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Dimensionality of the Chinese Positive Youth Development Scale: Confirmatory Factor Analyses

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Abstract

This paper examines the dimensionality and factorial invariance of the Chinese Positive Youth Development Scale (CPYDS) using multigroup confirmatory factor analyses (MCFA). Secondary 1 students (N = 5,649) responded to the CPYDS in the context of a positive youth development program. Results showed that there are 15 basic dimensions of the CPYDS which are subsumed under four higher-order factors (i.e., cognitive-behavioral competencies, prosocial attributes, positive identity and general positive youth development qualities). Evidence of factorial invariance in terms of configuration, first-order factor loadings, second-order factor loadings, intercepts of measured variable, and intercepts of first-order latent factor, was found. The findings suggest that the CPYDS has stable dimensions that can be used to assess positive youth development in Chinese adolescents.

Dimensionality of the Chinese Positive Youth Development Scale:

Confirmatory Factor Analyses

In response to the "exclusive focus on pathology" in the field of psychology (Seligman & Csikszentmihalyi, 2000), scholars and practitioners become increasingly interested in studying human strengths that buffer against mental health and illness (Rich, 2003). Given the notion that "problem free is not fully prepared" for youths to enter adult society (Catalano, Hawkins, Berglund, Pollard, & Arthur, 2002; Seligman & Csikszentmihalyi, 2000), researchers advocated the adoption of "positive youth development" approach (Benson, Mannes, Pittman, & Ferber, 2004; Lerner & Benson, 2003). According to Barton, Watkins and Jarjoura (1997), this serves as a "paradigm shift in perspective away from a focus on correcting 'deficits' in individual youths toward enhancing the potential for healthy youth development in all youths in the community (p. 484).

Positive youth development can be defined as the growth, cultivation, and nurturance of developmental assets, abilities, and potentials in adolescents. It attempts to understand adolescents in terms of strengths, instead of problems or risky behaviors (Amodeo & Collins, 2007). There are views arguing that psychological well-being of adolescents are likely to be improved by developing positive youth development in adolescents because the related qualities can serve as potent protective factors of risky behaviors (Klein et al., 2006; Seligman, 2001).

Although this approach is appealing, there are several problems related to the assessment of the constructs of positive youth development. Firstly, there are wide variations in the related definitions and essence of positive youth development programs (Roth & Brooks-Gunn, 2003). Catalano et al. (2002) reviewed 77 programs on positive youth development and found that only 25 programs were successful in terms of positive changes in the objective outcome indicators

based on either true experimental or quasi-experimental designs. Further, they pointed out that the wide variation of the goals of these reviewed programs from promoting positive qualities versus reducing risk factors. As remarked by Gillham, Reivich and Shatté (2002), the discrepancies in the conceptualization of the programs "raise questions about the definition of positive youth development programs and the ways in which these programs differ from preventive interventions in general" (p. 3).

Secondly, the lack of valid and standardized instruments in assessing positive youth development constructs is another problem (Catalano et al., 2002). A computer search of the PsycINFO and Social Work Abstracts databases in July 2009 using "positive youth development" revealed that there were 341 and 17 citations, respectively. When the term "positive youth development" and "assessment" were used, there were 17 citations in PsycINFO, and no citations in Social Work Abstracts. These figures clearly revealed that more effort is needed in positive youth development research, especially for the development of sound psychometric measures. Roth and Brooks-Gunn (2003) highlighted the importance of valid and reliable measurement tools, as it tell us *why* certain programs are successful in promoting healthy development among participants' lives. The availability of positive youth development instruments provides a better understanding of how a program positively impacts youths, and thereby improving the quality of programs in the future (National Research Council, 2002; Roth et al., 1998).

Thirdly, the conception of "positive youth development" might vary across cultures as the scope and meaning of this subjective positive experience are conceptualized and prescribed by a particular set of values, norms and morals within society (Rich, 2001). Most of the positive youth development assessment tools to date were conducted in the West, little is known whether

the Western measures are applicable to non-Western contexts, such as the Chinese culture. Researchers highlighted the development of culturally appropriate instrument when assessing psychological functioning for different cultural and ethnic groups. Rich (2003) contended that "for a positive psychology to be convincing the diversity of the world's cultures and values must be reflected through careful, systematic research both within and beyond the United States….More work, quantitative and qualitative, psychosocial and biological, is needed to explore the possible paths to the good lives" (p. 3). Shek (2002) also pointed out that to enable human service professionals to assess service effectiveness, there was an urgent need to develop more instruments to assess psychosocial functioning of Chinese people.

In response to the lack of indigenous Chinese measures, Shek, Siu and Lee (2007) constructed the Chinese Positive Youth Development Scale (CPYDS) for assessing positive youth development in Chinese adolescents. The CPYDS was based on the 15 positive youth development constructs identified in the successful positive youth development programs reviewed by Catalaon et al. (2002), which consists of 15 subscales: 1) bonding, 2) resilience, 3) social competence, 4) emotional competence, 5) cognitive competence, 6) behavioral competence, 7) moral competence, 8) self-determination, 9) self-efficacy, 10) spirituality, 11) beliefs in the future, 12) clear and positive identity, 13) prosocial involvement, 14) prosocial norms, and 15) recognition for positive behavior. Shek et al. (2007) found that the CPYDS was internally consistent, and the scale and subscale scores were able to discriminate adolescents with and without positive development. Evidence on the convergent validity of the scale and subscales were also found.

