Construct Validity, Dimensionality and Factorial Invariance of the Rosenberg Self Esteem Scale: A Bifactor Modelling Approach among Children of Prisoners

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ABSTRACT

The Rosenberg Self Esteem Scale (RSES; Rosenberg, 1989) has traditionally been conceptualised as a unidimensional measure of self-esteem but empirical evidence is equivocal, with some studies supporting a one-factor solution and others favouring multidimensional models. The aim of this study was to examine the factor structure, factorial invariance and composite reliability of the RSES within a European sample of children affected by parental imprisonment (N = 724). The study specified and tested six alternative factor models using conventional confirmatory factor analytic (CFA) techniques and a confirmatory bifactor modelling approach. The RSES was most effectively represented by a bifactor model including a general self-esteem factor comprising of all ten scale items and separate method effects for the positively and negatively phrased items. This model was found to be factorially invariant among boys and girls. Composite reliability indicated good internal consistency for the general self-esteem dimension but slightly less so for the positive and negative methods effects. Results are discussed in terms resolving the debate surrounding the appropriate factor structure and scoring of the RSES.

Key words: Rosenberg Self Esteem Scale (RSES); Bifactor Modelling; Confirmatory Factor Analysis; Factorial Invariance; Children of Prisoners

INTRODUCTION

Qualitative studies have variously demonstrated that children affected by parental imprisonment suffer feelings of sadness, despair, loss, rejection, confusion, anxiety (e.g. Bocknek, Sanderson & Britner, 2009; Jones et al., 2013). Combined with exposure to secondary stigma, social isolation, bullying and victimization (e.g. Cunningham, 2001; Murray, 2007), it would not be surprising if parental imprisonment was found to have deleterious consequences to self-esteem. Indeed, during the course of interviews, children of prisoners have been reported to express feelings such as shame, guilt and embarrassment that could be considered synonymous with low self-esteem (Brown, Dibb, Shenton & Elson, 2000; Hissel, Bijleveld & Kruttschnitt, 2011). This is cause for concern given that empirical evidence suggests lower levels of self-esteem play an important role in the development of clinical depression, whereas higher levels of self-esteem can promote resilience in response to adverse life events (see Pyszczynski et al., 2004 for a review). Taking into consideration research that has demonstrated that boys and girls react differently to parental imprisonment, with boys displaying more externalising problems and girls more internalising problems (Murray et al, 2009; Murray & Farrington, 2008), gender differences in self-esteem might also be anticipated in response to parental imprisonment.

Despite the findings that have emerged from qualitative research, very few studies have adopted a robust quantitative approach to measuring the self-esteem of children of prisoners, i.e. through the application of standardised instruments. Although research in this area is limited, it does suggest that there might be some utility in examining the contribution of caregiving arrangements and interventions in supporting positive self-esteem outcomes for children of prisoners. Hanlon et al. (2005), for example, administered the Piers-Harris Children's Self Concept Scale (Piers, 1984) to children with incarcerated mothers and revealed levels of self-esteem comparable to the general population. It was suggested that the

children's positive adjustment was a consequence of the consistent and nurturing environment provided by their caregiver (mostly grandmothers). Conversely, Springer, Lynch and Rubin (2000) administered the Hare Self-Esteem Scale (Hare, 1980), to children of prisoners who had participated in a group-based intervention and revealed no significant improvement in self-esteem. Utilising the Self-Perception Profile for Children and for Adolescents (Harter, 1985; 1988), Harrison (1997) demonstrated that a parenting programme for prisoners had no significant impact on the self-esteem of the participants' children.

As illustrated above, a variety of instruments have been designed to measure self-esteem amongst children and young people, but the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989) remains one of the most commonly used. Rosenberg (1965) initially described self-esteem as a component of the self-concept in which individuals hold favourable or unfavourable perceptions about themselves in terms of their worth and importance. The RSES was originally designed to measure self-esteem as a single construct, but despite its widespread use, there remains uncertainty with regards to the number of latent variables that effectively explain the underlying structure of the instrument.

Through the application of confirmatory factor analysis (CFA), a number of researchers have found support for a one-factor solution (e.g. Dunbar, Ford, Hunt & Der, 2000; Gana, Alaphilippe & Bailly, 2005; Shevlin, Bunting & Lewis, 1995). Other studies, however, have suggested that multi-factorial solutions might be more appropriate (see Huang & Dong, 2012 for a review). This includes a large body of literature indicating that items load onto two distinct factors, one representing positive evaluations of the self and one representing negative evaluations of the self (e.g Carmines & Zeller, 1979; Kaufman, Rasinski, Lee & West, 1991). A crucial concern is whether these latter findings reflect two substantially different latent factors or are a consequence of an unwanted method effect arising from the positive and negative phrasing of items (Bagozzi, 1993).

In an attempt to provide clarification, Marsh (1996) tested six possible model solution and found support for a single common factor and a method factor primarily comprising of the negatively worded items. Marsh (1996) suggested that the younger, less verbally able students in the sample might have experienced more difficulties responding to the negatively phrased items. However, this study utilised a 7-item version of the scale, limiting the number of items per factor and the comparability of the instrument to the full 10-item version. In an extension to the previous study, Corwyn (2000), Tomás and Oliver (1999) and Quilty, Oakman and Risko (2006) administered the full ten-item version of the scale to high school students and young people, and confirmed the presence of a single latent variable with negative item method effects.

