

# Preliminary Validation of the Brief Multidimensional Students' Life Satisfaction Scale (BMSLSS) Among Chinese Elementary School Students

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**Abstract** The aim of the present study was to provide further support for the validity of the Brief Multidimensional Students' Life Satisfaction Scale (BMSLSS), using a sample of 1904 Chinese elementary school students (Grades 4–6). Toward this aim, we first performed item analysis and factor analyses to investigate the structure of the BMSLSS. Second, we examined its internal consistency reliability, convergent and discriminant validity, test-retest reliability and predictive validity. Last, we tested its measurement invariance across gender using multi-group analysis. The results provided preliminary evidence for the reliability and validity of the BMSLSS in assessing Chinese elementary school students' life satisfaction. The potential applications of the BMSLSS for future research were discussed.

**Keywords** Life satisfaction · Brief Multidimensional Students' Life Satisfaction Scale (BMSLSS) · Validation · Elementary school students

## 1 Introduction

With the rise of positive psychology, researchers are paying greater attention to measures of positive aspects of human functioning (McCullough and Snyder 2000; Seligman and Csikszentmihalyi 2000), including measures of children and adolescents' subjective well-being. One of the most widely used, positive subjective indicators is life

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satisfaction. Life satisfaction (LS) refers to a cognitive evaluation of the positivity of one's life as a whole or with specific domains (Diener et al. 1999).

Studies of life satisfaction have burgeoned over the past several decades, revealing a rich nomological network of relations with important life outcomes (Lyubomirsky et al. 2005). For example, life satisfaction has been shown to be positively correlated with important facets of positive life functioning in children and adolescents, such as self-efficacy (Fogle et al. 2002), self-esteem and self-concept (Bradley and Corwyn 2004; Terry and Huebner 1995), positive emotions (Seligson et al. 2003; Suldo and Huebner 2005), internal locus of control (Ash and Huebner 2001; Dew and Huebner 1994), and hope (Gilman and Huebner 2006). Similarly, life satisfaction has been shown to be negatively associated with facets of poor life functioning in children and adolescents, such as internalizing and externalizing behavior (Haranin et al. 2007; McKnight et al. 2002), depression (Gilman et al. 2000a; Greenspoon and Saklofske 1997), interpersonal rejection (Furr and Funder 1998), aggressive behaviors (Valois et al. 2001), sexual risk-taking behaviors (Valois et al. 2002) and substance abuse (Zullig et al. 2001). However, research on life satisfaction among children and adolescents has been sparse, compared to that of adults (Bender 1997; Proctor et al. 2009). This relative lack of research attention has perhaps been related to the relative lack of reliable and valid measures of life satisfaction appropriate for children and adolescents (Gilligan and Huebner 2002; Park et al. 2004; Seligson et al. 2003). To solve this problem, a number of measures of life satisfaction have been developed for use with children and adolescents. For instance, the Perceived Life Satisfaction Scale (PLSS: Adelman et al. 1989), Students' Life Satisfaction Scale (SLSS: Huebner 1991a), Multidimensional Students' Life Satisfaction Scale (MSLSS: Huebner 1994a), Quality of Life Profile-Adolescent Version (QOLPAV: Raphael et al. 1996), Comprehensive Quality of Life Scale, Fifth edition (ComQol-S5: Cummins 1997), and the Brief Multidimensional Students' Life Satisfaction Scale (BMSLSS: Seligson et al. 2003) have been developed. The above life satisfaction measures have been derived from three major conceptual frameworks: two unidimensional models (i.e., global and general life satisfaction) and a multidimensional model (Gilman and Huebner 2000; Huebner 2004). The two unidimensional models converge in the assumption that a single, total score can represent different levels of life satisfaction. Unlike the unidimensional models, the level of one's satisfaction with life as a whole or with specific domains in the multidimensional model is not represented by a combined, single, total score; rather, scores of various life domains are interpreted independently. This approach enables the respondents to report high levels of life satisfaction in one life domain and low levels in another domain, providing richer, more differentiated profiles of life satisfaction judgments (Long and Huebner 2014). As one example, Huebner (1994a) proposed a hierarchical satisfaction model in which five specific second-order domains are incorporated under a general life satisfaction factor (Gilman et al. 2000b; Tian and Liu 2005). However, more life satisfaction measures (e.g., the SLSS) were designed to assess unidimensional life satisfaction (i.e., global or general life satisfaction). Only a few measures are dedicated to multidimensional life satisfaction, such as the MSLSS and the BMSLSS. Both of them assess multiple domains as well as general life satisfaction. Since the MSLSS is too lengthy and impractical for multivariate, longitudinal studies, large-scale studies, and intervention studies, the 5-item BMSLSS was developed based on the theoretical model of the MSLSS to measure children and adolescents' life satisfaction with family, friends,