Although there was strong support for the reliability and validity of the CPYDS in the study by Shek et al. (2007), the dimensionality of the scale was not examined because of the

small sample size involved (N =322). Therefore, there is a need to clarify the factor structure of the CPYDS to see whether the 15 dimensions really exit in reality. Furthermore, with reference to the 15 positive youth developmental constructs identified by Catalano et al. (2002), one question that should be asked is how are these constructs related to each other and whether they can be categorized in other dimensions. Judging from the operational definitions and items on these dimensions, it can be argued that the 15 positive youth development constructs can be categorized into four groups. First, cognitive competence, behavioral competence and self-determination can be grouped together as "cognitive-behavioral competencies" which are concerned about problem solving and making healthy choices in life. Second, prosocial norms and prosocial involvement can be regarded as "prosocial attributes". Third, clear and positive identity and beliefs in the future are attributes of "positive identity". For the rest of the constructs, they can be regarded as "general positive youth development qualities".

Against the above background, the purpose of the present study was to examine the factor structure of the CPYDS. First, factor structure of the CPYDS was tested via confirmatory factor structure (CFA). Besides models involving primary factors, a hierarchical model of the CPYDS based on the conceptual model underlying the CPYDS was examined. Second, factorial invariance of the CPYDS would be examined in terms of factor pattern, factor loadings and intercepts.

METHOD

Participants

The data of the present study were derived from the first wave data of a multi-year universal positive youth development program in Hong Kong. A total of 5,649 Secondary 1 students (2793 males, 2639 females)* participated in this study. A total of 48 schools

*217 participants did not indicate their gender.

(24 experimental groups, 24 control groups) from different parts of Hong Kong participated in this study. The participants could be considered as heterogeneous as they came from different areas and socio-economic classes in Hong Kong. The mean age of the participants was 12 years (*SD* = .94).

Procedures

During the data collection process, the purpose of the study was mentioned and confidentiality of the data collected was repeatedly emphasized to all students in attendance on the day of testing. Parental and student consent had been obtained prior to data collection. All participants responded to all scales in the questionnaire in a self-administration format. Adequate time was provided for the subjects to complete the questionnaire. A trained research assistant was present throughout the administration process.

Instruments

In the context of evaluation, participants responded to the measures of positive youth development, delinquency, substance abuse and life satisfaction. Positive youth development was measured by the Chinese Positive Youth Development Scale (CPYDS). The CPYDS is an 80-item self-report instrument developed to assess positive youth development. The CPYDS has 15 subscales, including bonding (6 items), resilience (6 items), social competence (7 items), recognition for positive behavior (4 items), emotional competence (6 items), cognitive competence (6 items), behavioral competence (5 items), moral competence (6 items), self-determination (5 items), self-efficacy (2 items), clear and positive identity (7 items), beliefs in the future (3 items), prosocial involvement (5 items), prosocial norms (5 items), and spirituality (7 items). The details of the items can be seen in Shek et al. (2007).

Data Analytic Strategy

Before testing the invariance of model parameters, a preliminary analysis was conducted to check any violations of multivariate normality assumption, the skewness and kurtosis values of all items. This preliminary step was important because maximum likelihood estimation method (ML) would only estimate the model correctly under the assumption of multivariate normality of the observed variables (Breckler, 1990; Curran, West, & Finch, 1996).

There were three parts in the data analysis process. Firstly, confirmatory factor analysis (CFA) was conducted to test the theoretical dimensions of the CPYDS. Then, hierarchical confirmatory factor analysis (HCFA) was used to examine the higher-order structure of the CPYDS. Secondly, multigroup confirmatory factor analysis (MCFA) was adopted to examine different factor model features (e.g., factor loadings) across genders. Specifically, a series of measurement invariance tests based on the analysis of means and covariance structures (MACS) was employed. Followed the steps outlined by Byrne and Stewart (2006), the factorial invariance of the instrument was examined in terms of: a) configural invariance, b) first-order factor loadings, c) second-order factor loadings, d) intercepts of the measured variable, and e) intercepts of first-order latent factor. Widaman and Reise (1997) pointed out that this strong factorial invariance (i.e., invariance factor loadings and intercepts) are adequate to answer most substantive research questions, and therefore, invariance of factor uniqueness (error) and latent factor means were not examined in the study. Finally, identical factor analytic procedures mentioned above were carried out to further assess the stability of the factor structure by randomly splitting the total sample into two subsamples (i.e., odd and even groups).

To evaluate the overall fit of the models, several fit indices were employed. These included chi-square (χ^2), root mean square error of approximation (RMSEA), goodness-of-fit index (GFI), standardized mean square residual (SMSR), Bentler-Bonett nonnormed fit index

(NNFI), comparative fit index (CFI), and the expected cross-validation index (ECVI) (Schumacker & Lomax, 2004; Tanaka, 1993). For GFI, CFI, NNFI, there is a general agreement that the values of .95 or greater indicate a satisfactory fit to the data (Schumacker & Lomax, 2004). The values of both SRMR and RMSEA below .08 and .06 respectively represent acceptable model-data fit (Hu & Bentler, 1999).

As the chi-square difference test becomes bias when sample size increases, changes in CFI (ΔCFI) were employed to determine model fit for factorial invariance (Vandenberg & Lance, 2000). Specifically, the value of ΔCFI less than or equal to .01 suggests that the invariance hypothesis should not be rejected (Cheung & Rensvold, 2002). All analyses were conducted using the covariance matrices via LISREL 8.80 (Jöreskog & Sörbom, 2006).

RESULTS

All variables were normally distributed (i.e., the univariate skewness and kurtosis values were lower than 2 and 7, respectively) (Chou & Bentler, 1995; Curran et al., 1996; Finney & DiStefano, 2006). Therefore, maximum likelihood estimation (ML) was used.

Comparison of first- and second-order factor models

Table 1 shows the overall goodness-of-fit indices for the models with primary factors and second-order factors. The 15 dimensions of the CPYDS were demonstrated in Model 1 (Table 1) and met the acceptable level for internal consistency reliability (above .70), except for self-efficacy (.50) (Table 2). The high correlations among the factors (range from .52-.88, Table 2) suggested the hierarchical structure of the models (Brown, 2006; Marsh & Hocevar, 1985), and therefore a second-order model was tested (Model 2).

