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The Spiritual Well-Being Questionnaire: Testing for model applicability, measurement and structural equivalencies, and latent mean differences across gender

by

Rapson Gomez, and John W. Fisher

School of Behavioural and Social Sciences and Humanities

University of Ballarat, Victoria

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Corresponding Author: Rapson Gomez, School of Behavioural and Social Sciences and Humanities, University of Ballarat, P.O. Box 663, Ballarat, 3353, Victoria, Australia.

Electronic mail may be sent to r.gomez@ballarat.edu.au

Abstract

Fisher (1998) proposed a spiritual well-being model, comprising primary factors for the domains of personal, communal, environmental and transcendental well-being, that cohere to form a single higher order or global spiritual well-being dimension. In line with this model, Gomez and Fisher (2003) published the Spiritual Well-Being Questionnaire (SWBQ), with scales for measuring personal, communal, environmental and transcendental spiritual well-being. This study used multi-group confirmatory factor analysis (CFA) to examine gender equivalencies of the measurement and structural models of the SWBQ, and the latent mean in the four SWBQ factors. A total of 3,101 females and 1,361 males, with age ranging from 15 years to 32 years, completed the SWBQ. The statistical fit results supported the invariance of the measurement model, and some aspects of the structural model. The practical fit indices results provided support for the invariance of both the measurement and structural models. The results also showed little gender differences. Together, these findings supporting gender equivalencies for the SWBQ.

The Spiritual Well-Being Domains of the Spiritual Well-Being Questionnaire: Testing for Measurement and Structural Equivalencies and Latent Mean Differences Across Gender

1. Introduction

Spirituality and other spiritual related areas are now emerging as an important area of research (Miller, 2003; Seeman, Dubin & Seeman, 2003). Recently, Fisher (1998) proposed a hierarchal multidimensional model of spiritual well-being. The model comprising four oblique primary order factors, namely personal, communal, environment and transcendental, that all cohere to form a higher order secondary overall or global spiritual well-being factor. In Fisher's (1998; see also Gomez & Fisher, 2003) model, the personal domain deals with how one intra-relates with oneself with regard to meaning, purpose and values in life. The communal domain expresses in the quality and depth of inter-personal relationships, between self and others, and includes love, justice, hope, and faith in humanity. The environmental domain deals with enjoyment, care and nurture for the physical and biological world, including a sense of awe, wonder and unity with the environment. The transcendental domain deals with the relationship of self with some-thing or some-One beyond the human level, such as a cosmic force, transcendent reality, or God, and involves faith towards, adoration and worship of, the source of mystery of the universe. Fisher's multidimensional model has been supported in a number of studies (Gomez & Fisher, 2003; Fisher, 1998, 2001; Fisher, Francis & Johnson, 2000).

Gomez and Fisher (2003) have recently published the Spiritual Well-Being Questionnaire (SWBQ). The SWBQ comprises 20 items, five items for each of the four domains identified by Fisher. In a series of four studies reported in the same paper, Gomez and Fisher (2003) provided evidence for the internal consistency, reliability and validity of the SWBQ. Both exploratory factor analyses and confirmatory factor analyses supported the four-factor oblique model. The four-factor oblique model showed statistically better fit than a four factor orthogonal model and also a one-factor model comprising all 20 SWBQ items. A joint factor analysis of the four SWBQ domains with Eysenck's personality dimensions (Eysenck & Eysenck, 1991) showed that the spiritual well-being domains were independent of the personality dimensions, thereby supporting their factorial independence. Also, consistent with predictions from existing theory and data, the SWBQ domain scores for personal, communal, environmental spiritual well-being correlated as expected with extraversion, neuroticism, psychoticism and happiness. The SWBD factor scores alos contributed additional variance over that of the personality dimensions in the prediction of happiness, thereby indicating support for their incremental validity. The results also showed that SWBQ scores correlated appropriately with the scores of Ellison's (1983) Spiritual Well-Being Scale. In addition, the four studies supported the reliabilities of the four subscales in terms of internal consistency, composite reliability, and variance extracted. Overall, these findings indicate good support for validity and reliability of the SWBQ.