school, self and living environment. As it is sufficiently brief and easy-to-use, the BMSLSS has been deemed appropriate for longitudinal studies, large-scale studies (e.g., national and international life satisfaction monitoring research) and intervention studies where time constraints might be an issue (Gilman and Huebner 2003). To date, the BMSLSS has been studied with numerous samples of children and adolescents in the general population ages 8–18 in a number of different countries (Abedi and Vostanis 2010; Seligson et al. 2003, 2005; Siyez and Kaya 2007). Moreover, the BMSLSS has been considered to be the most frequently used measure for assessing life satisfaction among children and adolescents in cross-cultural studies around the world (Casas et al. 2014). However, most studies on life satisfaction in children and adolescents have been done in developed western countries. Thus, a full understanding of the development, nature, and consequences of individual differences in life satisfaction with children and adolescents will likely require research on life satisfaction in other countries and cultures. As the world's most populous country, China is a country with a high population of children and adolescents. The theme of children and adolescents' life satisfaction is a relatively new research topic in China, and research on life satisfaction of children and adolescents with the BMSLSS remains scarce. Despite the apparent importance of youth life satisfaction, only a handful of studies have been devoted to Chinese adolescents' life satisfaction. For example, Ye et al. (2013) have provided some evidence supporting the reliability and validity of the BMSLSS and compared the differences between genders on the five life domains in adolescents (aged from 12 to 18) from the Hunan province of China. Kwan (2007) used the BMSLSS to investigate the relations between family structure and global and domain-specific life satisfaction reports of adolescents from secondary schools in Hong Kong. As for younger age groups, the authors are aware of no existing studies in China that have employed the BMSLSS with the elementary school students to study their life satisfaction. This discrepancy may be partially explained by measurement limitations. As was the case previously for western countries, one major reason that for the limited studies of the life satisfaction of children in China likely relates to the lack of psychometrically sound measures suitable for younger Chinese children. Nevertheless, some researchers have found that it may be possible to study younger children's life satisfaction. For instance, Huebner et al. (2007) and Liu et al. (2014) have found that elementary school students from Grade 4 to Grade 6 display the ability to distinguish and evaluate different major, specific domains of life satisfaction. Given that the meaning and importance of life satisfaction constructs may differ depending on cultural characteristics, life satisfaction measures should be validated before using them in different cultures, age groups, and so forth (Irmak and Kuruüzüm 2008). Therefore, it is essential to examine the psychometric properties of measures, such as the BMSLSS, with members of the Chinese population rather than assuming cross-cultural comparability.

Taken together, there is an urgent need to find a suitable life satisfaction measure for Chinese elementary school age students and to lay the groundwork for future cross-cultural studies. Therefore, in the present study, we aim to preliminarily validate the BMSLSS with Chinese elementary school students and provide further evidence for its psychometric properties.

## 2 Method

### 2.1 Participants

The convenience samples used in our studies were randomly drawn from public elementary schools in a city located in Guangdong province of southern China. A total of 1904 students from Grades 4 to 6 completed the measures. The age of the participants ranged from 9 to 14 ( $M=11.25$ ,  $SD=0.99$ ). It should be noted that the typical age of admission to school is 6 years old in the Chinese school system. However, for various reasons, a few students begin school before or after 6 years old. Therefore, a 9-year-old student was the youngest student in this study, and a 14-year student was the oldest.

These schools were chosen because ongoing research relationships have been established between the schools and the first author's institution. According to the information provided by the local education authorities, the schools participating in the current study were coeducational, ordinary elementary schools, and reasonably representative of such institutions in China. All the schools were comparable in terms of the quality of students, school size, class size, and teachers' teaching ability. Most of the participants were from middle-income families with parents who earned at least a high school diploma. In the present study, data analyses were based on three independent samples of elementary school students.

- Sample 1 This sample was used for the item analysis and the exploratory factor analysis (EFA). Of the 800 participants, 401 were males, and 399 were females. The age of the participants ranged from 9 to 14 ( $M=11.22$ ,  $SD=0.99$ ). This sample covered three grades: 4, 5 and 6th.
- Sample 2 This sample was used for the confirmatory factor analysis (CFA), the analyses of internal consistency reliability, convergent validity and discriminant validity, and measurement invariance testing. Of the 799 participants, 422 were males, and 377 were females. The age of the participants ranged from 9 to 14 ( $M=11.28$ ,  $SD=0.99$ ). This sample covered three grades: 4, 5 and 6th.
- Sample 3 This sample was used for the analyses of test-retest reliability and predictive validity, including two waves of data. Of the 305 participants, 174 were males, and 131 were females. The age of the participants ranged from 9 to 14 ( $M=11.27$ ,  $SD=0.94$ ). This sample also covered three grades: 4, 5 and 6th. Participants completed the measures on two occasions across an interval of 5 weeks (Time 1: March and Time 2: May).

