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TESTING THE FACTORIAL INVARIANCE OF THE SATISFACTION WITH LIFE SCALE ACROSS CHINESE ADOLESCENTS

DAOYANG WANG
Beijing Normal University and Anhui Normal University
MINGMING HU
Beijing Normal University
QINFANG XU
Beijing Normal University and Nanjing Normal University of Special Education

We tested the factorial invariance of the Satisfaction with Life Scale (SWLS) across 2,178 rural, urban, and rural-to-urban Chinese adolescent students from middle schools and universities. We examined the psychometric properties of the SWLS and tested a 1-factor model with each of the rural, urban, and rural-to-urban groups. Multigroup analysis results revealed configural, weak, strong, and strict invariance of the SWLS across the groups, and also factorial invariance, factorial covariance, and latent mean invariance. The results showed that the SWLS had high internal consistency reliability and supported the single-factor structure. In addition, they showed that the gap in satisfaction with life between rural and urban populations in China may have diminished.

Keywords: Satisfaction with Life Scale, life satisfaction, subjective well-being, Chinese adolescent students, factorial invariance, rural-to-urban migration.

Daoyang Wang, Collaborative Innovation Center of Assessment toward Basic Education Quality, Beijing Normal University and Department of Psychology, Anhui Normal University; Mingming Hu, Institute of Brain and Cognitive Sciences, State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University; Qinfang Xu, Collaborative Innovation Center of Assessment toward Basic Education Quality and Institute of Brain and Cognitive Sciences, State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University and School of Languages, Nanjing Normal University of Special Education.
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Correspondence concerning this article should be addressed to Qinfang Xu, Institute of Brain and Cognitive Sciences, State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, No. 19, Xinjiekouwai Street, Haidian, Beijing 100875, People's Republic of China. Email: **fangerhappy@163.com**

Subjective well-being (SWB) is generally conceptualized as being multifaceted, with both affective and cognitive components (Tay, Herian, & Diener, 2014). The affective components are usually further divided into pleasant and unpleasant affect (Ubl et al., 2015), and the cognitive component is referred to as life satisfaction (Hahn, Specht, Gottschling, & Spinath, 2015). The two components are not completely independent but are distinctive and can provide complementary information when assessed separately (Tay et al., 2014; Ubl et al., 2015).

To measure life satisfaction, Diener, Emmons, Larsen, and Griffin (1985) developed the Satisfaction with Life Scale (SWLS), which has since been widely used. Although the SWLS comprises only five items, it has demonstrated good psychometric properties (Pavot, 2014) in a broad range of cultural contexts, such as North American (Gnilka, Ashby, Matheny, Chung, & Chang, 2015), German (Glaesmer, Grande, Braehler, & Roth, 2011), Italian (Di Fabio & Gori, 2015), Spanish (Vázquez, Duque, & Hervás, 2013), Portuguese (Tomás, Gutiérrez, Sancho, & Romero, 2015), Norwegian (Moksnes, Løhre, Byrne, & Haugan, 2014), Malaysian (Aishvarya et al., 2014), Korean (Lim, 2015), and Chinese (Ye, 2007) cultures. However, as these versions cover various cultural contexts, the factorial invariance of the SWLS across different groups needs to be examined.

Recent researchers have discussed the factorial invariance of the SWLS in regard to age, gender, and culture (González, Solá, Corte-Real, & Fonseca, 2016; Tomás et al., 2015). They have shown that the factorial invariance of the SWLS is consistent across languages and gender (Lim, 2015; Moksnes et al., 2014; Tomás et al., 2015). However, researchers should first assess the measurement equivalence or invariance when they use the scale, to confirm that the underlying constructs are the same across groups of different ages, nationalities, or cultural backgrounds.

Previous researchers have discussed factorial invariance across country and culture, age, and gender. For example, Lim (2015) reported that the Korean version of the SWLS demonstrates consistently acceptable reliability and validity indices as well as psychometric properties similar to the English version of the SWLS. Tomás et al. (2015) examined configural, metric (or weak), and scalar (or strong) invariance across ages using the Portuguese version of the SWLS in Angola. Their results showed that scalar invariance held across gender and age. Wu and Yao (2006) found that the Taiwanese version of the SWLS had strict (or error) factorial invariance across gender, and Bai, Wu, Zheng, and Ren (2011) showed that the Chinese version of the SWLS had strict invariance across gender, partial strict invariance across levels of education, and partial strong invariance across ages, income levels, and residential regions. However, in each of the three main regions in China—Mainland China, Taiwan, and Hong Kong—there are different social and economic conditions (Ye, 2007), which may impact on people's evaluation of their life satisfaction (Yao & Wu, 2009).