However for the SWBQ to be useful when gender is considered, it will be needed first of all to demonstrate the invariance of the SWBQ and comparability of the factor scores across the gender groups. In our previous study (Gomez & Fisher, 2003), exploratory factor analyses showed support for similar factor structure and loadings for males and females. However, exploratory factor analysis does not provide a clear test of invariance since the analysis is conducted separately for each group and it uses observed scores, which contain measurement error (Byrne, 1988). A more valid approach is to use multi-group CFA as this approach test for invariance for both groups simultaneously, and uses latest scores that are free of measurement error. So far there are no data on how females and males compare on the SWBQ factors of personal, communal, environment and transcendental spiritual well-being. Exploration of this using latent scores that free of measurement error would be valuable in this respect. This can also be done using multi-group CFA.

The current study used multi-group CFA to examine the equivalencies (invariance) of the measurement (i.e., number of factors and factor loadings) and structural (i.e., factor variances and covariances) models of the SWBQ in males and females, and also the latent mean differences for these factor across these groups. The path model for the SWBQ is shown in Figure 1. As shown, there are four factors, namely personal, communal, environment and transcendental, that correlate with each other. Each of the factors had five indicators (the appropriate items from the SWBQ), and there was no loading of indicators across factors or correlation between residuals.

2. Method

2.1 Participants

The sample in this study consisted of 4,462 participants from mainly secondary schools and universities, and some participants from the general community (mainly church groups) in Australia. There were also university students from the UK and Ireland. Their ages ranged from 15 years to 32 years. The sample represented approximately 70% of individuals invited to participate in the study. There were 3,101 females and 1,361 males. The mean age (*SD*) for females and males were 22.16y (4.56) and 21.63y (4.80) respectively. All age categories had more or less equal proportions of females and males.

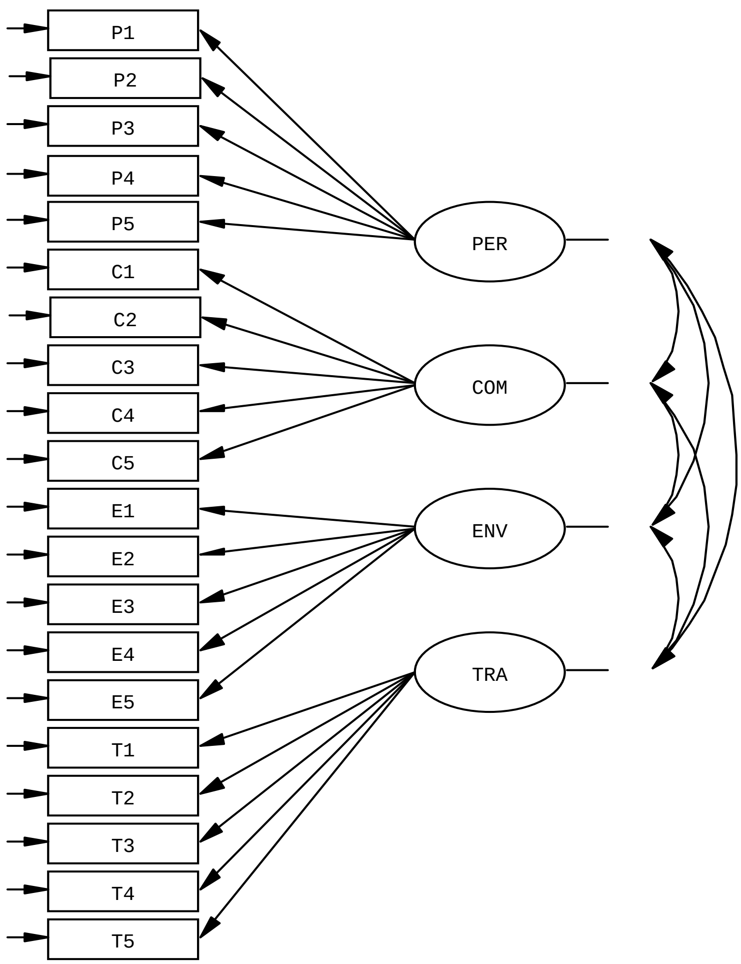

Figure 1. The four-factor oblique model of the SWBQ.