A 15-factor second-order model comprised of four higher-order and fifteen lower-order factors as outlined in Figure 1 (i.e., cognitive-behavioral competencies higher-order factor: self-

determination, behavioral competence and cognitive competence; prosocial attributes higher-order factor: prosocial involvement and prosocial norms; positive identity higher-order factor: beliefs in the future, and clear and positive identity; general positive youth development qualities higher-order factor: resilience, social competence, self-efficacy, moral competence, bonding, recognition for positive behavior, spirituality, and emotional competence) was tested. This model exhibited adequate fit to the data ($\chi^2_{(3059)} = 44635.46$, $p < .01$, CFI = .98; GFI = .80; NNFI = .98; RMSEA = .06; SRMR = .05; EVCI = 10.30, Table 1). All factor loadings were statically significant ($t > 1.95$, $p < .05$) and ranged from .48 to .87 (Table 3).

In this model, all first-order factors loaded strongly onto the second-order factors (above .90), with the exception for the factors loaded on general positive youth development qualities higher-order factor (i.e., bonding, resilience, social competence, recognition for positive behavior, emotional competence, moral competence, self-efficacy and spirituality) (Table 3). A hierarchical model is generally preferred if the fit of the higher-order model is not worse than its lower-order counterpart as it provides a more parsimonious solution (Bong, 1997; Marsh, Balla, & McDonald, 1988). Therefore, Model 2 was employed in subsequent invariance tests.

Invariance tests across genders

To examine the stability of the dimensionality of the CPYDS, the second-order model (Model 2) was examined separately for each gender before testing for measurement invariance (Byrne, 1998). To attain statistical identification purpose, the variance of items, with factor loading above .50 from their respective factors was fixed to a value of 1.0 (Table 3).

In Table 1, both models exhibited adequate fit of the proposed model with the datasets in males (Model 3: $\chi^2_{(3059)} = 22589.26$, $p < .01$; CFI = .98; GFI = .80; NNFI = .98; RMSEA = .05; SRMR = .04; EVCI = 10.25) and females (Model 4: $\chi^2_{(3059)} = 27451.48$, $p < .01$; CFI = .98; GFI

= .75; NNFI = .98; RMSEA = .06; SRMR = .05; EVCI = 13.21). All factor loadings in both models were significant ($t > 1.95$, $p < .05$) and above .40 (Table 3). Given the satisfactory fit of both models, a series of measurement invariance tests were performed across genders.

Prior to testing for measurement invariance, a baseline model was requested to show the numbers of factors were equated across groups (Byrne, 1998). No equality constraint was imposed in this model. From Table 4, Model 7 fitted the observed data well ($\chi^2_{(6118)} = 50040.73$, $p < .01$; CFI = .98; NNFI = .98; RMSEA = .06; SRMR = .05; EVCI = 11.68), suggesting the generalizability of the factor pattern across genders (i.e., invariant factor pattern/configural invariance). Therefore, further restricted models for testing invariant factor loadings and intercepts were conducted.

In Model 8, equality constraints were added on first-order factor loading parameters testing for invariance of first-order factor loadings. Compared to Model 7, the difference in chi-square test from these two models was statistically significant ($\Delta\chi^2_{(65)} = 2356.13$, $p < .01$) (Table 4). However, researchers argued that this criterion was too sensitive to large sample size (Marsh, 1994; Schumacker & Lomax, 2004) and complex model structure (e.g., a higher-order model involves fewer numbers of parameters as compared to its lower-order counterparts) (Brown, 2006). Therefore, a practical approach was generally adopted (ΔCFI equal to or less than .01) for demonstrating measurement invariance (Byrne & Stewart, 2006; Cheung & Rensvold, 2002). As shown in Table 4, the value of ΔCFI remained unchanged (ΔCFI =0.0), and thereby suggesting the invariance of all first-order loadings across genders.

In Model 9, both first- and second-order factor loadings were constrained to be equal between males and females (i.e., testing for invariance of second-order factor loadings). From Table 4, it showed that the value of ΔCFI remained unchanged (ΔCFI = .00) and the chi-square

difference test was significant ($\Delta\chi^2_{(15)} = 419.71$, $p < .01$) when compared to Model 8. These findings indicated that the second-order factor loadings were invariant across genders.

Given all first- and second-order factor loadings were invariant, the intercept invariance tests were allowed to be conducted (Chen, Sousa, & West, 2005). In this form of invariance test, all factor loadings (first and second-order factor loadings) and the intercepts of the measured variables were constrained to be equal across genders (Model 10). The chi-square difference test was significant ($\Delta\chi^2_{(50)} = 20817.64$, $p < .01$) and the value of ΔCFI was .01, suggesting the intercepts of all measure variables were invariant between males and females (Table 4).

Finally, equality constraints were imposed on first- and second-order factor loadings and the intercepts of the measured variables and first-order latent factors in Model 11. The chi-square test difference was significant ($\Delta\chi^2_{(15)} = 6886.71$, $p < .01$) and the value of ΔCFI remained unchanged (ΔCFI = .00) (Table 4). This demonstrated that the intercepts of first-order latent factors were invariant across genders.

