

Structural Equation Model to Predict Subjective Quality of Life: A Comparison of Scales with Different Numerical Anchoring

Mehrdad Mazaheri, PhD¹

1. Department of Psychology,
University of Sistan &
Baluchestan

Corresponding author:

Mehrdad Mazaheri, PhD
Assistant Professor Department
of Psychology, University of
Sistan & Baluchestan, Zahedan-
Iran. P.O. Box 98155-1147
Tel: +98-541-8056771
Fax: +98-541-2416120
Email: mazaheri@hamoon.usb.ac.ir

Objective: The main aim of the current survey was to evaluate a hypothesized model on subjective quality of life (SQOL), and to survey the role of scale anchoring on satisfaction and dissatisfaction ratings.

Method: The sample consisted of 456 volunteering students who were randomly assigned in to two different conditions, and rated their current overall life (dis)satisfaction and their (dis)satisfaction on six different domains of life. Each condition used one of the two rating scale formats; the formats differed in anchoring (-5 to +5 and 0 to 10). In order to find how the six different domains of life combine to produce an overall measure of subjective quality of life, a SQOL model was designed; and the strength of this hypothesized model of SQOL was examined using structural equation modeling.

Results: The results of testing for multiple group invariance of the hypothesized model indicated a cross-validity for the studied model for measuring SQOL. Our results also indicated that comparing the two different response formats, only for scores derived from Horizontal (0 to 10) response format, all the paths in the model were found to be significant.

Conclusion: The results of the confirmatory factor analysis (CFA) support the conclusion that the proposed model of SQOL fit the data well, and is able to predict SQOL.

Key words: Psychometrics, Quality of life, Satisfaction, Dissatisfaction

Iran J Psychiatry 2010; 5:134-139

The debate among researchers as to the “ideal” rating format has an extensive history. A desired effect of the rating scale method is to provide subjects with a format that allows them to make equal interval judgments thus meeting statistical assumptions of an interval scale of measurement. However, while the rating scale provides a powerful tool for investigating a wide variety of phenomenon, investigations of rating scale function reveal performance anomalies across scale formats.

Rating scales differ in the number of categories as well as number and placement of labels to aid in selection of a category. “Label” is verbal, descriptive statements placed at various locations along vectors of possible response options. Frequently, these options are numbers of increasing and/or decreasing magnitude. The respondent’s task is to select the numerical response option associated with the appropriate label that he/she perceive to be the best representation of his/her attitude or belief on a latent trait. There are several characteristics of response formats that are of relevance to the quality of survey data, ranging from the labeling of response categories and the issue of

administering scales with or without midpoints, to the question of whether response categories are ordered from positive to negative or the other way around.

Rating scales can be presented as a bipolar or unipolar format. There are two ways in which we may signal to respondents whether we wish them to treat a response scale as unipolar or bipolar. The usual way is by using verbal anchors which are either unipolar (eg [no more power, much more power], [not having any success, having great success]) ,or bipolar (eg [much more power, much less power], [much success, much failure]). The second way, as applied in this research, is to use numeric labels which either imply a unidimensional construct (eg [0 to 10], [0 to 5], [0 to 6], [-5 to 0]) ,or a bipolar construct (e.g. [+5 to -5], [+3 to -3], [+2 to -2]) (1).

While the numeric values are often included only for coding and response convenience, Schwartz and co-workers (2) have demonstrated that they carry more, sometimes unintended, meanings. For a particular question, “How successful have you been in life, so far?”, they showed that a scale with numeric values ranging from 0 to 10 was not the same as a scale whose values ranged from -5 to +5. The verbal anchors were

"not at all successful" (0 or -5) and "extremely successful" (10 or +5). They argued that when a 0 to 10 scale is used respondents infer that 0 stands for the absence of any amount; the scale becomes unipolar. In contrast, respondents infer that the scale is bipolar when the numeric values range from -5 to +5. For example, when asking people how successful they had been in their life, if a 0 to 10 scale is offered, they will assume that the low anchor (0) corresponds to not having any success. This contrasts with the interpretation of the lowest point on the -5 to +5 scale as being unsuccessful (being a failure).