### 2.2 Measures

#### 2.2.1 Brief Multidimensional Students' Life Satisfaction Scale (BMSLSS)

The BMSLSS (Seligson et al. 2003), a short form of the Multidimensional Students' Life Satisfaction Scale (MSLSS), was designed to assess domain-specific life satisfaction of children and adolescents (ages 8–18). The BMSLSS consists of five items, each

representing one of the five life satisfaction domains that have been shown to be important to children and adolescents (e.g., "I would describe my satisfaction with my family life friends school experience myself where I live as..."). One additional item (i.e., "I would describe my satisfaction with my overall life as...") was used to assess overall (i.e., global) life satisfaction as well as a validity check for the BMSLSS. The BMSLSS uses a seven-point response option scale with options ranging from 1 = terrible to 7 = delighted. A mean score of the BMSLSS, representing general life satisfaction, was calculated by summing the item responses to the five items and dividing by five. Higher scores indicated higher life satisfaction.

In this study, the Chinese version of the BMSLSS was developed by using the back-translation method. The scale was first translated into Chinese by a panel of bilingual psychological researchers. The Chinese version was then back-translated into English by two independent bilingual researchers. Finally, the panel reviewed the back-translated version and compared it with the original version. Several meetings were held to discuss the difficulties during the translation process and some minor revisions were made. Previous research showed that the internal consistency of the scale ranged from 0.68 to 0.89 for the five items of the BMSLSS (Funk et al. 2006; Seligson et al. 2005; Siyez and Kaya 2007). The BMSLSS has been used with Chinese adolescents, and the evidence suggested good psychometric properties (Kwan 2007; Ye et al. 2013). In the present study, the Cronbach's alpha coefficient of the BMSLSS was 0.77.

### 2.2.2 Students' Life Satisfaction Scale (SLSS)

The SLSS (Huebner 1991a) was designed to measure global life satisfaction of children and adolescents (ages 8–18) by using items that require participants to evaluate the quality of their lives as a whole rather than evaluate them with respect to specific domains. It was used as a criterion measure of the convergent validity for the BMSLSS in the present study because previous studies have shown that the SLSS and the BMSLSS were highly correlated (Seligson et al. 2003). The scale consists of seven items (e.g., "My life is going well."; "I would like to change many things in my life."). It is a four-point scale with a response ranging from 1 = never to 4 = always. A total score of the SLSS was calculated by summing the item responses to the seven items. Higher scores indicated higher global life satisfaction. Previous research showed that the internal consistency of the scale ranged from 0.73 to 0.86 (Huebner 1991a; Huebner 1991b; Huebner et al. 2000; Terry and Huebner 1995). The SLSS has been used with Chinese elementary school students, and the evidence suggested good psychometric properties (Hou et al. 2009; Wang and Zou 2008). In the present study, the Cronbach's alpha coefficient of the SLSS was 0.68.

### 2.2.3 Rosenberg Self-Esteem Scale (RSES) (Chinese version)

The Chinese version of the RSES (Wang et al. 2010) was used to measure self-esteem or global feeling of self-worth of elementary school students. It was used as a criterion measure of the discriminant validity for the BMSLSS because previous studies have shown that life satisfaction and self-esteem are two related, but differentiable measures assessing different constructs (Huebner 1994b; Huebner et al. 1999; Terry and Huebner 1995). The RSES consists of ten items (e.g., "I am able to do things as well as most

other people.”; “I take a positive attitude toward myself.”), in which five items are positively worded and five items are negatively worded. It is a four-point scale with a response ranging from 1 = strongly disagree to 4 = strongly agree. The negatively worded items are reverse scored. A total score of the RSES was calculated by summing the item responses to the ten items. Higher scores indicated higher self-esteem. Previous research showed that the internal consistency of the scale ranged from 0.72 to 0.89 (Corwyn 2000; Rosenberg 1965). The RSES has been used with Chinese elementary school students, and the evidence suggested good psychometric properties (Kong et al. 2012; Tian et al. 2012). In the present study, the Cronbach’s alpha coefficient of the RSES was 0.75.