Invariance tests across groups

To further examine the stability of the dimensionality of the CPYDS, the total sample was divided into two subsamples based on the case number (i.e., odd and even groups) and identical invariant test procedures for gender were conducted across subsamples. As shown in Table 1, models exhibited adequate fit of the proposed model with the datasets in odd (Model 5: $\chi^2_{(3059)} = 26227.27$, $p < .01$, CFI = .98; GFI = .78; NNFI = .98; RMSEA = .06; SRMR = .05; EVCI = 11.65) and even groups (Model 6: $\chi^2_{(3059)} = 24843.63$, $p < .01$; CFI = .98; GFI = .78; NNFI = .98; RMSEA = .06; SRMR = .05; EVCI = 11.15). All factor loadings in both models were significant ($t > 1.95$, $p < .05$) and above .45 (Table 3). Therefore, a series of measurement invariance tests were performed across groups.

The goodness-of-fit indices of the baseline model reached acceptable level (Model 11: $\chi^2_{(6118)} = 51070.89$, $p < .01$, CFI = .98; NNFI = .98; RMSEA = .06; SRMR = .05; EVCI = 11.40, Table 4). This model indicated that the factor pattern was invariant across odd and even groups (i.e., configural invariance). In Model 13, equality constraints were imposed on first-order factor loadings. Compared to Model 12, the chi-square difference test was significant ($\Delta\chi^2_{(65)} = 1382.16$, $p < .01$) and the value of ΔCFI remained unchanged (ΔCFI = .00). This result showed that the first-order factor loadings were invariant across groups. Similar to the previous test, the difference in chi-square test between Model 13 and Model 14 was significant ($\Delta\chi^2_{(15)} = 156.94$, $p < .01$) and the value of ΔCFI remained unchanged (ΔCFI = .00). In other words, Model 14 provided evidence for the invariance of second-order factor loadings across groups. These results were also found when comparing Model 14 and Model 15 ($\Delta\chi^2_{(50)} = 11496.38$, $p < .01$; ΔCFI=.00), suggesting that the intercepts of all measure variables were invariant across groups. Finally, the intercepts of first-order latent factors were invariant across groups as shown in Model 16 (Model 15 vs 16, $\Delta\chi^2_{(15)} = 1410.13$, $p < .01$; ΔCFI=.00).

In summary, the findings supported the 15 dimensions of the CPYDS. The hierarchical model of the CPYDS exhibited better fit than the primary factor model. Through a series of invariance tests across subjects' gender and case number, factorial invariance of the higher-order factor model in terms of configural invariance, first-order factor loadings, second-order factor loadings, intercepts of measured variable, and intercepts of first-order latent factor, were supported.

DISCUSSION

The objectives of this study were to examine the dimensionality of the Chinese Positive Youth Development Scale (CPYDS) via hierarchical confirmatory factor analysis (HCFA) and to

investigate the factorial invariance of the related models. The findings arising from this validation study are generally encouraging and robust, suggesting that the CPYDS assesses 15 aspects of positive youth development which are subsumed under four constructs of "cognitive-behavioral competencies", "prosocial attributes", "positive identity" and "general positive youth development qualities". Factorial invariance analyses also showed that the factor structure of the CPYDS was stable across different groups.

The literature on adolescent psychology has primarily geared toward the study of adolescent psychopathologies and there are growing views arguing that more attention should be paid to adolescent strengths. For example, Benson (1997) argued against the pathological model and proposed a developmental model. Lerner and Benson (2003) similarly argued for the endorsement of the asset promotion paradigm, which advocates that we should view young people as resources to be developed. In the area of child developmental indicators, there are similarly more measures of adolescent developmental problems and efforts to develop positive youth development indicator is not widespread (Child Trends Databank, 2005; Roth et al., 1998; The Survey of Student Resources and Assets, 2009). As pointed out by Scales, Benson, Leffert, and Blyth (2004), "studies of adolescent behavior are dominated by naming, measuring, and predicting problem behaviors … empirically, the territory of positive developmental outcomes, as contrasted with that of risk behaviors, has been less explored" (p. 27). Lerner (2004) noted that the lack of positive indicators might often inadequate to depict desirable, healthy, and valued behaviors for children and adolescents. Even worse, this would influence the public perceptions of the state of our adolescents to be more negative than it really was (Guzman, Lippman, Moore, & O'Hare, 2003; Moore & Lippman, 2005).

"Treatment is not just fixing what is broken; it is nurturing what is best" (Seligman & Csikszentmihalyi, 2000, p. 7). Larson (2000) argued that "this field has evolved separately from developmental psychology and has not had a strong base of research and theory, especially regarding positive youth development" (p. 171). More empirical support for the positive youth development approach is needed for helping youths to stretch their full potential when they enter into adult society (Rich, 2001; Roth et al., 1998). Researchers highlighted several strengths for using measurement tools to build indicator of youth development: a) provide access to data on youth by building a data archive; b) monitor the changes in youth development across time; c) lay the groundwork for future programs and policies related to youth development; d) building international data that allows countries which have comparable indicators of youth development, and e) balance the proliferation of deficit indicators in the existing youth development research (Lippman, 2007; Moore, Lippman, & Brown, 2004). With reference to the above background, the present study is definitely a positive response.

The dearth of empirically valid and standardized measures might hinder our understanding of the predictors for positive youth development outcomes and the studying of inter- and intra-individual variation of these indicators across developmental stages (Lippman, 2007; Moore & Lippman, 2005). "A major obstacle to tracking indicators of positive youth development constructs is the absence of widely accepted measures for this purpose. Although such outcomes as academic achievement, engagement in the workforce, and financial self-sufficiency are commonly used, many aspects of positive youth development go unassessed due to the underdeveloped state of the assessment tools" (Catalano, Berglund, Ryan, Lonczak, & Hawkins, 1999, p vi-vii).