Some investigators suggested that the type of response format and the scales' orientation may affect the respondents' response (2-11).

French-Lazovik and Gibson (12) demonstrated that the distribution parameters (means, skewness) of rating scale data were influenced by the labels used. They hypothesized that the negative skew found in most distributions of performance ratings is dependent upon the choice of verbal labels used to anchor rating scale points. Using evaluative rating labels, they were able to systematically change the ratings in the predicted (or hypothesized) direction. The degree of negative skew in distributions of behavioral rating measures was altered by the verbal labels used as anchors. Both means and skewness coefficients were affected by the evaluation labels used in the study. The results presented also showed that a rating scale anchored by a set of more positive evaluative labels (those having higher descriptor indices), results in a shift of the mean numerical values toward the less positive end of the scale. On the other hand, a rating scale anchored by a set of less positive evaluative labels results in a shift of the mean numerical values toward the more positive end of the scale.

According to the literature, life satisfaction can be assessed as a global judgment of overall life satisfaction, or can be broken down further into satisfaction with distinct domains of life (13-18), which vary in relative importance to one another depending upon the individual (19-21). Andrews and Whithey (20) reported evidence that shows how people's feelings about various life domains can be used to predict their general sense of well-being. In a study on the relationship between overall life satisfaction and satisfaction in different domains of life (health, financial situation, job, housing, leisure, and environment), Van Praag, Frijters and Ferrer-i-Carbonell (22) concluded that "satisfaction with life as a whole can best be conceived as an aggregate concept, which can be broken down into its domain components."

Structural Equation Modeling (SEM) is a statistical technique for building and testing models, which are often causal in nature. It is a hybrid technique that encompasses aspects of confirmatory factor analysis, path analysis and regression. Indeed all of these can be seen as special cases of SEM. Among its strengths is the ability to model constructs as latent variables which

are not measured directly, but are estimated in the model from a number of manifest variables assumed to 'tap into' the construct. This allows the modeler to explicitly capture unreliability of measurement in the model, in theory allowing the structural relations between latent variables to be accurately modeled. In fact, SEM is an extension of the General Linear Model (GLM) that simultaneously estimates relationships between multiple independent and dependent variables, in the case of a structural model and/or multiple observed and latent variables, in the case of confirmatory factor analysis.

The main aim of the current survey was to evaluate a hypothesized model on subjective quality of life (SQOL), and to survey the role of scale anchoring on satisfaction and dissatisfaction ratings.

Materials and Method

Participants

A sample of 456 volunteering students, who were randomly assigned in to two different conditions, rated their current overall life (dis)satisfaction and their (dis)satisfaction on six different domains of life (Physical health, Psychological well-being, Social relations, Leisure, Financial situation and Student life). Each condition used one of the two rating scale formats; the formats differed in anchoring (-5 to +5 and 0 to 10).

Materials and Procedure

Overall life (dis)satisfaction and (dis)satisfaction in different domains of life were measured by a questionnaire containing a total of 14 items. Two items assessed overall life satisfaction and overall life dissatisfaction which were followed by 12 items for assessing satisfaction (6 items) and dissatisfaction (6 items) in six different domains of life including: Physical health, Psychological well-being, Social relations, Leisure, Financial situation and Student life (Figure 1).

Satisfaction and dissatisfaction measures

All satisfaction and dissatisfaction measures are rated on an 11-point visual analogue scale. (Figure 2). Each response format presented in one of the two sets of anchoring (-5 to +5, and 0 to 10) as an anchor-point.

SEM Model for Predict Subjective Quality of Life (SQOL)

In order to find how the six different domains of life combine to produce an overall measure of subjective quality of life, a SQOL model was designed; and the strength of this hypothesized model of SQOL was examined using structural equation modeling (see Figure 3).

In this model, as seen in Figure 3, ellipses represent latent variables, Physical Health, Psychological Well-Being, Social Relations, Leisure, Financial Situation, and Student Life; and the rectangles represent measured variables, overall life satisfaction, overall

life dissatisfaction as well as (dis) satisfaction in six different domains of life, physical health, psychological well-being, social relations, leisure, financial situation, student life.

