1983). Factorial invariance and self esteem: reassessing race and sex differences. *Social Forces*, 61(3), 834–846.
- Jöreskog, K. G. (1971). Simultaneous factor analysis in several populations. *Psychometrika*, 36, 206–409.
- Jöreskog, K. G., & Sörbom, D. (1989). *LISREL8: Users Reference Guide*. Chicago: Scientific Software International Inc.
- Kammann, R., & Flett, R. (1983). Affectometer 2: A scale to measure current levels of general happiness. *Australian Journal of Psychology*, 35, 257–265.
- Lewis, C. A., Shevlin, M. E., Bunting, B. P., & Joseph, S. (1995). Confirmatory factor analysis of the Satisfaction With Life Scale: Replication and methodological refinement. *Perceptual and Motor Skills*, 80, 304–306.
- Pavot, W., Diener, E., Colvin, C. R., & Sandvik, E. (1991). Further validation of the Satisfaction With Life Scale: evidence for the cross-method convergence of well-being measures. *Journal of Personality Assessment*, 57, 149–167.
- Pavot, W., & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment*, 5(2), 164–171.
- Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, Design and Analysis: An integrated approach*. Hilldale, N.J.: Lawrence Erlbaum Associates.
- Reise, S. P., Widman, K. F., & Pugh, R. H. (1993). Confirmatory factor analysis and item response theory: two approaches for exploring measurement invariance. *Psychological Bulletin*, 114, 552–566.
- Shevlin, M. E., & Bunting, B. P. (1994). Confirmatory factor analysis of the Satisfaction With Life Scale. *Perceptual and Motor Skills*, 79, 1316–1318.

- Sörbom, D. (1974). A general method for studying differences in factor means and factor structures between groups. *British Journal of Mathematical and Statistical Psychology*, *27*, 229–239.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070.
- Yardley, J. K., & Rice, R. W. (1991). The relationship between mood and subjective well-being. *Social Indicators Research*, *24*, 101–111.