In Mainland China, 12.6 million school-age rural children have been affected by rural-to-urban migration. Although these children's identity is sometimes classified as urban, it is, in fact, still rural. Xu and Xie (2015) found significant positive effects of migration on the children's objective well-being because their family socioeconomic status improved, and found no negative effects on their SWB. Although Bai et al. (2011) examined measurement invariance of the SWLS across residential regions—which they defined as metropolitan areas, county towns, and rural areas—they did not include rural-to-urban migrant participants, who have become a distinctive section of the Chinese population over the past 30 years.

Adolescents who are defined as rural-to-urban are those who live in an urban area but maintain an agricultural household registration (hukou). The *hukou system* is the legal basis for personal identification, and has operated in Mainland China since the 1950s to guarantee social stability and to balance an agricultural surplus with urban industrialization. Under this system, every Chinese citizen is required to be officially registered with the hukou authority (the hukou police) from birth, and is categorized as either agricultural (rural) or nonagricultural (urban). Individuals can change their hukou categorization permanently from rural to urban only through government authorization. Rural-to-urban adolescents may have different life experiences from adolescents who are members of families who were originally urban or who are still living in rural areas. These differences may influence their evaluation of life satisfaction.

In this study we tested the factorial invariance of the SWLS across rural, urban, and rural-to-urban Chinese adolescents. Chinese adolescents also differ in terms of their educational background and family income level according to their residential region (Bai et al., 2011). Thus, we formed the following hypothesis:
Hypothesis 1: That the previously reported partial invariance may not apply to rural and urban adolescents as classified by the hukou system.

Method

Participants and Procedure

We conducted our survey between October and December 2015. Data were obtained via the Internet. Previous researchers have found that online versions of personality questionnaires have good equivalence and similar psychometric properties to traditional paper and pencil forms (Aluja, Rossier, & Zuckerman, 2007; Gosling, Vazire, Srivastava, & John, 2004). Written consent was obtained from participants after they had been given a full explanation of the study procedure. Parents or guardians of participants under 18 years old were informed, and their consent was obtained.

Participants comprised 2,178 Chinese adolescent students enrolled at one of four middle schools and two universities in Anhui and Beijing, China. Two

classes were selected randomly at each grade level. In terms of gender, 55.9% of the students were male (n = 1,218), and 44.1% were female (n = 960). The mean age for the males was 19.53 ± 1.54 years, and the mean age for females was 19.12 ± 1.73 years. Participants were divided into three hukou residential groups, rural (living in the country with an agricultural hukou), urban (living in urban areas with a nonagricultural hukou), and rural-to-urban (living in an urban area but maintaining an agricultural hukou) as follows: rural (n = 552, 25.3%) with ages ranging from 15 to 24 years (M = 18.33, SD = 1.82); urban (n = 566, 26%) with ages ranging from 15 to 25 years (M = 19.24, SD = 1.50); rural-to-urban (n = 1,060, 48.7%) with ages ranging from 15 to 25 years (M = 19.93, SD = 1.31).

Instrument

We used the SWLS to measure life satisfaction (Diener et al., 1985) with five items on a 7-point Likert scale ranging from 1 = *strongly disagree* to 7 = *strongly agree* (see Appendix). The scores are reversed and given in a range from 5 (*not satisfied*) to 35 (*highly satisfied*), with 20 as the neutral point. The Chinese version of the SWLS has been shown to have reliability and validity, with Cronbach's α of .78 and split-half reliability of .70 (Ma & Chan, 2015; Wang, Yuen, & Slaney, 2009).

Statistical Analysis

All statistical analyses were conducted with SPSS 22.0 and Mplus 7. We created tables of descriptive statistics for participants' residential status and gender distribution, and calculated Cronbach's α for the SWLS. Item analysis included means, standard deviations, skewness, kurtosis, and correlations among the five items.