Results

The results for the run of the data which was obtained from the two different response formats of Horizontal (0 to 10), and Horizontal (-5 to +5) are presented in Table 1.

As demonstrated in Table 1, the χ^2 statistic obtained for the models were 123.96 ($df = 27$, $p < .001$) and 48.99 ($df = 27$, $p < .001$), which seemed to suggest an inadequate fit of the model. However, most of the other indicators, such as CFI, NNFI, NFI and IFI were all higher than .90 and provide much more favorable results for the proposed model to fit the data well.

Table 2 provides correlations and estimated coefficients among the six different domains of life for the hypothesized model of SQOL.

As seen in Table 4, the comparison of models, Unconstrained and Measurement weights, was found no significant across sample 1 and sample 2, which

indicate the factor loadings of two different response formats (-5 to +5 and 0 to 10) is not statistically different for both sample 1 and sample 2.

Table 3 provides estimated Regression Weights (**B**) and Standardized Regression Weight (**β**) coefficients of all pathways for the hypothesized model of SQOL. As seen in Table 3, comparing the two different rating scales, only for scores were derived from the Horizontal (0 to 10) response format and all the paths in the model are significant. To find whether or not the results of the (dis)satisfaction ratings reported in the current study can be reproduce using the same scales with a new participants, a sample of 184 volunteering students were asked to rate their current overall life (dis)satisfaction and their (dis)satisfaction with six different domains of life.

Using the “Unconstrained” and “Measurement weights” model, the invariant of the components of the measurement model, SQOL model, were examined across particular groups (Samples 1 and 2). The analysis was done separately for two pairs of parallel response formats obtained from sample 1 and sample 2, and the results are presented in Table 4.

By using questions below, we would like to know how **satisfied** and **dissatisfied** you feel about your life and various aspects of your life. Please keep in mind your standards, hopes, pleasures and concerns and think about your life in the last two weeks. Be sure to answer every item.

- 1- All things considered, how satisfied are you with your **life as a whole**?
- 2- All things considered, how dissatisfied are you with your **life as a whole**?
- 3- All things considered, how satisfied are you with your **physical health**?
- 4- All things considered, how dissatisfied are you with your **physical health**?
- 5- All things considered, how satisfied are you with your **psychological well-being**?
- 6- All things considered, how dissatisfied are you with your **psychological well-being**?
- 7- All things considered, how satisfied are you with your **social relations**?
- 8- All things considered, how dissatisfied are you with your **social relations**?
- 9- All things considered, how satisfied are you with your **leisure**?
- 10- All things considered, how dissatisfied are you with your **leisure**?
- 11- All things considered, how satisfied are you with your **financial situation**?
- 12- All things considered, how dissatisfied are you with your **financial situation**?
- 13- All things considered, how satisfied are you with your **student life**?
- 14- All things considered, how dissatisfied are you with your **student life**?

Figure 1. Satisfaction and Dissatisfaction items

Satisfaction Rating Scales	Horizontal (0 to 10)	Not at all Satisfied	0	1	2	3	4	5	6	7	8	9	10	Very Satisfied
	Horizontal (-5 to +5)	Not at all Satisfied	-5	-4	-3	-2	-1	0	1	2	3	4	5	Very Satisfied
Dissatisfaction Rating scales	Horizontal (0 to 10)	Not at all Dissatisfied	0	1	2	3	4	5	6	7	8	9	10	Very Dissatisfied
	Horizontal (-5 to +5)	Not at all Dissatisfied	-5	-4	-3	-2	-1	0	1	2	3	4	5	Very Dissatisfied

Figure 2. Two different response formats for satisfaction and dissatisfaction rating scales