With specific reference to the Chinese culture, there is a paucity of instruments assessing psychosocial functioning of Chinese adolescents (Shek, 2002). In their review of the development of evidence-based practice in Hong Kong, Shek, Lam and Tsoi (2004) pointed out that there was an urgent need to develop more objective outcome measures in different Chinese communities. Therefore, the use of the CPYDS can enable Chinese helping professionals such as psychologists to assess positive youth development in Chinese and non-Chinese contexts in an objective manner. This scale may also be valuable for helping professionals working with Chinese adolescents living in non-Chinese contexts, such as Chinese Americans. Given the empirical evidence on the psychometric adequacy of the CPYDS, researchers can design effective positive youth development programs and evaluate them rigorously in the future (Park & Peterson, 2006). The CPYDS would lay the groundwork for future study in examining the unmeasured aspects of positive youth development in Chinese populations. Further, it might provide insight for both consistencies and inconsistencies between the findings of positive youth development programs as derived from the Western and Chinese contexts.

The second implication of the findings is that the subscales based on the CPYDS can be constructed to look at specific aspects of positive youth development. "An important and necessary first step in this process of understanding development of character strengths is identifying core components of character and developing scientifically valid and reliable measures of character strengths and virtues appropriate for different cultural and developmental groups" (Park & Peterson, 2006, p. 893). The use of the CPYDS's subscales can enable professionals and researchers to assess positive youth development in a more systematic and differentiated manner. This is important because different positive youth development programs may be associated with different adolescent developmental outcomes. One example is that the

CPYDS has been used to assess the effectiveness of a large-scale positive youth development program (Project P.A.T.H.S.) in Hong Kong (Shek et al., 2008; Shek, 2009).

The existence of the higher-order factors suggests that there is a need to look at the inter-relationships among different dimensions of positive youth development. As theoretical models on the inter-relationships among different aspects of positive youth development are not well-developed, the present findings offer promising evidence to the literature. It is interesting to ask how the promotion of prosocial attributes may help an adolescent to develop positive identity. In addition, development of psychosocial competencies may help to develop adolescent positive identity. Lastly, the evidence of structural invariance of the CPYDS's subscales allows the comparison of group means and examination of longitudinal stability of these constructs across time and genders in the future (Bontempo, Hofer, & Lawrence, 2006; Meredith, 1993).

There are several limitations of the present findings. First, because the assessment of positive youth development was based on self-report measures from the perspective of the adolescent only, the use of multiple perspectives would constitute a better strategy to assess the construct. Second, because the sample was recruited from Chinese adolescents in Hong Kong, there is a need to replicate the findings in other Chinese contexts. It would be interesting to ask whether the present findings are applicable to adolescents in non-Chinese contexts. Nevertheless, in view of the paucity of research on positive youth development measures in both the Western and Chinese contexts, the present findings can be regarded as pioneering and ground-breaking in the Chinese culture.

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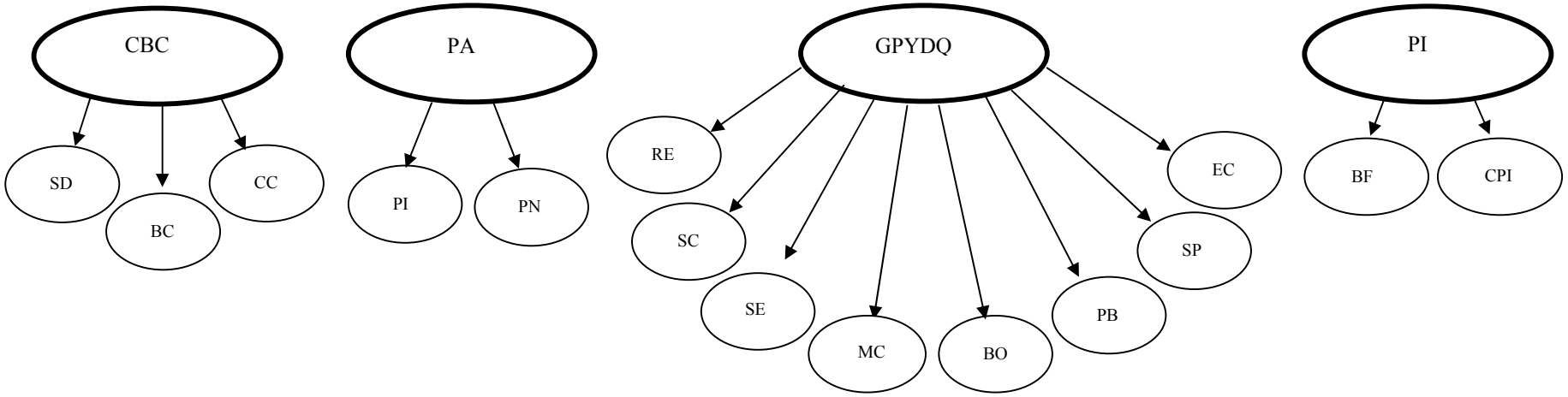

Figure 1. Measurement model for the second-order model of the Chinese Positive Youth Development Scale (CPYDS).
Note. CBC: cognitive-behavioral competencies; PA: prosocial attributes; PI positive identity; GPYDQ: general positive youth development qualities; SD: self-determination; BC: behavioral competence; CC: cognitive competence; PI: prosocial involvement; PN: prosocial norms; RE: resilience; SC: social competence;. SE: self-efficacy; MC: moral competence; BO: bonding; PB: recognition for positive behavior; SP: Spirituality; EC: emotional competence; BF: beliefs in the future; CPI: clear and positive identity.