Byrne, Shavelson, and Muthén (1989) differentiated measurement invariance from structural invariance. The former comprises metric or weak invariance, scalar or strong invariance, and strict or error variance invariance. Structural invariance consists of factorial invariance or factorial covariance, and latent mean invariance. In factorial invariance analysis, each group is tested separately with a one-factor model. We tested six types of invariance in this study. First, *configural invariance* refers to the same number of factors in each group and the same pattern of fixed and free parameters. Second, *weak invariance* implies equal factor loadings across groups. Third, *strong invariance* implies item uniqueness is constrained to be equal across groups. Fourth, *strict invariance* refers to the hypothesis that the measurement error in the manifest indicators is the same in all groups. Fifth, *factor variance/covariance invariance* refers to an omnibus test of the equality of the latent variables' variance/covariance matrices across groups. Finally, latent mean invariance is tested by constraining the kappa matrices ($\kappa_{g1} = \kappa_{g2}$) to be equal across groups. If the baseline model is supported,

further constraints can then be imposed on the model. Otherwise, if the baseline model for each group is not the same, factorial invariance analysis should not be conducted.

We used the following parameters to identify the model fit, the χ^2/df, root mean square error of approximation (RMSEA), confidence interval (CI), comparative fit index (CFI), and Tucker-Lewis index (TLI). According to conventional criteria, a good fit would be indicated by CFI > .95 and TLI > .95, and an acceptable fit would be indicated by CFI > .80 and TLI > .80. RMSEA values ≤ .05 indicate a good fit, values between .05 and .08 indicate an adequate fit, and values between .08 and .10 indicate a mediocre fit. A p value less than .05 is considered significant (Schermelleh-Engel, Moosbrugger, & Müller, 2003). For the statistical analysis, we employed χ^2 differences ($\Delta\chi^2$) to compare constrained with unconstrained models, with nonsignificant values suggesting multigroup equivalence. Because the χ^2 difference test is highly dependent on the sample size (Schweizer, 2010), two other indices of CFI differences (ΔCFI) and TLI differences (ΔTLI) were used. The cutoff criteria for ΔCFI and ΔTLI is usually .01; ΔCFI or ΔTLI greater than .02 indicates definite differences (Meade, Johnson, & Braddy, 2008). We first examined whether or not there were differences in the SWLS among the three groups (rural, urban, and rural-to-urban), using one-way analysis of variance (ANOVA). If there were significant differences, we followed up with the least significance difference (LSD) test, estimates of effect size were computed using the partial eta squared measure (η_p^2; small ≥ 0.01, medium ≥ 0.06, large ≥ 0.14) suggested by Cohen (1988).

Results

Descriptive Statistics Analysis

Descriptive statistics for each item according to the hukou residential group are presented in Table 1. Skewness and kurtosis for all items were generally in the range of -1 to +1 for each group except for Item 5 for the urban group (kurtosis = -1.02). Thus, the maximum likelihood estimation was acceptable for use in the current situation (Muthén & Kaplan, 1985). The level of internal consistency reliability was high for all participants, namely, .90 for the total sample, .88 for the rural sample, and .90 for the urban and rural-to-urban samples. Moreover, the means for the rural, urban, and rural-to-urban groups were significantly different for each item, although the effect size was low (Item 1, $F_{(2, 2175)} = 6.54$, $p < .05$, $\eta_p^2 = 0.006$, LSD, urban > rural, urban > rural-to-urban; Item 2, $F_{(2, 2175)} = 8.03$, $p < .05$, $\eta_p^2 = 0.007$, LSD, urban > rural, urban > rural-to-urban; Item 3, $F_{(2, 2175)} = 9.01$, $p < .05$, $\eta_p^2 = 0.008$, LSD, urban > rural, urban > rural-to-urban; Item 4, $F_{(2, 2175)} = 11.66$, $p < .05$, $\eta_p^2 = 0.011$, LSD, urban > rural, urban > rural-to-urban; Item 5: $F_{(2, 2175)} = 7.84$, $p < .05$, $\eta_p^2 = 0.007$, LSD, urban > rural, urban > rural-to-urban).