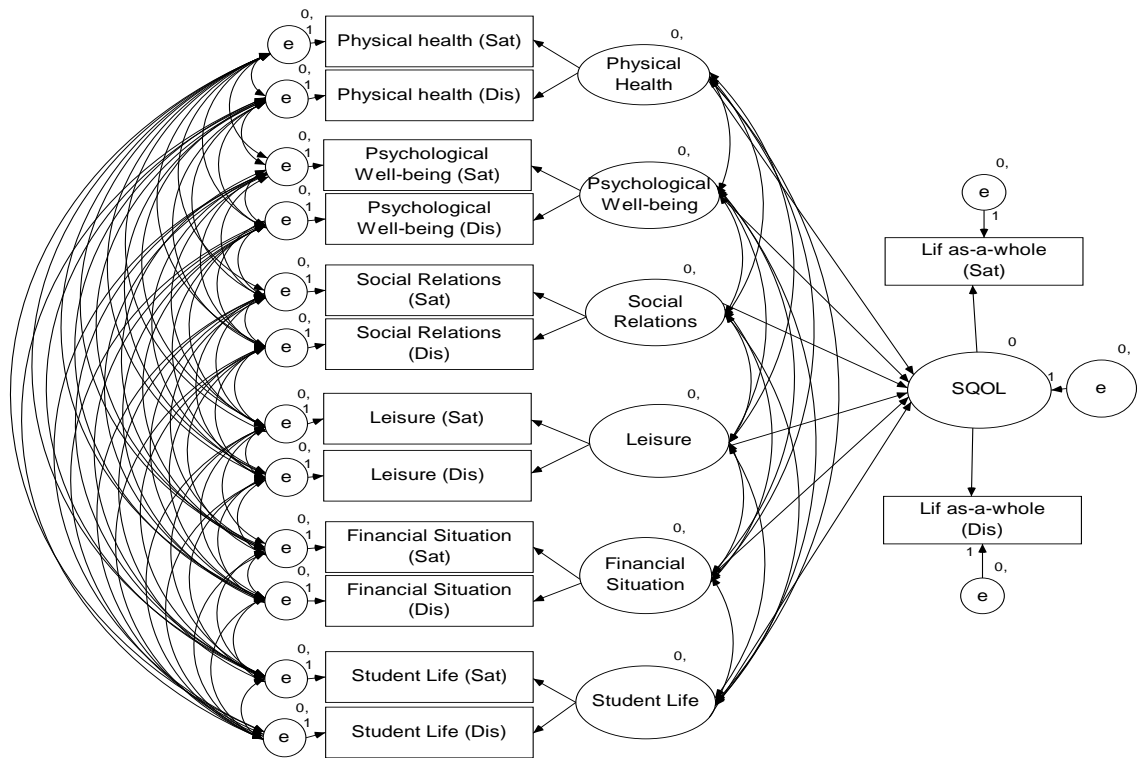


Figure 3. A Model of SQOL

Table 1. Fit Indices of the Hypothesized Model of SQOL

Response Formats	Measures									
	χ^2	df	χ^2/df	CFI	NNFI	NFI	RMSEA	PCLOSE	IFI	HOELTER
Horizontal (0 to 10)	123.96	27	4.59	.98	.91	.97	.11	.00	.98	99
Horizontal (-5 to +5)	48.99	27	1.81	.99	.95	.97	.08	.10	.99	116

NOTE:

χ^2 = Chi-Square; df= degrees of freedom; CFI= Comparative Fit Index; NNFI= Non-Normed Fit Index; NFI= Normed Fit Index; RMSEA=Root Mean Square Error of Approximation; PCLOSE=Probability of Close Fit

Table 2. Inter-correlations of the Six Domains obtained from Unconstrained model

Response formats	Correlations	1	2	3	4	5
Horizontal (0 to 10)	1. Physical Health	-				
	2. Psychological Well-being	.27	-			
	3. Social Relations	.39	.39	-		
	4. Leisure	.24	.25	.29	-	
	5. Financial situation	.20	.23	.30	.28	-
	6. Student Life	.40	.34	.55	.35	.26
Horizontal (-5 to +5)	1. Physical Health	-				
	2. Psychological Well-being	.19	-			
	3. Social Relations	.19	.45	-		
	4. Leisure	.05	.34	.20	-	
	5. Financial situation	.30	.25	.13	.19	-
	6. Student Life	.24	.40	.29	.44	.34

Table 3: Regression Weights (B) and Standardized Regression Weight (β) coefficients