Table 1 *Summary of Goodness of Fit for all CFA and HCFA models*

Model	Description	χ^2	df	CFI	GFI	NNFI	SRMR	RMSEA (90% CI)	ECVI (90% CI)
1	15 primary factor model	40709.47**	2975	.98	.82	.98	.04	.05 (.05- .05)	9.13 (9.00-9.26)
2	Second-order model	44635.46**	3059	.98	.80	.98	.05	.06 (.06- .06)	10.30 (10.17-10.44)
3	Males	22589.26**	3059	.98	.80	.98	.04	.05 (.05- .06)	10.25 (10.05-10.44)
4	Females	27451.48**	3059	.98	.75	.98	.05	.06 (.06- .06)	13.21 (12.98-13.43)
5	Odd	26227.27**	3059	.98	.78	.98	.05	.06 (.06- .06)	11.65 (11.45-11.86)
6	Even	24843.63**	3059	.98	.78	.98	.05	.06 (.06- .06)	11.15 (10.95-11.35)

Note. N_{whole}=5649; N_{males}=2793; $N_{females}$=2639; N_{odd}=2828; N_{even}=2821; CFA=confirmatory factor analysis; CFI = comparative fit index; GFI = goodness-of-fit index; NNFI = Bentler-Bonett nonnormed fit index; RMSEA = root mean square error of approximation; SRMR= standardized root mean square residual; ECVI = expected cross-validation index; CI=confidence interval.
**$p < .01$.

Table 2 *Correlation Coefficients, Mean of Inter-item Correlations and Cronbach's α among Factors*

Factor	A	Mean inter-item correlations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 BO	.83	.45	.-														
2. RE	.82	.44	.74	-													
3. SC	.83	.42	.74	.75	-												
4. PB	.76	.44	.81	.73	.75	-											
5. EC	.83	.44	.72	.77	.79	.73	-										
6. CC	.84	.47	.66	.82	.78	.72	.87	-									
7. BC	.76	.38	.71	.78	.80	.73	.83	.87	-								
8. MC	.77	.37	.73	.75	.76	.74	.80	.82	.87	-							
9. SD	.76	.40	.65	.74	.74	.65	.72	.83	.85	.80	-						
10. SE	.50	.34	.52	.64	.59	.57	.59	.70	.67	.66	.79	-					
11. CPI	.84	.43	.66	.70	.73	.68	.76	.78	.74	.74	.81	.77	-				
12. BF	.82	.61	.61	.73	.67	.61	.68	.76	.72	.71	.78	.72	.88	-			
13. PI	.83	.49	.75	.71	.72	.77	.70	.72	.74	.77	.72	.61	.74	.73	-		
14. PN	.77	.40	.68	.70	.67	.69	.66	.68	.76	.81	.69	.59	.65	.69	.87	-	
15. SP	.88	.51	.65	.66	.56	.57	.64	.60	.58	.59	.58	.52	.66	.64	.62	.55	-

Note. BO=bonding; RE=resilience; SC=social competence; PB=recognition for positive behavior, EC=emotional competence; CC=cognitive competence; BC=behavioral competence; MC=moral competence; SD= self-determination; SE=self-efficacy; CPI= clear and positive

identity; BF=beliefs in the future; PI=prosocial involvement; PN=prosocial norms; SP=spirituality. All parameters were significant ($p < .05$).

Table 3 *Completely Standardized Factor Loadings, Uniqueness and Squared Multiple Correlations for the models*

		Model 2				Model 3 (males)				Model 4 (females)				Model 5 (odd)				Model 6 (even)			
		First-order		Second-order		First-order		Second-order		First-order		Second-order		First-order		Second-order		First-order		Second-order	
	SMC	FL*	U	FL*	D	FL*	U	FL*	D	FL*	U	FL*	D	FL*	U	FL*	D	FL*	U	FL*	D
BO	.68			.82	.32			.83	.32			.81	.34			.82	.34			.83	.31
A1 [a]	.54	.73	.46			.72	.48			.74	.45			.71	.49			.75	.43		
A2	.42	.65	.58			.62	.61			.65	.58			.64	.59			.65	.58		
A3	.53	.73	.47			.72	.48			.74	.46			.73	.47			.73	.46		
A4	.59	.77	.41			.76	.42			.76	.42			.76	.42			.77	.41		
A5	.48	.69	.52			.68	.54			.69	.52			.68	.53			.70	.51		
A6	.49	.70	.51			.70	.51			.71	.50			.67	.55			.73	.47		
RE	.76			.87	.24			.88	.23			.87	.25			.87	.24			.87	.24
A7 [a]	.49	.70	.51			.69	.52			.72	.48			.71	.49			.70	.52		
A8	.44	.66	.56			.64	.58			.68	.53			.67	.55			.66	.57		
A9	.50	.71	.50			.70	.51			.70	.51			.71	.50			.71	.50		
A10	.43	.66	.57			.64	.59			.67	.55			.64	.58			.67	.55		
A11	.54	.73	.46			.72	.49			.75	.44			.72	.48			.74	.45		
A12	.54	.73	.46			.72	.49			.74	.45			.72	.48			.75	.44		
SC	.75			.87		.25		.87	.25			.85	.27			.87	.24			.86	.27
A13 [a]	.30	.55	.70			.55	.70			.54	.71			.54	.71			.56	.69		
A14	.59	.77	.41			.76	.42			.77	.40			.77	.40			.77	.41		
A15	.61	.78	.39			.77	.41			.79	.38			.77	.41			.79	.37		
A16	.67	.82	.33			.80	.36			.82	.32			.80	.37			.84	.30		
A17	.51	.72	.49			.69	.52			.74	.45			.71	.49			.73	.47		
A18	.32	.57	.68			.54	.71			.59	.65			.57	.68			.57	.68		
A19	.41	.64	.59			.61	.62			.64	.58			.66	.57			.63	.60		
PB	.70			.84	.30			.81	.34			.86	.27			.84	.30			.83	.30
A20 [a]	.56	.75	.44			.74	.46			.76	.42			.75	.43			.75	.44		
A21	.59	.77	.41			.76	.42			.76	.42			.77	.41			.77	.41		
A22	.39	.62	.61			.63	.61			.61	.63			.64	.59			.61	.63		
A23	.41	.64	.59			.63	.60			.64	.59			.64	.50			.64	.60		
EC	.78			.88	.22			.89	.21			.87	.24			.88	.22			.89	.21
B1 [a]	.48	.69	.52			.69	.52			.69	.53			.71	.50			.68	.54		
B2	.50	.71	.50			.70	.51			.71	.50			.72	.48			.70	.52		
B3	.46	.68	.54			.66	.57			.68	.53			.67	.55			.69	.52		
B4	.49	.70	.51			.66	.57			.74	.45			.69	.52			.71	.50		
B5	.47	.69	.53			.67	.55			.68	.54			.68	.53			.69	.52		
B6	.45	.67	.55			.66	.56			.67	.56			.67	.55			.67	.55		

Note: BO=bonding; RE=resilience; SC=social competence; PB=recognition for positive behavior, EC=emotional competence.