(*Note*. P, C, E and T are questionnaire items for personal, communal, environmental and transcendental spiritual well-being, respectively. PER, COM, ENV and TRA are latent factors for personal, communal, environmental and transcendental spiritual well-being, respectively)

2.2 Measure

All respondents completed the SWBQ. This questionnaire has already been described in detail in the introduction. The SWBQ has scales for personal, communal, environmental, and transcendental spiritual well-being. To allow for self-ratings, respondents are asked to indicate for each item how they feel the statements in the items described their personal experience over the last 6 months, using a five-point Likert scale, ranging from very low (rated 1) to very high (rated 5).

The personal items were "*developing a sense of identity*", "*developing self-awarness*", "*developing joy in life*", "*developing inner peace*", and "*developing meaning in life*". The communal items were "*developing a love for other people*", "*developing forgiveness for other people*", "*developing trust between individuals*", "*developing respect for others*", and "*developing kindness towards other people*". The environmental items were "*developing connection with nature*", "*developing awe at breathtaking view*", "*developing oneness with nature*", "*developing harmony with the environment*", and "*developing a sense of 'magic' in the environment*". The transcendental items were "*developing a personal relationship with God*", "*developing worship of the Creator*", "*developing oneness with God*", "*developing peace with God"* and "*developing prayer life*".

There is evidence of good reliability and validity for all four subscales of the SWBQ. For the sample in the current study, the internal reliability for the personal, communal, environmental and transcendental spiritual well-being subscales were .81, .80, .86 and .95 respectively for females, and .76, .80, .84 and .94 respectively for males.

2.3 Procedure

The plain language statement to potential participants indicated that the study was addressing aspects of human spiritual experience and behavior. Following consent, participants were asked to complete the SWBQ either in groups at the end of lectures (for mainly university students) or at some time during school hours (for secondary school students), or individually (for mainly participants from the general community). In all instances, the completed questionnaire was collected immediately after it was completed. A total of 4,572 ratings were obtained, of which there were 4,462 complete ratings. Only the questionnaires with complete ratings were included in the study.

2.4 Analytic strategy

2.4.1 Analysis of measurement and structural invariance.

Invariance was examined using the procedure suggested by Byrne (1998). The procedure involves computing at least three models with CFA multi-group analyses. These models relate to the invariance in the number of underlying factors and factor loadings (components of the measurement model), and the invariance in factor variances and covariances (structural component)[1]. In general, when two groups are involved, the model relevant to the invariance in the number of underlying factors involves specifying the baseline models in both groups so that the parameters are free to take on any value (model 1). The fit indices for this model provide a test for invariance of the number of factors. The test relevant to the invariance in factor loadings involves specifying the baseline model in the first group so that the parameters are free to take on any value, while in the second group, the factor loadings are constrained equal to the first group (model 2). The model relevant to the invariance in factor variances and covariances also involves specifying the baseline model for the first group with parameters free to take on any value, while constraining the factor loadings (if found tenable) and factor variances and covariances of the second group to be equal to the first group (model 3).