Pathways	Horizontal (0 to 10)			Horizontal (-5 to +5)		
	B	β	p	B	β	p
Physical Health→SQOL	.22	.22	.001	.14	.18	.009
Psychological Well-being→ SQOL	.42	.46	.001	.36	.46	.001
Social Relations→ SQOL	.11	.12	.018	.25	.31	.001
Leisure→ SQOL	.10	.11	.008	.08	.12	.097
Financial Situation→ SQOL	.10	.12	.004	.08	.12	.066
Student Life→ SQOL	.15	.16	.002	.01	.01	.859
Physical Health→ <i>Physical Health</i> (Sat.)	1	.86	.001	1.00	.99	.001
Physical Health→ <i>Physical Health</i> (Dis.)	-.94	-.84	.001	-.98	-.87	.001
Psychological Well-being→ <i>Psychological well-being</i> (Sat.)	1	.98	.001	1.00	.96	.001
Psychological Well-being→ <i>Psychological well-being</i> (Dis.)	-.97	-.91	.001	-.99	-.94	.001
Social Relations→ <i>Social relations</i> (Sat.)	1	1.04	.001	1.00	.98	.001
Social Relations→ <i>Social relations</i> (Dis.)	-.89	-.88	.001	-.94	-.86	.001
Leisure→ <i>Leisure</i> (Sat.)	1	.99	.001	1.00	1.03	.001
Leisure→ <i>Leisure</i> (Dis.)	-.96	-.93	.001	-.84	-.80	.001
Financial Situation→ <i>Financial situation</i> (Sat.)	1	.97	.001	1.00	.98	.001
Financial Situation→ <i>Financial situation</i> (Dis.)	-1.03	-.95	.001	-.95	-.95	.001
Student Life→ <i>Student life</i> (Sat.)	1	1	.001	1.00	.98	.001
Student Life→ <i>Student life</i> (Dis.)	-.97	-.93	.001	-1.01	-.95	.001
SQOL→ Overall life Satisfaction	1	.98	.001	1.00	.94	.001
SQOL→ Overall life Dissatisfaction	-.99	-.93	.001	-1.07	-.90	.001

Table 4: Goodness-of-Fit Statistics for Tests of Invariance across sample 1 and sample 2

Response format	Model Description	χ^2	df	$\Delta\chi^2$	Δdf	CFI	RMSEA	p <
Horizontal (0 to 10)	Unconstrained	179.96	54	-	-	.98	.08	-
	Regression weights	190.94	67	10.98	13	.98	.07	ns
Horizontal (-5 to +5)	Unconstrained	110.95	54	-	-	.98	.07	-
	Regression weights	116.35	67	5.40	13	.98	.06	ns

Discussion

The hypothesized model of SQOL was designed to test the relationships between six domains of Physical Health, Psychological Well-being, Social Relations, Leisure, Financial Situation, and Student Life, as the latent variables with 2 indicators (satisfaction and dissatisfaction in concern domains) per each domain to predict subjective quality of life as a latent variable. Our results indicated that in spite of a significant χ^2 statistic for the model, other indicators, such as CFI, NNFI, NFI, and IFI were all higher than .90, indicating that the model fits the data well (see Table 1).

With regards to life satisfaction, Diener and co-workers (23) acknowledged the importance of particular domains of life (e.g. satisfaction with self, family, etc.); they define subjective well-being (SWB) as “a broad category of phenomena that include people’s emotional responses, domain satisfaction, and global judgments of life satisfaction.” In the current study, we explored the role of (dis)satisfaction in different domains of life to predict overall life (dis)satisfaction. Our findings also accord to previous research which shows how people’s feelings about various life domains can be used to predict their general sense of well-being (11, 20).

Our results of comparing the two different response formats indicated that, only for scores derived from

Horizontal (0 to 10) response format, all the paths in the model were found significant (Table 3). This finding suggests that an adequate predictive validity exists for all the six different domains of life to predict subjective quality of life.

Our results show that the multiple group invariance of the SQOL model, for each response format across sample 1 and sample 2 was non-significant (see Table 4 for different models). These results can be considered as an evidence for the cross-validity of the subjective quality of life rating (SQOL model) as well as the reproducibility coefficient of the rating scales which have been used for (dis)satisfaction ratings in this research.