#### 2.2.4 Elementary School Students’ Subjective Well-Being in School Scale (ESSSWBSS)

The ESSSWBSS (Liu et al. 2014) was used to measure elementary school students’ subjective well-being in school, which was composed of three subscales: School Satisfaction subscale, Positive Affect in School subscale and Negative Affect in School subscale. The ESSSWBSS was used as a measure of predictive validity for the BMSLSS because previous studies of SWB’s top-down effect have shown that overall SWB predicts SWB in major life domains (e.g., job satisfaction ) (Headey et al. 1991; Lance et al 1989). For school-age children and adolescents, school represents a major life domain and thus satisfaction with school experiences would be expected to relate to satisfaction with life as a whole. Such an expectation is supported by various studies. For example, Yan and Zheng (2008) found that general life satisfaction had a strong influence on college students’ SWB in school. Furthermore, Park and Huebner (2005) observed that school satisfaction strongly related to Asian students’ overall life satisfaction. Thus, the ESSSWBSS was used as a measure of predictive validity for the BMSLSS in this study. The School Satisfaction subscale consists of 23 items (e.g., “Our campus has a beautiful environment.”), which is a six-point scale with a response ranging from 1 = strongly disagree to 6 = strongly agree. The Positive Affect in School subscale consists of five adjectives describing positive emotions experienced during school (e.g., relaxed, proud). It is a six-point scale with a response ranging from 1 = never to 6 = always. The Negative Affect in School subscale consists of five adjectives describing negative emotions experienced during school (e.g., sad, angry). It is also a six-point scale with a response ranging from 1 = never to 6 = always. The ESSSWBSS has been used with Chinese elementary school students, and the evidence suggested good psychometric properties (Liu et al. 2014). In the present study, the Cronbach’s alpha coefficients of the School Satisfaction subscale, Positive Affect in School subscale and Negative Affect in School subscale were 0.94, 0.89 and 0.87, respectively.

#### 2.3 Procedure

The data collection procedure was the same for the three samples. Approval for the study was obtained from Human Research Ethics Committee of South China Normal University and the school boards, principals, and teachers of the participating schools. Following the approvals, letters describing the study and consent forms were sent to the students’ parents. Only the children who returned the consent forms signed by a parent and who gave their own assent took part in the study. A packet of self-report instruments was administered to groups of about 50 students at a time in a classroom

by a trained graduate assistant. The participants all received identical verbal and written instructions from the trained graduate assistant. The students were allowed to take as much time as needed to complete the packet of instruments. All participants were voluntary and had the right to withdraw from the study at any time. Personal information of the participants was treated as confidential and only the researchers were able to gain access to it. After students finished all the measures, they were debriefed regarding the purpose of the investigation.

## 2.4 Data Analysis

Descriptive analyses were calculated for the five items of the BMSLSS and the mean score of the BMSLSS at Time 1. The item analysis was determined using the corrected item-total correlations for the five items of the BMSLSS. EFAs and CFAs were performed to examine the factor structure of the BMSLSS. Model fit for CFA was assessed using a number of indices. First of all, Chi square ( $\chi^2$ ) was considered. Traditionally, a good factor structure is inferred when the  $\chi^2$  likelihood ratio is non-significant. However, given the sensitivity of the  $\chi^2$  statistic to sample size (Saris 1982; Jöreskog and Sörbom 1996), multiple complementary fit indices were used to assess model fit as recommended by Hu and Bentler (1999): the non-normed fit index (NNFI), comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Acceptable model fit was defined by the following criteria: RMSEA < 0.08, NNFI > 0.90, CFI > 0.90. Good model fit was defined by the following criteria: RMSEA < 0.05, NNFI > 0.95, CFI > 0.95. The internal consistency for the five domains of the BMSLSS was determined using Cronbach's alpha coefficient. Regarding convergent validity, Pearson correlations were calculated between the mean score of the BMSLSS and overall life satisfaction item score, and the mean score of the BMSLSS and the SLSS score, respectively. With respect to discriminant validity, Pearson correlations were calculated between the mean score of the BMSLSS and the self-esteem score. Test-retest reliability coefficient was assessed by the Pearson correlations between the mean score of the BMSLSS at Time 1 and the mean score of the BMSLSS at Time 2. Predictive validity was assessed using hierarchical multiple regression analyses between the mean score of the BMSLSS at Time 1 and the students' SWB in school scores at Time 2. Measurement invariance testing was investigated by multi-group analysis.

Descriptive analyses, corrected item-total correlations, EFAs, Cronbach's alpha coefficients, Pearson correlations, and hierarchical multiple regression analyses were computed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). CFAs and measurement invariance testing were conducted using AMOS 17.0 (SPSS Inc.). No missing data was included in the data analysis procedure, for participants whose questionnaires were blank or had missing values were excluded in the final database.