Table 1. *Satisfaction With Life Scale: Means, Standard Deviations, Skewness, Kurtosis, and Cronbach's Alpha for Items, and the Item Correlation Matrix for the Total Sample and the Rural, Urban, and Rural-to-Urban Groups*

Items	*M*	*SD*	Skewness	Kurtosis	α	Item 1	Item 2	Item 3	Item 4	Item 5
Rural (n = 552)					.88					
Item 1	3.95	1.42	-0.06	-0.46	–	–				
Item 2	4.06	1.41	-0.07	-0.45	–	.78**	–			
Item 3	4.24	1.42	-0.12	-0.58	–	.73**	.80**	–		
Item 4	4.18	1.48	-0.10	-0.51	–	.56**	.64**	.70**	–	
Item 5	3.34	1.63	.25	-0.76	–	.42**	.46**	.48**	.47**	–
Urban (n = 566)					.90					
Item 1	4.23	1.57	-0.20	-0.62	–	–				
Item 2	4.26	1.52	-0.13	-0.58	–	.77**	–			
Item 3	4.46	1.54	-0.34	-0.50	–	.73**	.79**	–		
Item 4	4.43	1.55	-0.25	-0.65	–	.64**	.70**	.71**	–	
Item 5	3.63	1.85	.22	-1.02	–	.56**	.57**	.57**	.57**	–
Rural-to-urban (n = 1,060)					.90					
Item 1	3.97	1.51	-0.09	-0.58	–	–				
Item 2	3.95	1.50	-0.01	-0.54	–	.74**	–			
Item 3	4.13	1.54	-0.10	-0.69	–	.71**	.81**	–		
Item 4	4.04	1.57	-0.07	-0.66	–	.62**	.65**	.70**	–	
Item 5	3.28	1.73	.45	-0.73	–	.52**	.53**	.56**	.59**	–

Note. ** $p < .01$.

Rural, Urban, and Rural-to-Urban Invariance

Prior to multigroup analysis, we tested the one-factor model separately in each residential group. The model fit was adequate in the three groups; rural, χ^2 (6) = 52.40, $p < .05$, CFI = .97, RMSEA = .118; urban, χ^2 (6) = 59.17, $p < .05$, CFI = .97, RMSEA = .125; rural-to-urban, χ^2 (6) = 121.48, $p < .05$, CFI = .97, RMSEA = .135.

Next, we estimated and tested the set of increasingly constrained multigroup confirmatory factor analyses. First, multigroup analysis with the unconstrained model showed an acceptable baseline model for the rural, urban, and rural-to-urban groups, χ^2 (15) = 141.96, $p < .05$, CFI = .982, TLI = .963, 90% CI = [0.092, 0.125], RMSEA = .108. Then, factor loadings were constrained to be equal across all groups. The weak invariance model was also a good fit, χ^2 (23) = 155.77, $p < .05$, CFI = .981, TLI = .975, 90% CI = [0.076, 0.103], RMSEA = .089. The χ^2 difference between the baseline model and the weak invariance model was not significant, $\Delta\chi^2$ (8) = 13.81, $p > .05$, suggesting that factor loadings were invariant for all the groups. Then, on the basis of the weak invariance model, intercepts were constrained to be equal across the three residential groups. The strong invariance model was also a good fit, χ^2 (31) = 168.30, $p < .05$, CFI = .980, TLI = .981, 90% CI = [0.067, 0.090], RMSEA = .078. The χ^2 difference test between the weak invariance and the strong invariance models was not significant, $\Delta\chi^2$ (8) = 12.53, $p > .05$, suggesting that the unique variances of each item were also invariant across the three residential groups. Finally, on the basis of the strong invariance model, uniqueness variance and covariance were constrained to be equal across the three residential groups. The strict invariance model was also a good fit, χ^2 (41) = 184.22, $p < .05$, CFI = .979, TLI = .985, 90% CI = [0.059, 0.080], RMSEA = .069. The χ^2 difference test between the strong and strict invariance models was not significant, $\Delta\chi^2$ (10) = 15.92, $p > .05$, showing that strict invariance was supported. On the basis of the strict invariance model, we further tested the equality of factor variance/covariance across the three residential groups. The factor variance/covariance invariance model was also a good fit, χ^2 (43) = 189.97, $p < .05$, CFI =.980, TLI = .981, 90% CI = [0.059, 0.079], RMSEA = .078. The result of the χ^2 difference test for this examination was not significant, $\Delta\chi^2$ (3) = 5.75, $p > .05$, showing that the equality of factor variance/covariance was supported. On the basis of the factor variance/covariance invariance model, we further tested the equality of latent mean variance across the three residential groups. The latent mean invariance model was also a good fit, χ^2 (45) = 211.29, $p < .05$, CFI = .976, TLI = .984, 90% CI = [0.062, 0.081], RMSEA = .071. The χ^2 difference test associated with equality of latent mean invariance was significant, $\Delta\chi^2$ (2) = 21.32, $p < .05$, but the differences in practical fit were minimal (ΔCFI and ΔTLI < .01). Accordingly, the equality of latent mean invariance was considered tenable, and the SWLS

may be considered equivalent for the rural, urban, and rural-to-urban Chinese adolescent participant groups.