Following this, the hypotheses relating to the invariance for factor loadings, and factor variances and covariances are tested. At the statistical level, the test for the invariance of factor loading involves using χ^2 statistics to determine the difference in statistical fit between models 2 and 1, while the test for the invariance of factor variances and covariances involves the comparison of χ^2 statistics for models 3 and 1. For both comparisons, non-significant difference indicates statistical support for the hypotheses being tested. The invariance for both factor

[1] Although some researchers also test for invariance of error variances and covariances, it is now widely accepted that this is an overly restrictive test (Byrne, 1998). Thus this test was not conducted here.

loadings and factor variances and covariances can also be examined by comparing the other indices (RMSEA and CFI) of the models compared. Such comparisons provide a test for invariance at the practical level, with small differences supporting invariance for groups compared.

In line with the method proposed by Byrne (1998), the analyses here tested for differences between females and males in the number of factors, the pattern of factor loadings of the 20 SWBQ items on their respective latent factors, and the pattern of variances and covariances among the four latent factors.

2.4.2 Analysis of mean latent factor difference.

In general for covariance structural analysis, it is assumed that all observed variables are measured as deviations from their mean, i.e., the means are equal to zero. Thus the intercepts associated with them are irrelevant in the analysis. However when latent mean difference is of interest, the observed mean scores take on nonzero values, and consequently the intercept parameters need to be included. In LISREL, parameterizing the necessary intercepts into CFA models is accomplished by incorporating into the model a dummy variable called constant. The intercepts are the factor loadings of the regression of the observed variables (called tau-X) and the regression of the latent factors (called kappa) on the constant. The kappa values of the model represent the latent mean parameters. The LISREL approach to evaluation of latent mean difference requires that the number of latent factors and their loadings, and the regression of the observed variables on the constant be constrained equal across the two groups. Also, the variances and covariances of the latent factors, and the variances (and covariances when included) of error terms are to be freely estimated across the groups. In addition, the kappa values are to be freely estimated in one group and constrained equal to zero in the other group. The latter is regarded as the reference group. Thus LISREL provides the relative differences between the latent factor scores of groups rather than differences between actual mean latent factor scores.

In this study, latent mean differences across the gender groups were examined for personal, communal, environment and transcendental latent factors, based on the 4-factor oblique model of the SWBQ. For this analysis, the number of latent factors (i.e., four) and their factor loadings were constrained equal across the two groups, as were the intercepts and loadings for the ratings on all the 20 SWBQ items. The variances and covariances of the latent factors, the variances of the error terms in the baseline model were freely estimated across the groups. Also, latent mean values for females were freely estimated, while these values for males (the reference group) were set at zero.

3. Results

3.1 SWBQ: Descriptive, skewness and kurtosis

Table 1 shows the mean, standard deviation, skewness and kurtosis values of all the 20 items of the SWBQ for both females and males. The significance of the skewness and kurtosis values were examined using PRELIS 2.51 (Joreskög, & Sorböm. 1996b). As shown in the table, for both groups, most of the questionnaire items showed statistical significant skewness and kurtosis. The test of multivariate normality for continuous variables for females showed significant multivariate skewness (17.91, $z = 68.13$, $p < .001$) and multivariate kurtosis (572.00, $z = 55.70$, $p < .001$). There was also significant multivariate skewness (23.40, $z = 42.57$, $p < .001$) and multivariate kurtosis (576.75, $z = 37.64$, $p < .001$) for males. Thus, the assumption of multivariate normality in both the groups was violated.

With maximum likelihood estimation, lack of multivariate normality can cause several problems for model testing. These include inflated chi-square values, underestimation of fit indices, and inappropriately low standard errors leading to inflated loadings and correlations (West, Finch, & Curran, 1995).

