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Abstract Cross-cultural researches on the Ryff's Psychological Well-being (PWB) Scales are currently not available. The aim of the paper was to investigate the measurement invariance of the 18-item version of the PWB Scales across 1,114 high school and undergraduate Italian and Belarusian students. After identifying the six correlated first-order factors and one second-order factor model of the Ryff's PWB Scales, as baseline model for each sample, multi-groups confirmatory factor analyses were subsequently performed. All analyses were performed using the Robust Diagonally Weighted Least Squares estimation procedures, entering a polychoric correlation matrix. Multi-groups analyses showed that factor structure of the preferred model did not change across the Italian and Belarusian samples. Although the obtained results provided a preliminary support for cross-cultural structural invariance of the PWB Scales, further investigations are required to ensure its generalizability and applicability. Limitations and suggestions for future researches as well as psychosocial applications for educational context were discussed.

Keywords Eudaimonic well-being · Flourishing · Structural invariance · Cross-cultural · Confirmatory factor analysis

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1 Introduction

Psychological well-being (PWB) has received an increasing attention in the scientific community and among practitioners (e.g., Abbott et al. 2006; Burns and Machin 2009, 2010; Fernandes et al. 2010; Giannetti et al. 2006; Lavasani et al. 2011; Ruini et al. 2003; Sirigatti et al. 2009; Springer et al. 2011; Van Dierendonck et al. 2008). The theoretical roots of PWB research stretch back to the World Health Organization's conception of health (1946), described as not merely the antithesis to disease, but a state of complete physical, mental and social well-being.

Starting from this broader definition of health, in the late 80 s of last century, Ryff (1989) developed a multidimensional model of PWB, based on an extensive review of the scientific literature, and the integration of clinical, human positive functioning and developmental life span theories (Allport 1961; Erikson 1968; Jahoda 1958; Jung 1933; Maslow 1968; Neugarten 1968; Rogers 1961). This model included six dimensions: a positive attitude toward the self and one's past life (Self-Acceptance); a close, trusting and open relationships with others (Positive Relations with Others); self-regulation and independence (Autonomy); the competence to manage the environment and external activities (Environmental Mastery); a belief in the meaning to one's present and past life (Purpose in Life); a sense of improvement or expansion over time (Personal Growth). The interest in PWB was currently reinforced by the development of coaching psychology, oriented to the enhancement of life experiences, work performances and well-being (Grant 2006), and by the existing positive psychology framework (Seligman and Csikszentmihalyi 2000), which emphasized the need for identifying and enhancing protective factors, virtues and strengths of individuals and systems.

On the basis of the definition given to the different dimensions, Ryff (1989) realized a self-report measure—the Ryff's Psychological Well-being (PWB) Scales—with the aim to operationalize each of the six PWB dimensions. Several steps were needed in order to achieve the final version of the instrument, composed of 20 items per dimension (Ryff 1989). Not surprisingly, the PWB Scales have been translated into many different languages, and utilized in various socio-cultural and linguistic contexts, such as Italian (Fava et al. 2001; Giannetti et al. 2006; Penzo et al. 2011; Ruini et al. 2003; Ruini et al. 2009; Sirigatti et al. 2009), Dutch (Van Dierendonck 2004), Chinese (Cheng and Chan 2005), Swedish (Lindfors et al. 2006), Spanish (Triadó et al. 2007; Van Dierendonck et al. 2008), Portuguese (Fernandes et al. 2010) and French (Salama-Younes et al. 2011).

Although different versions of the PWB Scales have been developed (18-, 24-, 39-, 42-, 54-, and 84-item versions), the 18-item version is the most commonly used (Clarke et al. 2001; Fernandes et al. 2010; Lindfors et al. 2006; Ryff and Keyes 1995; Springer and Hauser 2006). The Ryff's PWB Scales are one of the most widely applied measures of PWB in clinical and general samples, different for gender, age, marital status, level of education, health, and other aspects of well-being (Clarke et al. 2001; Keyes et al. 2002; Ryff 1989; Ryff and Keyes 1995).