## 3 Results

### 3.1 Descriptive Analyses

Means and standard deviations were calculated for the five items of the BMSLSS, and the mean score of the BMSLSS at Time 1 (see Table 1). Mean scores on the Friends,

**Table 1** Descriptive statistic and correlations among the items of the BMSLSS

Variable	<i>M</i>	<i>SD</i>	Skew	Kurt	1	2	3	4	5
1. Family	6.21	1.20	-1.78	2.94	-				
2. Friends	5.79	1.36	-1.32	1.41	0.43***	-			
3. School	5.61	1.45	-1.06	0.56	0.39***	0.51***	-		
4. Self	5.54	1.48	-1.12	0.75	0.40***	0.46***	0.40***	-	
5. Living environment	6.19	1.21	-1.82	3.18	0.37***	0.34***	0.35***	0.33***	-
6.T1 BMSLSS	5.87	0.97	-1.10	0.94	0.70***	0.77***	0.75***	0.74***	0.64***

*N*=799. *Skew* Skewness, *Kurt* Kurtosis, *BMSLSS* Brief Multidimensional Students' Life Satisfaction Scale, *T1BMSLSS* the mean score of the BMSLSS at Time 1

\*\*\**p*<0.001

School, and Self items, as well as the mean score on the BMSLSS at Time 1 fell within the range of “mostly satisfied”, while the Family and Living Environment items fell within the range of “pleased”. Correlations among the five items of the BMSLSS showed that the five domains significantly positive correlated with each other at the *p*<0.001 level. Of the five life satisfaction items, the Friends item had the strongest correlation with the mean score of the BMSLSS at Time 1 (*r*=0.77).

### 3.2 Item Analysis and Factor Analyses

#### 3.2.1 Item Analysis

The item analysis was determined using the corrected item-total correlations for the five items of the BMSLSS. Corrected item-total correlations for the five items of the BMSLSS ranged from 0.53 to 0.63 for all the participants in sample 1, 0.54 to 0.64 for the boys and 0.50 to 0.65 for the girls (see Table 2).

**Table 2** Factor loadings and corrected item-total correlations for the BMSLSS items

	Total	Boys	Girls	<i>r</i> <sub>tt</sub>
Family	0.78	0.75	0.80	0.62 <b>0.58</b> 0.65
Friends	0.78	0.79	0.78	0.63 <b>0.64</b> 0.63
School	0.73	0.71	0.75	0.57 <b>0.54</b> 0.59
Self	0.75	0.74	0.76	0.59 <b>0.58</b> 0.61
Living environment	0.70	0.74	0.68	0.53 <b>0.57</b> 0.50
Eigenvalue of variance	56.13 %	55.40 %	56.79 %	

Extraction method: Principal component analysis. *BMSLSS* Brief Multidimensional Students' Life Satisfaction Scale. *r*<sub>tt</sub> Item-total scale-score-corrected correlation coefficient, *r*<sub>tt</sub> of all the participants in Sample 1 is represented before the first slash, for boys (in bold) after the first slash and for girls after the second slash



### 3.2.2 Factor Analyses

The EFAs were performed to explore the factor structure of the BMSLSS, using the data of Sample 1. Principal component analysis of the factor extraction method was adopted in the EFAs. For all the participants in Sample 1, the Bartlett's test was statistically significant,  $\chi^2=1183.07$ ,  $df=10$ ,  $p<0.00$  and the Kaiser-Meyer-Olkin statistic (KMO = 0.80) was greater than its threshold value of 0.50. For the boys in Sample 1,  $\chi^2=548.69$ ,  $df=10$ ,  $p<0.00$ , KMO = 0.82. For the girls in Sample 1,  $\chi^2=655.54$ ,  $df=10$ ,  $p<0.00$ , KMO = 0.77. Results showed that all the five items loaded satisfactorily on a single factor which accounted for 56.13, 55.40 and 56.79 % of the variance for all the participants in Sample 1, the boys, and the girls, respectively. Factor loading ranged from 0.70 to 0.78 for all the participants in Sample 1, with loadings of 0.71 to 0.79 for the boys and 0.68 to 0.80 for the girls, respectively (see Table 2).

A principal deficit of EFA is its capitalization on chance, thus different factorial structures could emerge for different samples (Kline 2005). The 2-step EFA-CFA approach was able to examine the replicability of the resulting factor structure from EFAs in sample 1. Therefore, CFAs were performed in order to examine the factorial structure obtained from EFAs. The values for skewness and kurtosis were used to assess normality, using SPSS 16.0 and Amos 17.0. The most commonly used critical values for univariate normality are  $\pm 3$  and  $\pm 8$  (Kline 1998). As shown in Table 1, all the variables in the present study demonstrated values well below these levels. In addition, we used Mardia's coefficient to assess multivariate normality. According to Bollen (1989), a Mardia's coefficient smaller than  $p(p+2)$ , where "p" indicates the number of variables, suggests multivariate normality. In the study, Mardia's coefficient was 23.03, which was smaller than 5(5+2), indicating a multivariate normal distribution. Maximum likelihood estimation was adopted for the CFA. Results showed that one-factor models achieved an acceptable fit for all the participants in Sample 2, the boys and the girls (NNFI = 0.98; CFI = 0.99; RMSEA = 0.04, 90%CI [0.01, 0.07]; NNFI = 0.99; CFI = 0.99; RMSEA = 0.03, 90%CI [0.00, 0.08]; NNFI = 0.94; CFI = 0.97; RMSEA = 0.06, 90%CI [0.02, 0.10]). Figure 1 presents the standardized factor loadings of each item for the model.