Table 1 Descriptive Information of the SWBQ for Females and Males

	Female (*N* = 3,101)				Male (*N* = 1,362)			
Items	Mean	*SD*	S	K	Mean	*SD*	S	K
P1 (self- identity)	4.09	0.91	-0.85	0.37	3.87	0.92	-0.61	0.20
P2 (self-awareness)	4.01	0.86	-0.69	0.31	3.84	0.93	-0.59	0.16
P3 (joy in life)	4.17	0.92	-1.02	0.71	3.98	1.00	-0.88	0.40
P4 (inner peace)	3.86	1.02	-0.60	-0.18	3.60	1.02	-0.48	-0.14
P5 (meaning in life)	3.98	0.95	-0.71	0.12	3.79	1.02	-0.69	0.19
C1 (love others)	4.13	0.81	-0.67	0.25	3.80	0.87	-0.47	0.26
C2 (forgive others)	4.02	0.87	-0.66	0.21	3.79	0.94	-0.56	0.16
C3 (trust others)	4.25	0.84	-1.01	0.84	3.96	0.95	-0.81	0.53
C4 (respect others)	4.40	0.75	-1.27	1.79	4.01	0.87	-0.80	0.52
C5 (kindness - others)	4.33	0.77	-1.08	1.20	4.02	0.88	-0.75	0.49
E1 (connect to nature)	3.45	1.07	-0.27	-0.48	3.29	1.14	-0.30	-0.54
E2 (awe at nature)	3.65	1.09	-0.45	-0.41	3.53	1.01	-0.41	-0.39
E3 (oneness - nature)	3.25	1.10	-0.17	-0.51	3.11	1.19	-0.18	-0.70
E4 (magic in nature)	3.38	1.07	-0.32	-0.35	3.27	1.12	-0.25	-0.54
E5 (harmony - nature)	3.22	1.23	-0.16	-0.83	2.88	1.29	0.04	-1.00
T1 (relation with God)	3.03	1.33	-0.05	-1.09	3.16	1.38	-0.21	-1.10
T2 (worship of God)	2.92	1.35	0.03	-1.14	3.16	1.36	-0.22	-1.16
T3 (one with God)	2.91	1.34	0.04	-1.12	3.07	1.36	-0.13	-1.12
T4 (peace with God)	3.14	1.35	-0.18	-1.10	3.33	1.35	-0.41	-0.96
T5 (prayer life)	2.84	1.33	0.12	-1.07	2.92	1.34	0.03	1.11

Note. *SD* = standard deviation, S = skewness, K = kurtosis. All S and K values were significant unless underlined.

Although there is no perfect solution to the lack of multivariate normality, one solution is to use maximum likelihood with robust estimation (West et al., 1995). This procedurecorrects for the lack of normality, resulting in a robust chi-square statistic referred to as the Satorra-Bentler chi-square statistic (S-Bχ^2). Like the χ^2 likelihood ratio test statistics, the S-Bχ^2 also test the closeness of fit between the unrestricted sample covariance matrix and the restricted (postulated model) covariance matrix, after correcting for multivariate nonnormality. Thus this study used the maximum likelihood procedure with robust estimation.

3.2 Testing for measurement and structural invariance

LISREL 8.51 (Joreskög & Sorböm, 1996a) was used to perform all the CFA in the study. All analyses were based on the covariance matrices with maximum likelihood estimation. As already pointed out maximum likelihood procedure with robust estimation was used to minimize the effects of multivariate non-normality. Thus statistical model fit was evaluated with the S-Bχ^2, and the differences in statistical fit between models were based on differences in S-Bχ^2. As the difference between two S-Bχ^2 values is not distributed as a chi-square, it is necessary to adjust for this difference. The formula for this adjustment as proposed by Satorra and Bentler (1999) was therefore used.

As χ^2 values are inflated by large sample sizes, two practical fit indices were also used. These were the Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI). The RMSEA provides a measure of model fit relative to the population covariance matrix when the complexity of the model is also taken into account. Values less than .06 indicate good fit, values .06 to .08 indicate reasonable fit, values from .08 to .10 indicate mediocre fit, and values greater than .10 indicate poor fit (Byrne, 1998). The CFI provides a measure of the fit of the hypothesized model relative to the independent model, with values ranging from 0.00 to 1.00). CFI values greater than .90 suggest well fitting models.