A number of studies (Abbott et al. 2006; Abbott et al. 2010; Burns and Machin 2009; Ryff and Keyes 1995; Sirigatti et al. 2009; Springer and Hauser 2006; Van Dierendonck et al. 2008) have investigated the PWB Scales factor structure in diverse populations, using different methodological and estimation procedures. The results of such studies have been controversial, suggesting the existence of a variety of alternative models, different for structures (linear and hierarchical) and item loadings (Abbott et al. 2006, 2010; Burns and Machin 2009; Cheng and Chan 2005; Fernandes et al. 2010; Van Dierendonck et al. 2008). Several studies revealed that the six correlated first-order factors and a general psychological

well-being second-order factor model (hierarchical model) is one of the models that best fit the data, also confirmed by a recent Italian investigation (Sirigatti et al. 2009).

The comparison of these results is difficult because of different methodological procedures used in the examination of the PWB Scales factor structure. As noted by some authors (Springer and Hauser 2006; Van Dierendonck et al. 2008), researchers who previously investigated the factor structure of the instrument have often used the traditional statistical procedures, however without considering the variables' metrological features or possible relationships between the factors. In recent investigations of the Ryff's PWB Scales structural validity, model estimations were based on polychoric correlations which provided asymptotically unbiased parameter estimates (Abbott et al. 2006; Sirigatti et al. 2009; Springer and Hauser 2006; Van Dierendonck et al. 2008). This procedure seems preferable in studies that analyze the psychometric characteristics of instruments based on ordinal variables, such as the PWB Scales, in order to avoid biased estimates of factor loadings and, consequently, inaccurate results (Holgado-Tello et al. 2010; Jöreskog 1994).

The growing interest in cultural diversity has led to the proliferation of cross-cultural researches directed to investigate how the psychological constructs may vary across different cultures. Over the years, an extensive body of studies has been carried out, covering different domains such as psychological features (Benson et al. 2010; Fan et al. 2008; Hofer et al. 1997; Nye et al. 2008), psychopathology (Ang et al. 2009; Byrne et al. 1995; Feaster et al. 2010; Hill and Hughes 2007; King et al. 2009; Wang et al. 2010), and different aspects of health and well-being (Erhart et al. 2009; Robitschek and Keyes 2009; Shevlin and Adamson 2005; Shevlin et al. 1998; Wu and Yao 2006).

Similar studies are currently not available as far as the PWB Scales are concerned, even though the instrument is widely applied in different socio-cultural and linguistic contexts. Even a careful translation (i.e., using translation/back translation procedures) is not sufficient to ensure that language-diverse versions of the instrument measure the same construct in a similar way. Moreover, notwithstanding separate studies on the Ryff's PWB Scales construct validity discovered some similarities in factor structure, such results do not represent the evidence that the instrument measures the same attributes across different socio-cultural and linguistic groups (Byrne et al. 2009; Byrne and Campbell 1999; Milfont and Fischer 2010). When people use different words to define the same beliefs, attitudes, values or behaviors, the scores cannot be compared across groups, and conclusions about the meaning and structure of the instrument may not be inferred.

An evaluation of the measurement equivalence across different cultures requires to be tested statistically (Byrne 2008; Byrne et al. 2009; Byrne and Campbell 1999; Gregorich 2006; Milfont and Fischer 2010). Cross-cultural generalizability studies allow evaluating whether the same instrument activates similar perceptive, cognitive and interpretative processes in different groups. For an empirical assessment of cross-cultural factor invariance, the multi-group confirmatory factor analysis (MGCFA) represents the most frequently used technique (Byrne 2006, 2008; Byrne et al. 2009; Byrne and Campbell 1999; Gregorich 2006; Milfont and Fischer 2010).

The investigation of cross-cultural invariance consists of a series of progressively restrictive tests of measurement invariance. There is no general agreement for the sequence of tests that should follow the configural invariance examination, such as the different parameters that should be taken into account from time to time. As stated by Vandenberg and Lance (2000), the choice of the specific tests for evaluating measurement invariance, besides their sequencing, should be guided by the aims of the study. No scientific publication recommends the use of all tests, and the inclusion of all tests in empirical studies is rare.