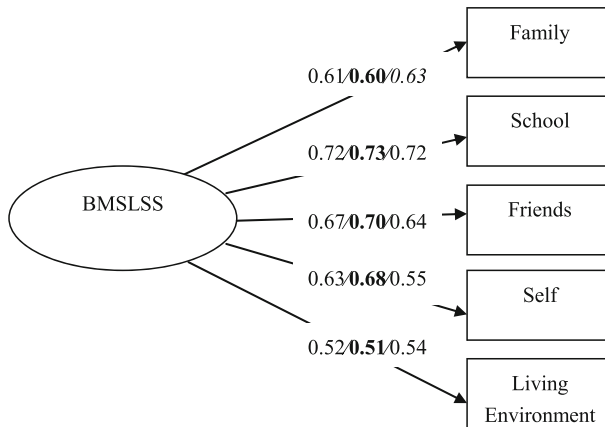
## 3.3 Reliability and Validity of the BMSLSS

### 3.3.1 Internal Consistency Reliability

The internal consistency reliability of the BMSLSS was assessed using the Cronbach's alpha coefficient. Using all the participants in sample 2, a Cronbach's alpha coefficient of 0.77 was obtained for the five domain-based items of the BMSLSS. The Cronbach's alpha coefficient for the five items was 0.78 and 0.75 for the boys and girls respectively.

### 3.3.2 Convergent Validity and Discriminant Validity

Convergent validity was investigated through the relationship between the mean score of the BMSLSS and the overall life satisfaction item score, and the relationship between the mean score of the BMSLSS and the SLSS score, using Pearson correlations. Discriminant validity was investigated through the relationship between the mean score of the BMSLSS and the self-esteem score, using Pearson correlations. Results



**Fig. 1** Structure of the BMSLSS with significant standardized factor loadings. Standardized factor loadings are presented for all the participants in Sample 2 before the first slash, for boys (*in bold*) after the first slash and for girls after the second slash. All correlations were significant at 0.01

showed that the mean score of the BMSLSS was more highly correlated with the overall life satisfaction item score ( $r=0.69$ ,  $p<0.01$ ) and the SLSS score ( $r=0.64$ ,  $p<0.01$ ) and less correlated with the self-esteem score ( $r=0.48$ ,  $p<0.01$ ).

### 3.3.3 Test-Retest Reliability

Test-retest reliability was assessed by the Pearson correlations between the mean score of the BMSLSS at Time 1 and the mean score of the BMSLSS at Time 2. The 5-week test-retest reliability coefficient was 0.88 for all the participants in Sample 3. More specifically, the 5-week test-retest reliability was 0.85 and 0.92 for the boys and the girls respectively.

### 3.3.4 Predictive Validity

Predictive validity was estimated through the relationship between the mean score of the BMSLSS at Time 1 and the elementary students' SWB in school scores at Time 2, using hierarchical multiple regression analyses. Before conducting the regression analyses, we assessed the multicollinearity of variables using the variance inflation factor (VIF), which is a measure of the amount of multicollinearity in a set of multiple regression variables; VIF values  $> 10$  indicate collinearity (Marquardt 1970). All the variables in the present study demonstrated values well below this level. The mean score of the BMSLSS was the predictor variable, and the scores on the three components of the students' SWB in school, namely School Satisfaction, Positive Affect in School, and Negative Affect in School, served as the dependent variables. First, demographic variables (including gender and grade level) were entered as the initial block of control variables for the hierarchical multiple regression analyses. Second, the mean score of the BMSLSS was entered as the second block of predictor variables. The results demonstrated that the mean score of the BMSLSS yielded significant contributions to the prediction of Time 2 School Satisfaction ( $\beta=0.63$ ,  $p<0.001$ ), Positive Affect in School ( $\beta=0.61$ ,  $p<0.001$ ) and Negative Affect in School ( $\beta=-0.30$ ,  $p<0.001$ ). The overall model accounted for 41, 38 and 10 % of variance in Time 2

School Satisfaction scores, Positive Affect in School scores and Negative Affect in School scores, respectively. The second block of variables accounted for a significant increment in the variance. The results demonstrated that the mean score of the BMSLSS yielded significant contributions to the prediction of the elementary school students' SWB in school measure (see Tables 3, 4 and 5).