In general, before testing for measurement and structural invariance, and differences in latent mean scores, it is necessary to ensure well fitting models for the groups involved. The results of CFA of the four-factor oblique model (Figure 1) showed excellent fit for males [χ^2 (*df* = 164) = 1654.02, S-Bχ^2 (*df* = 164) = 1356.00, RMSEA = .048 (90% CI for RMSEA = .046 - .051), CFI = .96] and females [χ^2 (*df* = 164) = 791.02, S-Bχ^2 (*df* = 164) = 628.89, RMSEA = .046 (90% CI for RMSEA = .042 - .049), CFI = .96]. Thus this model was used as the baseline models for both groups. Table 2 shows the results of analyses for testing the measurement and structural invariance across gender. As shown, the practical fit indices for model 1 were very good. Thus the invariance for the number of factors was supported. These indices for model 2 also showed very good fit, and their values were very close to those for model 1. In addition, the ΔS-Bχ^2 between models 2 and 1 was not significant. These results provide support for the invariance in the pattern of factor loadings across gender. The practical indices for model 3 were also very good and very close to those for model 1. However, the ΔS-Bχ^2 between models 3 and 1 was significant. Thus while there was practical support for invariance in factor variances and covariances for the groups, there was no statistical support for this (Table 3).

Further analyses were conducted to ascertain the sources contributing to the non-invariance in the factor variances and covariances matrix. Following Byrne (1998), this procedure involved testing, independently, the invariance of each factor variance and covariance, and comparing the fit of this model to that for Model 2. As suggested by Byrne (1998), we conducted this set of tests by cumulatively constraining all parameters found to be equivalent across the groups. The results for all these analyses are also shown in Table 3. As shown, the results indicated no significant S-Bχ^2 differences for the variances for personal, environmental and transcendental, and the covariance between transcendental and personal. There were

Table 2 Summary of Test for Invariance of SWBQ Measurement and Structural Models

Competing Models (M)	*df*	χ^2	S-Bχ^2	Δdf	ΔS-Bχ^2	RMSEA (90 % CI)	CFI
1 Number of factors invariant	328	2445.05	2315.16	-	-	.052 (.050 - .054)	.96
2 M2 with pattern of factor loadings held invariant	344	2464.03	2368.68	16	26.54	.051 (.049 - .053)	.96
3 M2 with all factor variance & covariance held invariant	354	2569.06	2486.88	10	133.76*	.052 (.050 - .054)	.96
4 M2 with equivalent factor variances & covariances held cumulatively invariant							
Personal/Personal	345	2465.95	2370.95	1	1.96^{ns}	.051 (.049 - .053)	.96
Communal/Communal	346	2487.90	2395.90	2	33.13*	.052 (.050 - .053)	.96
Environmental/Environmental	346	2469.04	2375.65	2	5.71^{ns}	.051 (.049 - .053)	.96
Transcendental/Transcendental	347	2469.04	2379.04	3	6.59^{ns}	.051 (.049 - .053)	.96
Communal/Personal	348	2489.64	2399.15	4	27.66*	.051 (.049 - .053)	.96
Environmental/Personal	348	2486.61	2395.70	4	26.88*	.051 (.049 - .053)	.96
Environmental/Communal	348	2499.12	2407.80	4	41.87*	.052 (.050 - .053)	.96
Transcendental/Personal	348	3473.69	2382.18	4	10.97^{ns}	.051 (.049 - .053)	.96
Transcendental /Communal	349	2524.48	2439.4	5	89.44*	.052 (.050 - .054)	.96
Transcendental/Environmental	349	2478.58	2391.01	5	18.48*	.051 (.049 - .053)	.96

Note. S-Bχ^2 = Satorra-Bentler χ^2; RMSEA = root mean square error of approximation; CFI = comparative fit index. All χ^2 and S-Bχ^2 values significant at p = .001. For ΔS-Bχ^2 *p < .001; *ns* = not significant.

significant differences for the variance for communal, and the covariances for communal and personal, environmental and personal, communal and environmental, transcendental and communal, and transcendental and environmental. Examination of Table 3 shows however that for all comparisons, there was virtually no difference between the practical fit indices[2].