The failure of an invariance test may be due to various reasons such as misspecification of the model, erroneous methodological procedure, or the incongruous translation of the measurement instrument into different languages (Byrne and Watkins 2003). Such a failure may imply that the instrument activates different psychological processes, and that the differences between groups cannot be interpreted in unambiguous way (Horn and McArdle 1992).

Although there was a growing interest in applying the MGCFA (Byrne and Watkins 2003; Cheung and Rensvold 1999; Vandenberg and Lance 2000), however empirical studies that use this technique were still infrequent, especially if concerned with testing measurement invariance of second-order factor models (Chen et al. 2005). The evaluation of measurement invariance across groups is considered a gold standard for quantitative comparative research, particularly when multi-item self-report instruments are used. Despite this, the use of the MGCFA seems to be quite infrequent, at least in comparative health studies. The scarcity of measurement invariance research might be linked to the lack of awareness or methodological skills of researchers (Gregorich 2006).

To our knowledge—perhaps with the exception of the research carried out by Linley et al. (2009)—this investigation was the first one aimed at evaluating the factor structure of the PWB Scales across two different socio-cultural and linguistic groups of adolescents and young adults, utilizing the MGCFA technique. The present study had two purposes: the examination of the fitting of the 18-item version of the PWB Scales second-order factor model for the Italian and Belarusian groups, and the assessment of the measurement invariance of the PWB Scales with regard to both groups.

2 Method

2.1 Participants

Two convenience samples of high school and undergraduate students participated in the survey voluntarily, one group from Italy and the other from Belarus. The Italian sample was composed of 619 students who were enrolled in various high schools throughout Florence, the University of Florence and the European University of Rome; most of them were females (83 %); 87 % of the students were between 15 and 18 years of age, and the remainder were 19 or older. The majority were born in Florence and reside in Florence or its vicinity. The Belarusian sample consisted of 495 students who were recruited from the Francisk Skorina Gomel State University. Most of them were females (78.9 %); 69.6 % of the participants were aged between 17 and 18 years, while the remainder were 19 or older. The majority were residing in or near Gomel.

2.2 Measures

In addition to a personal data form—containing a set of questions about socio-demographic characteristics, such as gender, age, birth and where they live, and education level—the Italian version of the 18-item *Ryff's Psychological Well-being* (*PWB*) *Scales*, recently investigated in the Italian context (Sirigatti et al. 2009), was used to assess the psychological well-being. The six intercorrelated dimensions are: Self-Acceptance (SA), Positive Relations with Others (PR), Autonomy (AU), Environmental Mastery (EM), Purpose in Life (PL) and Personal Growth (PG). Each dimension was operationalized by means of a 3-item scale of negatively and positively assertions contained in the Italian adaptation of the 14-items per scale version carried out by Ruini et al. (2003). Participants' responses were provided using a

4-point Likert-type response scale, ranging from 1 (disagree strongly) to 4 (agree strongly). The following are examples of items for each dimension: "For the most part, I am proud of who I am and the life I lead" (SA), "I feel like I get a lot out of my friendship" (PR), "It's difficult for me to voice my opinions on controversial matters" (AU), "I have difficulty arranging my life in a way that is satisfying to me" (EM), "I don't have a good sense of what I am trying to accomplish in life" (PL), and "I think it is important to have new experiences that challenge how you think about yourself and the world" (PG). Higher scores were indicative of greater well-being on each dimension considered.

For the current investigation, the PWB Scales were translated from English to the Belarusian language by bilingual psychologists. The translated PWB Scales were consequently back-translated into the original language and then compared with the English version. Subsequently, adjustments were conducted to ensure understandability, unambiguity, psychological equivalence, and the accuracy of the translation from English to Belarusian.

2.3 Procedure

Data were gathered from the Italian and Belarusian samples, during school hours, and at the student teaching sites. Research participation was subjected to privacy information and consent to the processing of personal data, in accordance with the applicable law. Parental consent and authorization were obtained for the participation of underage students.

The booklet handed to each participant—containing a brief presentation of the study objectives and procedures, the personal data form and the Italian or the Belarusian 18-item version of the PWB Scales—was only used for reading the items. Responses were provided on answer sheets designed to be read by optical scanners. Each answer sheet was marked with an alphanumeric identification code, previously assigned to each participant, as a guarantee of anonymity. The staff was present in the classroom during data collection, providing support to participants.