### 3.4 Measurement Invariance

A series of stepwise analyses were adopted for the assessment of measurement invariance, which aimed to determine the extent to which items reflect comparable meaning across different groups of subjects. This type of analyses enhances the examination of the construct validity of the test because it provides evidence about construct-irrelevant invariance (Cordon and Finney 2008). Without tests of measurement invariance, it is unclear whether observed mean differences are reflections of "true" differences or if they are due to differential item functioning across groups (Little 1997; Steenkamp and Baumgartner 1998; Vandenberg and Lance 2000)

Three levels of measurement invariance analyses were tested in the following order: configural invariance, metric invariance, and scalar invariance. Configural invariance analysis tests the equivalence of the hypothesized factor structure through the relationship between the same items and the same factor across groups (Rensvold and Cheung 2001). Metric invariance analysis tests the extent to which the relationships between the factors and the items are equivalent across groups (Campbell et al. 2008; Rensvold and Cheung 2001). Scalar invariance analysis assumes equivalence of intercepts across groups (Rensvold and Cheung 2001).

The preliminary step in the process of measurement invariance testing was to evaluate whether the factor structure was equivalent across both groups. Thus, we first conducted two CFAs separately before multi-group analysis. The two groups consisted of the boys and the girls. Results showed that the hypothesized model provided

**Table 3** Hierarchical multiple regression of school satisfaction at time 2 on the mean score of the BMSLSS at Time 1

	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$	<i>F</i>	<i>df</i>
Step 1				0.01	0.01	1.83	2, 304
Intercept	78.09	15.57					
Grade	2.17	1.31	0.10				
Gender	2.81	2.49	0.07				
Step 2				0.41	0.40	70.39***	3, 304
Intercept	3.00	13.12					
Grade	2.86	1.01	0.13				
Gender	3.22	1.92	0.08				
T1BMSLSS	2.32	0.16	0.63***				

*N*=305. *BMSLSS* Brief Multidimensional Students' Life Satisfaction Scale, *T1BMSLSS* the mean score of the BMSLSS at Time 1

\*\*\*  $p < 0.001$

**Table 4** Hierarchical multiple regression of positive affect in school at time 2 on the mean score of the BMSLSS at Time 1

	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$	<i>F</i>	<i>df</i>
Step 1				0.00	0.00	0.22	2, 304
Intercept	21.32	3.75					
Grade	0.10	0.32	0.02				
Gender	0.37	0.60	0.04				
Step 2				0.38	0.37	60.12***	3, 304
Intercept	3.97	3.24					
Grade	0.26	0.25	0.05				
Gender	0.46	0.47	0.05				
T1BMSLSS	0.54	0.04	0.61***				

*N*=305. *BMSLSS* Brief Multidimensional Students' Life Satisfaction Scale, *T1BMSLSS* the mean score of the BMSLSS at Time 1

\*\*\* *p*<0.001

acceptable model fits to the data. For the boys, the indices were  $\chi^2=12.37$  (*df*=5), *p*<0.05; CFI = 0.99; NNFI = 0.99; RMSEA = 0.03; For the girls, the indices were  $\chi^2=6.42$  (*df*=5), *p*>0.05; CFI = 0.97; NNFI = 0.94; RMSEA = 0.06. Subsequently, multi-group analysis was performed. For the different gender groups, the CFI difference test ( $\Delta$ CFI) between the configural invariance model and the metric invariance model was -0.01, which was within the cutoff score of  $\Delta$ CFI  $\leq$  0.01 (Rensvold and Cheung 2001). Metric invariance across gender was supported. The difference between the metric invariance model and the scalar invariance model was  $\Delta$ CFI = -0.02, showing that scalar invariance was not supported. We then tested for partial scalar invariance across gender using a backward method by removing the constraints that

**Table 5** Hierarchical multiple regression of negative affect in school at time 2 on the mean score of the BMSLSS at Time 1

	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$	<i>F</i>	<i>df</i>
Step 1				0.01	0.01	1.25	2, 304
Intercept	17.32	3.89					
Grade	-0.14	0.33	-0.03				
Gender	0.91	0.62	0.09				
Step 2				0.10	0.09	11.10***	3, 304
Intercept	26.27	4.05					
Grade	-0.22	0.31	-0.04				
Gender	0.86	0.59	0.08				
T1BMSLSS	-0.28	0.05	-0.30***				

*N*=305. *BMSLSS* Brief Multidimensional Students' Life Satisfaction Scale, *T1BMSLSS* the mean score of the BMSLSS at Time 1

\*\*\**p*<0.001

contributed more chi-square values to the model until the partial scalar invariance model was acceptable. Using this procedure, a model for partial scalar invariance across the two gender groups was retained after freeing intercept parameters of item 5 (i.e., living environment item). The model fit of the partial scalar invariance model was satisfactory (see Table 6).