Discussion

Our results show that the Chinese version of the SWLS has high internal consistency reliability in the assessment of life satisfaction of Chinese adolescents according to their hukou classification, and the results support a single-factor structure. In addition, the Chinese version of the SWLS was factor invariant across rural, urban, and rural-to-urban Chinese adolescents.

These results differed from our research hypothesis, and were slightly different from Bai et al.'s (2011) results, which indicated a partial strong invariance across the residential regions. The first difference between the two studies was between our participants' three hukou residential groups and residential region, and Bai et al.'s definition of residential region groups, which concerned only participants' place of abode. In Mainland China, the hukou designation is strongly related to social welfare, such as access to education and social position. The hukou system forms a structural barrier that results in unequal segmentation of urban society into an open society for native urbanites and another society with limited opportunities for rural-to-urban migrants (Zhang & Xie, 2013). Hence, the existence of this system may influence the level of life satisfaction among rural, urban, and rural-to-urban adolescents.

Second, Bai et al. (2011) reported strict invariance across residential regions with Items 1 and 2 of the SWLS. However, our results showed that each of the five items in the Chinese version of the SWLS was invariant across the three hukou groups. Although Bai et al.'s findings indicated that the chi-square difference between partial strong invariance and factor variance or latent means was significant, $\Delta\chi^2$ (2) = 33.12/38.77, $p < .05$, the CFI difference was less than .01. Bai et al. also reported partial strict invariance of the SWLS across all levels of education, and partial strong invariance across all levels of income. The Chinese rural–urban gap (Xu & Xie, 2016) refers to differences in educational resources, income, and residential region. However, we did not find such variance across adolescents in our three hukou residential groups. One possible reason may be that as the Chinese government has reformed the hukou registration system to eliminate the urban–rural gap, rural-to-urban immigrant adolescents, as well as urban adolescents, now have access to education, employment, and social welfare (Huang, Dijst, van Weesep, & Zou, 2014). In addition, our participants in the rural-to-urban group were all middle school students or university students, for whom the educational resources were the same as those of their urban peers. This may have made up for the difference in the groups' socioeconomic status. If we had been comparing life satisfaction between adult peasant workers and urban residents, we may have obtained different results.

In summary, the results reported by Bai et al. (2011) are somewhat supported by our findings. Our Chinese adolescent participants in the rural, urban, and rural-to-urban groups differed with respect to their access to social welfare and social position, and the education level of the rural adolescents was significantly lower than that of the urban and rural-to-urban adolescents. These differences, however, may not have influenced their evaluation of life satisfaction.

However, there are some limitations in this study. First, we did not investigate factorial invariance across ages, and people of different ages may have different concepts about life satisfaction. Second, we could also have improved the representativeness of the sample. Our participants lived in a developed area (Beijing) and a semideveloped area (Anhui), and not in one of the less developed areas of China (provinces and cities in the west). Furthermore, we did not apply random sampling. Future researchers should focus on this. Finally, the results suggest that there is invariance of life satisfaction across rural, urban, and rural-to-urban Chinese adolescent groups. However, in a comparison of the SWLS between rural, urban, and rural-to-urban groups, the different educational resources, income, and residential regions of the sampled population still need to be considered, because these factors may lead to different understandings of life satisfaction.

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Appendix

Satisfaction with Life Scale

Below are five statements with which you may agree or disagree. Using the 1–7 Scale below, indicate your agreement with each item by circling the appropriate number. Please be open and honest with your responses.

	1 = *Strongly disagree*	2 = *Disagree*	3 = *Slightly disagree*	4 = *Neither agree nor disagree*	5 = *Slightly agree*	6 = *Agree*	7 = *Strongly agree*
1. In most ways my life is close to my ideal.	1	2	3	4	5	6	7
2. The conditions of my life are excellent.	1	2	3	4	5	6	7
3. I am satisfied with my life.	1	2	3	4	5	6	7
4. So far I have gotten the important things I want in life.	1	2	3	4	5	6	7
5. If I could live my life over, I would change almost nothing.	1	2	3	4	5	6	7