2.4 Data Analysis

Besides qualitative analyses in order to describe the socio-demographic characteristics of participants, preliminary data examinations were carried out. Missing data were replaced with the imputation of values belonging to another case with a similar pattern. The listwise deletion method was used when searching for similar patterns yielded negative results.

Testing for factor invariance of the 18-item version of the Ryff's PWB Scales required several steps, as recommended by researchers in the field (Byrne 2006, 2008; Byrne et al. 2009; Milfont and Fischer 2010). Preliminary confirmatory factor analyses (CFAs) were conducted on the six correlated first-order factors and a general psychological well-being second-order factor model, which was considered the most preferred PWB Scales factor structure model among the linear and hierarchical models, as identified by previous studies (Abbott et al. 2010; Burns and Machin 2009; Cheng and Chan 2005; Fernandes et al. 2010; Ryff and Keyes 1995; Sirigatti et al. 2009; Van Dierendonck et al. 2008). These CFAs were performed separately for the Italian and Belarusian samples, in order to assess whether the model taken into account fitted the data well in each group. If this evaluation was successful, then it was possible to consider the hierarchical model described above as the baseline model (BM) for each group, and further analyses for testing measurement invariance of the 18-item version of the PWB Scales were carried out.

Multi-groups CFAs were subsequently conducted with the aim to examine a sequence of progressively more restrictive models of invariance of the PWB Scales across both samples. In this regard, the following models with different constrained parameters were investigated: Configural Invariance (Model 0); Factor Correlation Invariance (Model 1); Factor Loadings and Factor Correlation Invariance (Model 2); Factor Correlation and Error Variances Invariance (Model 3); Factor Loadings, Factor Correlation and Error Variances Invariance (Model 4).

All the analyses—based on the answers provided by 1,109 participants—were conducted using LISREL 8.80 (Jöreskog and Sörbom 2006). Starting from a matrix of polychoric correlations, the *Robust Diagonally Weighted Least Squares* were estimated. Models evaluation was performed using the Satorra-Bentler Scaled Chi-Square (S–B χ^2), and several absolute, comparative and parsimonious fit indices: the S–B χ^2 to degrees of freedom ratio (S–B χ^2/df), the Root Mean Square Error of Approximation (RMSEA), the 90 Percent Confidence Interval for RMSEA (RMSEA 90 % CI), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI) and the Parsimony Goodness-of-Fit Index (PGFI) (Byrne 2006; Iacobucci 2010). According to the criteria suggested by Schermelleh-Engel et al. (2003), for all models fit was considered good if the S–B χ^2/df is at or below 2, RMSEA, RMSEA 90 % CI and SRMR values are at or below .05, CFI and NNFI values are at or above .97. Finally, PGFI values range between zero and one, and higher values indicate a more parsimonious fit.

3 Results

3.1 Baseline Model Identification

In the first step, a second-order CFA baseline model (BM) was estimated, separately for Italian and Belarusian participants. This procedure served to confirm the underlying factor structure for each socio-cultural and linguistic group, and fulfill the requirements for testing measurement invariance. Among the various concurrent solutions of the factor structure of the PWB Scales—available in this field of study (Sirigatti et al. 2009)—the hierarchical model was now the model distinctly tested for each group.

As shown in Table 1, this model, on the whole, revealed a good or an acceptable fit to the data for both groups: only in few indices they obtained different results. More specifically, the value of the S–B χ^2/df was better in the Belarusian group, while the value of the NNFI index was better in the Italian group. On the other hand, there were no substantial differences between groups in the RMSEA, SRMR, CFI, and PGFI values.

Path diagrams for the established BM were presented in Figs. 1 and 2, respectively for the Italian and the Belarusian groups.