Table 3 gender differences for the SWBQ factors based on observed scores

SWBQ factors	Group mean (standard deviation)		t-Value	Effect size
	Female	Male	(df = 4463)	(Cohen's α)
Personal	20.13 (3.53)	19.07 (3.50)	9.26	.20
Communal	21.12 (3.01)	19.67 (3.34)	14.59	.47
Environmental	16.94 4.45)(	16.07 (4.65)	6.00	.20
Transcendental	14.83 (6.13)	15.03 (6.14)	4.02	.13

Note: All t values significant at p = .001

3.3 Test for differences in latent factor mean

For an examination of latent mean difference, a prerequisite is invariance for the measurement model for the groups being compared. As reported earlier, there was invariance for the measurement model of the SWBQ for females and males, thereby justifying the examination of latent mean differences across the gender groups for the four subscales of the SWBQ. The analysis for the model to test the differences in mean latent scores across gender resulted in the following fit indices: χ^2 (*df* = 360) = 2561.52, S-Bχ^2 (*df* = 360) = 1989.07, RMSEA = .045 (90% CI for RMSEA = .043 - .047), and CFI = .96. These fit indices suggest a good fit for the model, thereby increasing the reliability of the results. For personal, communal and environmental well-being factors, the kappa or latent mean difference were all .01, with *t* values of 2.81, 4.24 and

[2] Multigroup models can often show well-fitting practical fit indices, yet still have items that are statistically noninvariant across groups.

difference at $p < .001$. The positive kappa value for this factor implies higher latent mean score 2.09.respectively. The results indicate that only the communal well-being factor showed gender for females.

4. Discussion

The results of this study found support for the invariance in factor loadings across males and females for the SWBQ. For the invariance in factor variances and covariances, the study showed somewhat mixed findings. In terms of statistic fit, the results supported no differences for the variances for personal, environmental and transcendental, and the covariance between transcendental and personal. There were significant differences for the variance for communal, and the covariances for communal and personal, environmental and personal, communal and environmental, transcendental and communal, and transcendental and environmental. However, the practical fit indices supported the invariance for all variances and covariances. The test for latent mean difference showed difference for only the communal well-being, with females scoring higher. Overall, these findings can be inferred as providing reasonable support for the equivalencies of the SWBQ across males and females.

Thus, overall, the SWBQ can be considered worthy of consideration in spiritual well-being research when gender is considered. It needs to be stressed, however, that the findings in the current study need to be viewed with certain limitations and controversies in mind. Firstly, as most participants in the study were secondary school and university students, between 17 to 32 years, it is uncertain if the results are applicable to the wider community and across a wider age range. Secondly, the use of self-ratings may have biased ratings, thereby confounding the ratings. Thirdly, the results of this study need also to be seen in the context that to date there is no agreement in the literature on what are the appropriate set of tests or sequence of tests that are needed for establishing group invariance and latent mean difference (Bentler, 1993; Bollen, 1989; Byrne, 1998; Joreskög & Sorböm, 1989; Marsh, 1994). Given this, it can be expected that some researchers may not agree with our analytic approach. However we wish to make the point that our approach for testing both group invariance and latent mean difference is in accord with acceptable standards that have been used previously (Byrne, 1998).

In concluding, this study may be of general methodological interests to researchers. Currently, most researchers generally apply theoretical models and use observed scores across gender groups without first testing their equivalencies across these groups. However, before groups can be validly compared on observed measures, there is need to establish group invariance (Byrne, 1998). It is clear that this has not been established for many measures in education, psychology and other social science research where groups have been compared using observed scores. As shown here, multi-group CFA methodology can be used to establish group invariance. It is hoped that this study has provided a basis for other researchers to use multi-group CFA methodology to further our understanding of group invariance and latent mean differences for a wider range of constructs used currently in education, psychology and other social science research.

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