References

1. O’Muircheartaigh CA, Gaskell GD, Wright DB. Evaluating numeric and verbal labels for response scales. Paper presented at the 48th Annual Conference of the American Association for Public Opinion Research, St. Charles, Illinois; 1993.
2. Schwarz N, Knauper B, Hippler HJ, Noelle-Neumann E, Clark F. Rating scales: Numeric values may change the meaning of scale labels. *Public Opin Q* 1991; 5: 570-582.
3. Scott J, Huskisson EC. Graphic representation of pain. *Pain* 1976; 2: 175-184.

4. Scott J, Huskisson EC. Vertical or horizontal visual analogue scales. *Ann Rheum Dis* 1979; 38: 560.
5. Gift AG. Validation of a vertical visual analogue scale as a measure of clinical dyspnea. *Rehabil Nurs* 1989; 14: 323-325.
6. Friedman LW, Friedman HH. A Comparison of Vertical and Horizontal Rating Scales, Mid-Atlantic Journal of Business 1994; 30: 107-111.
7. Paul-Dauphin A, Guillemin F, Virion JM, Briancon S. Bias and precision in visual analogue scales: a randomized controlled trial. *Am J Epidemiol* 1999; 150: 1117-1127.
8. Sangster RL, Willits FK, Saltiel J, Lorenze FO, Rockwood TH. The effects of numerical labels on response scales. Paper presented at the Annual Meeting of the American Statistical Association, Atlanta, GA; 2001.
9. Mazaheri M, Theuns P. A Comparison of Different Formats of the Anamnestic Comparative Self Assessment (ACSA) for the Assessment of Subjective Well-being. *Patient Reported Outcomes Newsletter* 2006; 36: 10-13.
10. Mazaheri M, Theuns P. Effects of Varying Response Formats on Self-ratings of Life-Satisfaction. *Soc Indic Res* 2009; 90: 381-395.
11. Mazaheri M, Theuns P. Structural Equation Modeling (SEM) for Satisfaction and Dissatisfaction Ratings; Multiple Group Invariance Analysis Across Scales with Different Response Format. *Soc Indic Res* 2009; 91: 203-221.
12. French-Lazovik G, Gibson CL. Effects of verbally labeled anchor points on the distributional parameters of rating measures. *Appl Psychol Meas* 1984; 8: 49-57.
13. Cummins RA. The Domains of Life Satisfaction: An Attempt to Order Chaos. *Soc Indic Res* 1996; 38: 303-328.
14. Headey B, Holmström E, Wearing A. The Impact of Life Events and Changes in Domain Satisfaction on Well-being. *Soc Indic Res* 1984; 15: 203-227.
15. Salvatore N, Muñoz Sastre MT. Appraisal of Life: "Area" versus "Dimension" Conceptualizations. *Soc Indic Res* 2001; 53: 229-255.
16. Meadow HL, Mentzer JT, Rahtz DR, Sirgy MJ. A Life Satisfaction Measure Based on Judgment Theory. *Soc Indic Res* 1992; 26: 23-59.
17. Veenhoven R. Developments in satisfaction research. *Soc Indic Res* 1996; 37: 1-46.
18. Rampichini C, D'Andrea SS. A Hierarchical Ordinal Probit Model for the Analysis of life satisfaction in Italy. *Soc Indic Res* 1997; 44: 41-69.
19. Diener E. Assessing subjective well-being: Progress and opportunities. *Soc Indic Res* 1994; 31: 103-157.
20. Andrews FM, Withey SB. Social Indicators of Well-being: Americans' Perceptions of Life Quality. New York: Plenum Press; 1976.
21. Campbell A, Converse PE, Rodgers WL. The Quality of American Life: Perceptions, Evaluations, and Satisfaction. New York: Russel Sage Foundation; 1976.
22. Van Praag B, Frijters P, Ferrer-i-Carbonell A. The Anatomy of Subjective Well-being. *J Econ Behav Organ* 2003; 51: 29-49.
23. Diener E, Suh EM, Lucas RE, Smith HL. Subjective well-being: Three decades of progress. *Psychol Bull* 1999; 125: 276-302.