Table 1 Baseline model: goodness-of-fit indices, respectively for the Italian ($n = 619$) and Belarusian ($n = 490$) groups

Group	S–B χ^2	*df*	S–B χ^2/df	RMSEA	RMSEA 90 % CI	SRMR	CFI	NNFI	PGFI
Italian	262.47*	129	2.03	.041	.034; .048	.056	.98	.98	.74
Belarusian	247.87*	129	1.92	.043	.035; .052	.060	.97	.96	.73

* $p < .05$

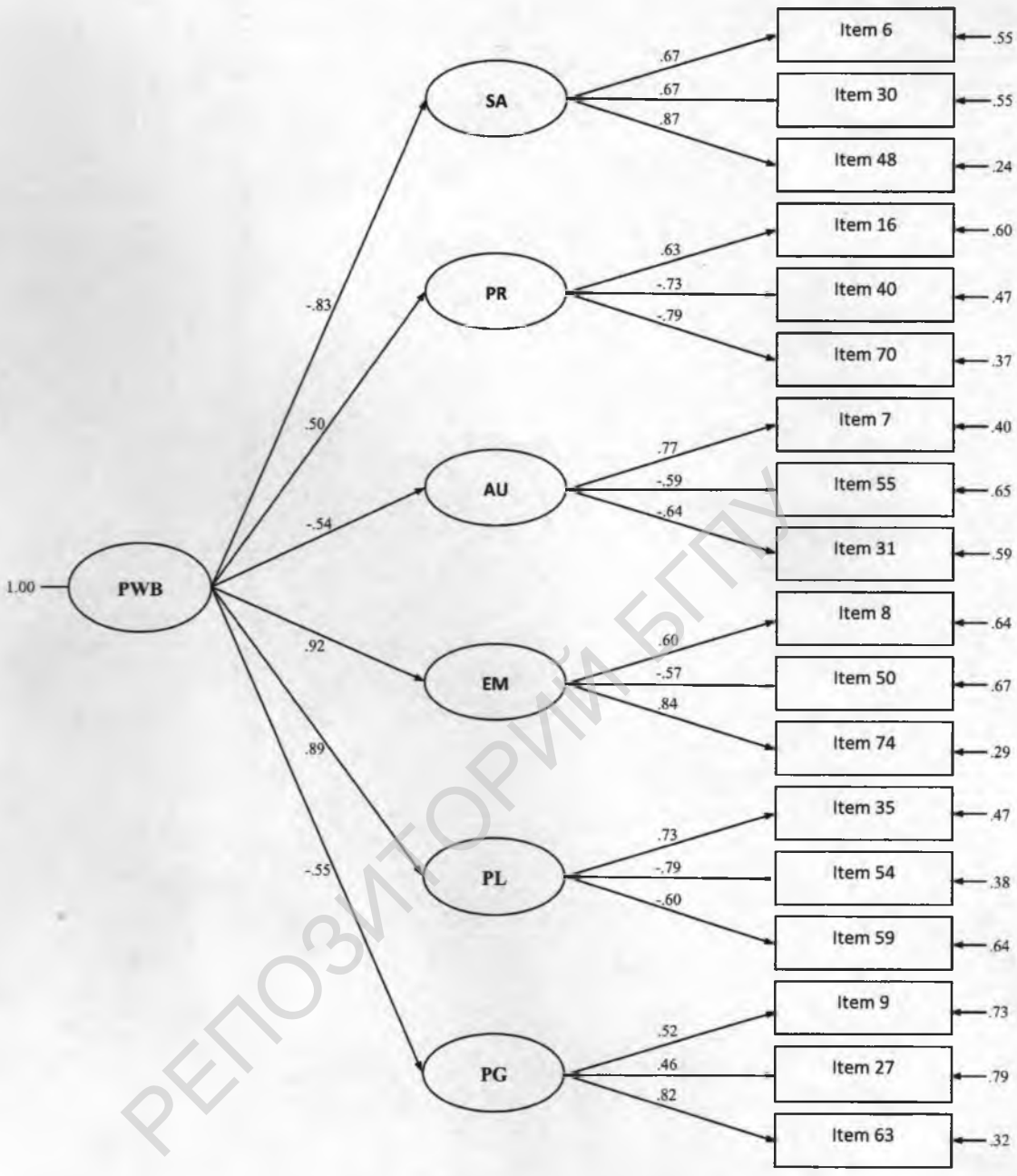

Fig. 1 Path diagram of baseline model, for the Italian group ($n = 619$). *Note* $\chi^2 = 262.47$, $df = 129$, p value = .0000, RMSEA = .041