All parameters were significant ($p < .05$); SMC=squared multiple correlation; FL = completely standardized factor loading; U = uniqueness; D= disturbance.

[a] Item was fixed to a value of 1.0.

Table 3 *(continued)*

		Model 2				Model 3 (males)				Model 4 (females)				Model 5 (odd)				Model 6 (even)			
		First-order		Second-order		First-order		Second-order		First-order		Second-order		First-order		Second-order		First-order		Second-order	
	SMC	FL	U	FL	D	FL	U	FL	D	FL	U	FL	D	FL	U	FL	D	FL	U	FL	D
CC	.87			.94	.13			.94	.12			.94	.13			.93	.13			.94	.12
B7	.43	.65	.57			.63	.60			.69	.53			.64	.59			.67	.55		
B8 [a]	.58	.76	.42			.76	.43			.76	.43			.76	.42			.76	.42		
B9	.55	.74	.45			.73	.46			.75	.44			.75	.44			.73	.47		
B10	.63	.80	.37			.79	.38			.80	.37			.80	.36			.79	.38		
B11	.54	.74	.46			.74	.45			.71	.49			.74	.45			.73	.46		
B12	.47	.69	.53			.66	.56			.70	.51			.69	.52			.68	.54		
BC	.87			.93	.13			.94	.11			.92	.16			.93	.13			.93	.13
B13 [a]	.33	.57	.67			.53	.72			.61	.63			.57	.67			.57	.68		
B14	.48	.69	.52			.65	.58			.72	.48			.70	.52			.68	.53		
B15	.49	.70	.51			.69	.52			.71	.50			.70	.51			.71	.50		
B16	.49	.70	.51			.70	.52			.70	.51			.71	.49			.69	.52		
B17	.42	.65	.58			.65	.58			.63	.60			.66	.57			.65	.58		
MC	.82			.90	.18			.91	.18			.90	.19			.92	.15			.89	.21
C1 [a]	.44	.66	.56			.65	.58			.64	.59			.66	.56			.66	.56		
C2	.51	.72	.49			.72	.48			.68	.53			.72	.48			.72	.49		
C3	.25	.50	.75			.46	.78			.50	.75			.49	.76			.50	.75		
C4	.40	.63	.60			.62	.61			.63	.61			.62	.61			.65	.58		
C5	.52	.72	.48			.70	.51			.73	.46			.73	.47			.72	.48		
C6	.44	.66	.56			.66	.56			.65	.57			.67	.56			.66	.56		
SD	.81			.90	.19			.88	.23			.91	.18			.90	.18			.89	.20
C7 [a]	.53	.73	.47			.70	.50			.74	.45			.73	.47			.72	.48		
C8	.67	.82	.33			.83	.32			.82	.33			.82	.33			.82	.33		
C9	.56	.75	.44			.76	.43			.74	.45			.74	.45			.75	.43		
C10	.46	.67	.54			.67	.55			.66	.56			.67	.55			.68	.54		
C11	.15	.39	.85			.42	.83			.33	.89			.37	.86			.40	.84		
SE	.56			.75	.44			.75	.43			.76	.43			.74	.45			.76	.42
C17	.23	.48	.77			.50	.75			.45	.80			.48	.77			.47	.77		
C18 [a]	.58	.76	.42			.74	.45			.78	.39			.76	.42			.76	.41		

Note: CC=cognitive competence; BC=behavioral competence; MC=moral competence; SD= self-determination; SE=self-efficacy. All parameters were significant ($p < .05$); SMC=squared multiple correlation; FL = completely standardized factor loading; U = uniqueness; D= disturbance.

[a] Item was fixed to a value of 1.0.