## 4 Discussion

Based on a multidimensional perspective of life satisfaction, we aimed to evaluate evidence for the psychometric properties of the BMSLSS with Chinese elementary school age students. Using 1904 participants, this study provided further support for the reliability and validity of the BMSLSS. Major findings are summarized below.

First, this study provided further evidence for the structure of the BMSLSS through item analysis, EFAs and CFAs. In the current study, the corrected item-total correlations showed a moderate magnitude, which indicated that the five domains of the BMSLSS, namely Family, School, Friendship, Self and Living Environment are all important life domains of relevance to students' general life satisfaction. The factor analyses supported the theory that the BMSLSS reflects a general LS factor comprised of five life domains (Seligson et al. 2003, 2005). These findings are consistent with the previous studies of middle school students and elementary school students in western countries (Funk et al. 2006; Seligson et al. 2003, 2005), suggesting that the BMSLSS factor structure remains invariant with respect to age and nation.

Second, this study provided further evidence for the reliability of the BMSLSS with Chinese elementary school students. The Cronbach's alpha coefficients for the five domains exceeded 0.75 in this study and were slightly higher than the result ( $\alpha=0.68$ ) found with American elementary school students (Seligson et al. 2005). All the test-retest reliability coefficients showed strong correlations, suggesting meaningful stability of general life satisfaction among Chinese elementary school students. Compared with the boys, the test-retest reliability coefficients were a little higher for the girls, indicating that girls might have more stable life satisfaction than boys.

**Table 6** Analysis of measurement invariance across gender

Model	$\chi^2$	<i>df</i>	RMSEA	CFI	$\Delta\chi^2(\Delta df)$	$\Delta CFI$
Step1: Configural invariance	23.69	14	0.03	0.99		
Step2: Metric invariance	35.89	19	0.03	0.98	12.20(4)	-0.01
Step3: Scalar invariance	55.81	24	0.04	0.96	19.92(5)	-0.02
Step4: Partial invariance	37.49	23	0.03	0.98	1.60(4)	0.00

$\Delta\chi^2$  chi-square difference between nested models,  $\Delta df$  difference in degrees of freedom between nested models, *CFI* comparative fit index,  $\Delta CFI$  comparative fit index differences between nested models, *RMSEA* root-mean-square error of approximation

<sup>a</sup> Partial scalar invariance on all items across two gender groups except for item 5

Third, this study provided further evidence for the validity of the BMSLSS with Chinese elementary school students. Evidence for the convergent validity of the BMSLSS was provided by the statistically significant correlations between the mean score of the BMSLSS and the scores on the overall life satisfaction item and the SLSS, whereas evidence of discriminant validity was provided through the relatively smaller correlations between the mean score of the BMSLSS and self-esteem score. With respect to predictive validity, evidence was provided by the significant predictive relationships between the mean score of the BMSLSS and the elementary students' SWB in school scores.

Finally, the measurement invariance of the BMSLSS was generally supported. However, given that only partial scalar invariance was supported across gender, future researchers should be cautious in interpreting mean differences, especially for the Living Environment item. This finding suggests that the effects of systematic responses biases and response threshold differences should be taken into account in studies of elementary school students' life satisfaction.

All in all, this study offers favorable preliminary evidence regarding the psychometric properties of the BMSLSS, suggesting that the BMSLSS is a promising measure for assessing life satisfaction with Chinese elementary school students. Potential applications of the BMSLSS are quite broad. First, the scale should facilitate basic science studies of the nature, origins, and consequences of life satisfaction differences in Chinese youth. Such studies may include large-scale, longitudinal studies of the development of life satisfaction of Chinese students across different age groups. Second, the scale may have practical applications, enabling the development of monitoring systems and systematic intervention programs to enhance the well-being of individual students as well as groups of students (e.g., at risk students). Finally, validation of this scale can facilitate the development of the cross-cultural studies between different countries on children's life satisfaction to develop a greater understanding of cultural influences on children's well-being.

Overall, this study provides promising evidence for the psychometric properties of the BMSLSS with Chinese children. It goes beyond previous studies by examining its usefulness among Chinese elementary school students in particular. Nevertheless, limitations of the study should be noted. First, although the samples used in this study were representative schools of the local provinces, and were large and adequate for statistical analysis, the samples were all from one province in South China. Generalizability would be increased through the use of studies using more nationally representative samples in China. Second, common-method bias effects are of concern, given the exclusive use of self-report methods. Thus, multi-informant designs could be employed in the future studies in order to increase confidence in the measurements in such research.

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