3.2 Testing for Factor Invariance

As the BM for each sample was determined, it was then incorporated into MGCFA models for measuring factor invariance of the 18-item version of the PWB Scales across the Italian and the Belarusian samples, focusing on the first examination of the Configural Invariance (Model 0). In this invariance model the same factor structure (i.e., the same pattern of fixed and free factor loadings) was specified for each group, and no equality constraints were imposed on model parameters across samples. The fit indices (S–B $\chi^2/df = 2.00$; RMSEA = .042; RMSEA 90 % CI = .037; .048; CFI = .98; NNFI = .98) indicated that the model obtained a good fit to the data, pointing that the same number of factors and factor-loading pattern were equivalent across both groups (see Table 2).

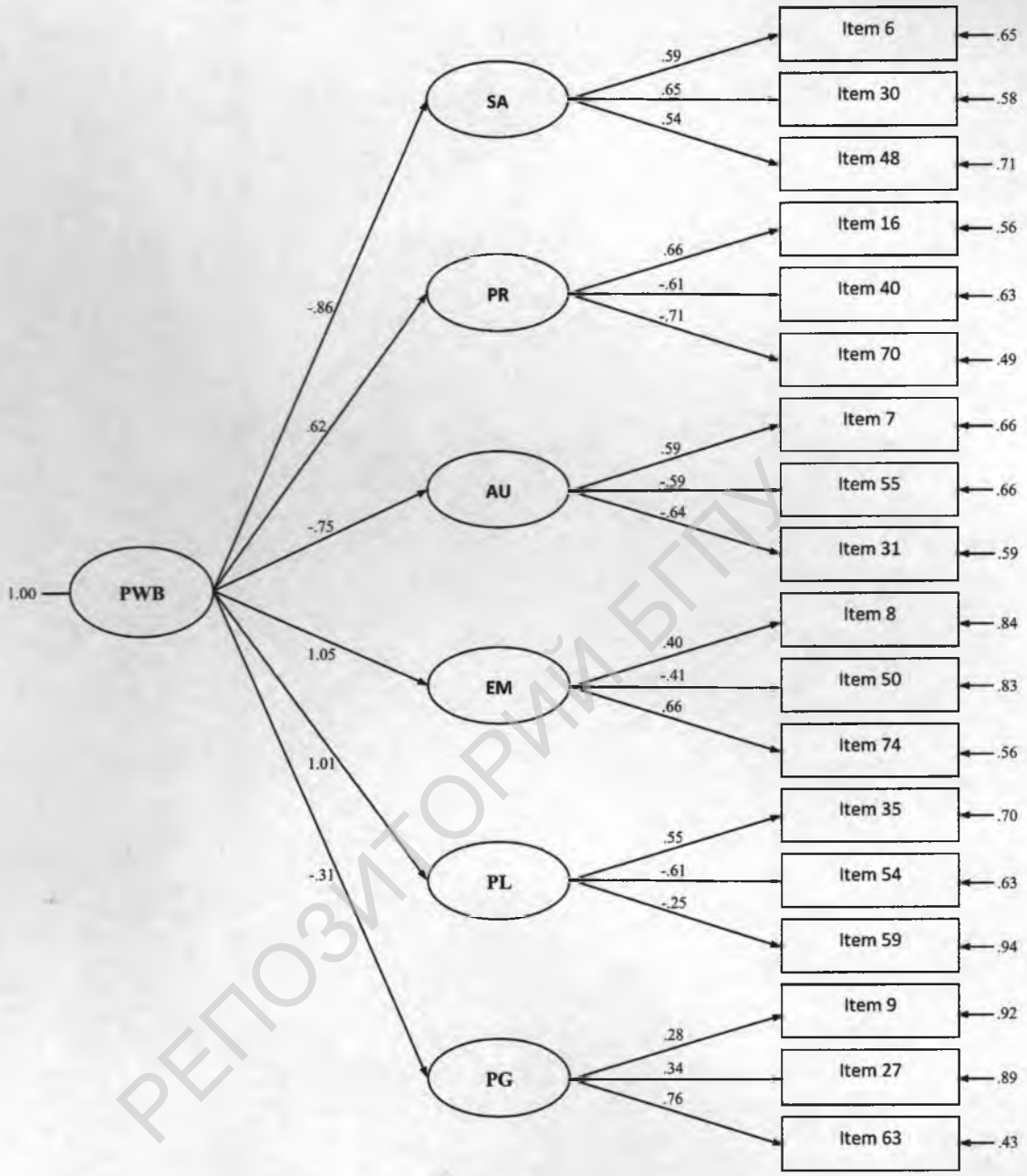

Fig. 2 Path diagram of baseline model, for the Belarusian group ($n = 490$). *Note* $\chi^2 = 247.87$, $df = 129$, p value = .0000, RMSEA = .043

When factor correlations were constrained to be equal in order to test the Factor Correlation Invariance across the two groups (Model 1), this model fitted the data appropriately with only slight differences from what noticed in Model 0. Similar results were obtained when Model 2 (Factor Loadings and Factor Correlation Invariance) was assessed: the S–B χ^2/df (2.14), the RMSEA (.045), the RMSEA 90 % CI (.040; .051), the CFI (.98) and the NNFI (.97) values reflected an acceptable fit of the model to the data, indicating that the factor loadings and factor correlations were equivalent across the Italian and Belarusian groups. Subsequently, the Factor Correlation and Error Variances Invariance (Model 3) were taken into account, by restricting factor correlations and error variances to be equal across the two groups. This model also showed to fit the data rather well,

Table 2 Summary of goodness-of-fit indices for testing measurement invariance of the hierarchical model of the 18-item version of the PWB Scales (n = 1,109)

Model tested	S–B χ^2	*df*	S–B χ^2/df	RMSEA	RMSEA 90 % CI	CFI	NNFI
Model 0	461.47*	231	2.00	.042	.037; .048	.98	.98
Model 1	528.26*	258	2.05	.044	.038; .049	.98	.98
Model 2	591.85*	276	2.14	.045	.040; .051	.98	.97
Model 3	618.70*	276	2.24	.047	.042; .052	.98	.97
Model 4	674.70*	294	2.29	.048	.044; .053	.97	.97