Table 3 *(continued)*

		Model 2				Model 3 (males)				Model 4 (females)				Model 5 (odd)				Model 6 (even)			
		First-order		Second-order		First-order		Second-order		First-order		Second-order		First-order		Second-order		First-order		Second-order	
	SMC	FL	U	FL	D	FL	U	FL	D	FL	U	FL	D	FL	U	FL	D	FL	U	FL	D
CPI	.92			.96	.08			.96	.08			.96	.08			.96	.34			.96	.08
D1 [a]	.54	.74	.46			.74	.45			.72	.47			.73	.47			.75	.44		
D2	.46	.68	.54			.67	.55			.68	.54			.67	.55			.68	.53		
D3	.46	.68	.54			.67	.55			.69	.52			.67	.56			.69	.53		
D4	.47	.69	.53			.67	.55			.71	.50			.68	.54			.70	.51		
D5	.60	.78	.40			.78	.40			.78	.39			.77	.40			.78	.39		
D6	.45	.67	.55			.67	.55			.65	.58			.67	.55			.66	.56		
D7	.43	.65	.57			.64	.58			.65	.58			.65	.58			.66	.57		
BF	.85			.92	.15			.94	.12			.89	.21			.92	.24			.92	.15
D8 [a]	.67	.82	.33			.82	.32			.80	.37			.81	.34			.82	.33		
D9	.62	.78	.38			.77	.41			.80	.36			.77	.40			.80	.37		
D10	.75	.87	.25			.85	.28			.88	.22			.87	.25			.87	.25		
PI	.92			.96	.08			.95	.09			.96	.06			.97	.24			.95	.10
D15 [a]	.50	.71	.50			.70	.51			.68	.53			.70	.51			.72	.49		
D16	.44	.67	.56			.67	.55			.64	.60			.66	.56			.67	.55		
D17	.66	.81	.34			.80	.35			.80	.37			.81	.35			.81	.34		
D18	.54	.73	.46			.73	.46			.73	.47			.73	.47			.74	.45		
D19	.64	.80	.36			.79	.41			.80	.36			.81	.35			.79	.37		
PN	.82			.91	.18			.91	.16			.89	.20			.91	.18			.91	.18
E1 [a]	.51	.72	.49			.71	.50			.69	.52			.72	.49			.72	.48		
E2	.56	.75	.44			.74	.46			.73	.47			.74	.45			.75	.44		
E3	.31	.56	.69			.58	.66			.53	.72			.55	.70			.57	.67		
E4	.59	.77	.41			.74	.45			.80	.36			.78	.40			.77	.41		
E5	.31	.56	.69			.54	.71			.54	.70			.57	.67			.55	.70		
SP	.49			.70	.51			.68	.53			.90	.48			.70	.51			.70	.51
H1 [a]	.66	.81	.34			.81	.34			.80	.36			.81	.35			.81	.34		
H2	.66	.81	.34			.80	.36			.81	.34			.82	.33			.80	.35		
H3	.64	.80	.36			.79	.37			.80	.37			.79	.37			.80	.36		
H4	.43	.65	.57			.65	.58			.65	.58			.66	.56			.65	.58		
H5	.75	.86	.25			.85	.29			.88	.22			.86	.25			.86	.25		
H6	.64	.80	.36			.78	.39			.81	.35			.80	.36			.80	.37		
H7	.32	.57	.68			.54	.71			.59	.65			.55	.70			.58	.66		

Note: CPI= clear and positive identity; BF=beliefs in the future; PI=prosocial involvement; PN=prosocial norms; SP=spirituality. All parameters were significant ($p < .05$); SMC=squared multiple correlation; FL = completely standardized factor loading; U = uniqueness; D= disturbance.

[a] Item was fixed to a value of 1.0.

Table 4 *Summary of Goodness of Fit for Invariance Tests*

Model	Description	χ^2	df	CFI	NNFI	RMSEA (90% CI)	SRMR	ECVI (90% CI)	$\Delta\chi^2$	Δdf	ΔCFI
Gender invariance											
7	Configural invariance (Baseline model)	50040.73**	6118	.98	.98	.06 (.06-.06)	.05	11.68 (11.54-11.83)	-	-	-
8	First-order factor loading invariant	52396.73**	6183	.98	.98	.06 (.06-.06)	.07	12.13 (11.98-.12.28)	2356.13** (Model 7 vs 8)	65	.00
9	Second-order factor loading invariant	52816.57**	6198	.98	.98	.06 (.06-.06)	.08	12.26 (12.10-12.41)	419.71** (Model 8 vs 9)	15	.00
10	Measured variable intercept invariant	73634.21**	6248	.97	.97	.08 (.00-.00)	.08	21.14 (1.27-1.27)	20817.64** (Model 9 vs 10)	50	.01
11	First-order intercept invariant	80520.92**	6263	.97	.97	.09 (.00-.00)	.09	27.17 (1.26-1.26)	6886.71** (Model 10 vs 11)	15	.00
Subgroup invariance											
12	Configural invariance (Baseline model)	51070.89**	6118	.98	.98	.06 (.06-.06)	.05	11.40 (11.26-.11.55)			
13	First-order factor loading invariant	52453.05**	6183	.98	.98	.06 (.06-.06)	.06	11.62 (11.48-.11.77)	1382.16** (Model 12 vs 13)	65	.00
14	Second-order factor loading invariant	52609.48**	6198	.98	.98	.06 (.06-.06)	.06	11.64 (11.50-11.79)	156.94** (Model 13 vs 14)	15	.00
15	Measured variable intercept invariant	64106.37**	6248	.98	.98	.07 (.07-.07)	.07	14.96 (14.76-.15.10)	11496.38** (Model 14 vs 15)	50	.00
16	First-order intercept invariant	65516.50**	6263	.98	.98	.07 (.07-.07)	.07	15.60 (15.40-15.74)	1410.13** (Model 15 vs 16)	15	.00

Note. N_{whole}=5649; N_{males}=2793; $N_{females}$=2639; N_{odd}=2828; N_{even}=2821.
CFA=confirmatory factor analysis; CFI = comparative fit index; GFI = goodness-of-fit index; NNFI = Bentler-Bonett nonnormed fit index; RMSEA = root mean square error of approximation; SRMR= standardized root mean square residual; ECVI = expected cross-validation index; CI=confidence interval; $\Delta\chi^2$ = change in goodness-of-fit χ^2 relative to previous model; Δdf=change in degrees of freedom relative to previous model; ΔCFI= change in comparative fit index relative to previous model.

Model 7 & Model 12 = no equality constraint was imposed; Model 8 & Model 13 = equality constraints were imposed on all first-order factor loadings; Model 9 & Model 14 = equality constraints were imposed on all first- and second-order factor loadings; Model 10 & Model 15 = equality constraints were imposed on all first- and second-order factor loadings, intercepts of the measured variables; Model 11 & Model 16 = equality constraints were imposed on all first- and second-order factor loadings, intercepts of the measured variables and first-order latent factors.
**$p < .01$.