Model 0 Configural invariance

Model 1 Factor correlation invariance

Model 2 Factor loadings and factor correlation invariance

Model 3 Factor correlation and error variances invariance

Model 4 Factor loadings, Factor correlation and error variances invariance

* $p < .05$

revealing that the factor correlation and error variances equivalence between the Italian and the Belarusian groups was supported.

Finally, besides the constrained parameters in Model 3, factor loadings were also imposed to be the same across the groups (Model 4). By requiring the Factor Loadings, Factor Correlation and Error Variances Invariance, goodness-of-fit indices for this model remained acceptable (S–B χ^2/df = 2.29; RMSEA = .048; RMSEA 90 % CI = .044; .053; CFI = .97; NNFI = .97). For this reason, the hypothesis that factor loadings, factor correlation and error variance were equivalent in the two groups was also sustainable.

Goodness-of-fit indices for all restricted models considered for testing factor invariance of the hierarchical model of the 18-item version of the PWB Scales across the two groups were summarized in Table 2.

4 Discussion

Over the years the PWB Scales have become the most popular instrument employed to assess the human positive functioning, through the integration of different theoretical approaches. Although this measurement instrument has been used in diverse socio-cultural and linguistic contexts and with several different scale versions, cross-cultural researches failed to take into consideration if the items of the PWB Scales have similar meaning among different cultures. Factor equivalence requires to be tested statistically. This is essential for the comparison and interpretation of psychological construct in different groups with regards to socio-cultural and linguistic profiles.

The aim of the present study was to investigate, for the first time, the factor invariance of the 18-item version of the PWB Scales in the Italian and Belarusian context. Measurement invariance was carried out using polychoric correlations and MGCFA's as the most appropriate methodological procedures, considering the nature of the variables and objectives of the study, as suggested by researchers (Byrne 2006, 2008; Byrne et al. 2009; Byrne and Campbell 1999; Gregorich 2006; Holgado-Tello et al. 2010; Jöreskog 1994; Milfont and Fischer 2010).

Preliminary CFAs revealed that the hierarchical model fitted the data well in both groups (BM), consistent with previous studies that consider this model as one of the most

preferred (Ryff and Keyes 1995; Sirigatti et al. 2009; Van Dierendonck 2004; Van Dierendonck et al. 2008).

Subsequent MGCFA's were performed on a sequence of hierarchically nested models. First analysis was conducted on the Configurational BM model. Goodness-of fit statistics showed that the hierarchical model fits the data well. This means that the Italian and Belarusian translated versions of the PWB Scales were similar for number of factor and factor-loading patterns, satisfying the precondition for analyzing subsequent invariance models. Factor Correlation invariance, that assumed the factor correlation to be equal, was the first taken into account. Results revealed that the measurement factor correlation was steady across the groups, implying that factors of the Ryff's PWB Scales had the same relationships in both Italian and Belarusian groups. Factor Loadings and Factor Correlation invariance was the subsequent model analyzed, by restricting factor loadings and factor correlation to be equal across the groups. The results indicated that the PWB Scales exhibited the same factor correlation as well as the same factor loadings values and patterns. In this regard, the six dimensions of the instrument were interpreted similarly across groups, and the Italians and Belarusians answered the items in the same way. Also when Factor Correlation and Error Variances invariance was tested, by imposing the same factor correlation and error variances on both groups, goodness-of fit statistics revealed a good model. This suggested that factor correlation was invariant but also that the same level of measurement error existed for each item of the PWB Scales between the Italian and Belarusian group, noting that the degree of item reliability was equivalent. Similar results were obtained when the more constrained model occurred. By adding the factor loadings invariance to the constrained parameters of previous model, factor loadings, factor correlation and error variances invariance was supported across the groups.

Results obtained by this study provided preliminary support for cross-cultural validity of the 18-item version of the PWB Scales, with the six correlated first-order factors and one second order factor model. Regardless of the number of parameters constrained, the Italian and Belarusian translated versions revealed the same factor structure of the original English versions (Ryff 1989; Ryff and Keyes 1995) as well as similar strength of the relationships among factors, the same patterns of factor loading and level of item reliability in both contexts. Despite this, a certain caution in interpreting the results must be provided.

This study was not free from limitations. Participants consisted of high school and undergraduate students and they were not representative of the entire population. Also the different socio-demographic characteristics in the two groups as well as the way in which they were enrolled did not allow generalizations. Future research with large and stratified randomly selected samples will be useful in order to continue the investigation of the measurement invariance of the 18-item version of the PWB Scales. Factor structure invariance of the Ryff's PWB Scales across gender, age, and procedures by which data are collected (e.g. self-administered, telephone or mail data), are other aspects that deserve to be explored. In addition, studies could also be directed to clinical samples, in order to assess whether the instrument can be used in psychopathological setting from different socio-cultural and linguistic contexts. Besides these, two methodological issues are worth highlighting. Although there is no agreement about the different restricted parameters that must be taken into account in measuring invariance, future investigations may consider other parameters, as well as those used in this study, such as factor mean and intercept invariance. Differently from the original version, participants responded to each question of the PWB Scales on a 4-point Likert-type scale. Even this aspect must be considered in interpreting the data.

Notwithstanding these limitations, these findings provided support for the use of the PWB Scales in educational setting from different socio-cultural and linguistic contexts. School psychologists and psychotherapists can use the Ryff's PWB Scales to assess the psychological well-being in students who attend high schools and universities. The information obtained will be used for planning interventions aimed at promoting psychosocial well-being. For instance, the instrument can be administered to students at the beginning, during, or the end of their studies, perhaps in a student consulting center, in order to monitor the change in psychological well-being during this particular period of life.

In conclusion, even if the present study showed the factor invariance of the 18-item version of the PWB Scales across a group of young Italians and Belarusians, further cross-cultural researches are required to better understand the nature and structure of the construct. This will allow for the increase in knowledge and ensure the generalizability of the PWB Scales as well as its applicability in educational settings and different cultural contexts.

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