More recently, investigators have administered the RSES to representative samples of adolescents (Marsh, Scalas & Nagengast, 2010) and adults (Hyland, Boduszek, Dhingra, Shevlin & Egan, 2014) and have comprehensively tested a series of traditional CFA models *in addition to a variety of bifactor model conceptualisations*. Bifactor modelling techniques were developed for use in situations where both single and multidimensional latent structures seem to provide an adequate representation of the scale (Reise, Moore & Haviland, 2010; Reise, Morizot & Hays, 2007), as with the RSES. In conventional CFA models, covariation between scale items is assumed to be explained in terms of one or more latent constructs, whereas in bifactor modelling, covariation amongst scale items is assumed to be explained by both "general factors" and "grouping factors" which exist at the same conceptual level. This enables the researcher to model a single self-esteem factor proposed to account for most of the item covariation in addition to two separate grouping factors to account for the positive and negative method factors emerging as a result of item wording. The bifactor modelling approach, therefore, has the added benefit of being able to distinguish between error variance and method variance and genuine latent constructs. Marsh et al. (2010) and Hyland et al.

(2014) found no support the one factor models, and similarly, very little support for the two-factor model. There was, however, strong support for a bifactor solution comprising of a single general self-esteem factor and two method/grouping factors reflecting positive and negative method effects.

Boduszek and colleagues have also tested a series of conventional CFA models and bifactor models of the RSES amongst samples of prisoners, and found that superior fit was achieved with a two-factor model comprising of separate positive and negative latent variables (Boduszek, Hyland, Dhingra & Mallet, 2013; Boduszek, Shevlin, Mallet, Hyland & O'Kane, 2012). Carmines and Zeller (1979) argue that if the positive and negative dimensions are indeed measuring substantially different aspects of self-esteem, then they should differentially relate to external variables. In further support of the two-factor model, positive (but not negative) self-esteem was found to be a significant predictor of recidivism (Boduszek et al., 2013), and negative (but not positive) self-esteem a significant predictor of criminal cognitions (Boduszek et al., 2012).

In summary, empirical evidence suggests that the RSES measures a single general self-esteem factor amongst children and young people (with the addition of positive and negative method effects), but amongst prisoners, it is more effectively represented by two distinct positive and negative self-esteem factors. This raises an important question with regards to children of affected by parental imprisonment; does the underlying factor structure of the RSES amongst this group of children resemble that of their peers or that of their imprisoned parents? Therefore, the first aim of this paper was to advance knowledge with regards to the application of standardised self-esteem measures to children of prisoners, namely the RSES, by investigating the underlying factor structure amongst a large European sample. In order to achieve this, a series of six competing models of the RSES were specified and tested using a combination of conventional CFA techniques and a confirmatory bifactor

modelling approach. It was also apparent from the literature review that there are a growing number of studies concerned with identifying differential reactions to parental imprisonment among boys and girls. This underscores the importance of identifying instruments that can provide a reliable indication of differences in the psychological adjustment of boys and girls. Therefore, the second aim of the paper was to examine the factorial invariance of the RSES among boys and girls. The third aim of the paper was to examine the composite reliability of the RSES among children of prisoners, thereby providing a more robust indication of internal reliability than the more frequently used Cronbach's alpha scores.

METHODS

Participants

The sample consisted of 724 children from the UK, Germany, Romania and Sweden who were affected by the imprisonment of a parent or carer. Participants were mainly recruited by non-governmental organisations as part of their normal work at prison visitor centres and counselling centres. Participants were 393 boys and 331 girls aged from 7 to 17 years (M = 11.27, SD = 3.12). Data on ethnicity was only available for the UK and Romania, where the majority of children were White (86.8%). Most children in the sample had a biological father in prison (73.0%) and were currently living with their biological mother (73.3%). Imprisoned parents had committed a variety of offences, and had served between one month and 15 years in prison (M = 2.5, SD = 2.7). The majority of children had maintained at least some contact with their imprisoned parent (via prison visits, telephone calls or letter writing; 91.2%).

Measure

The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989) consists of 10 Likert-type scale items designed to assess positive and negative evaluations of self. Respondents indicate their level of agreement ranging from 1 (strongly disagree) to 4 (strongly agree). Thus, the possible total score can range from a minimum of 10 to a maximum of 40, with higher scores reflecting more positive evaluations of self. This study utilised the English, German, Swedish and Romanian translation of the scale as appropriate.

Analysis

The dimensionality of the RSES was investigated through the use of conventional confirmatory factor analytic (CFA) techniques, along with the utilization of a confirmatory bifactor modelling approach (see Reise et al., 2010; Reise et al., 2007). Six alternative models of the latent factor structure of the RSES were specified and estimated using Mplus version 6.0 (Muthen & Muthen, 1998–2010) with maximum likelihood (ML) estimation. Three of these models were traditional CFA conceptualizations with items restricted to load only onto a single factor. In the bifactor models, each item was allowed to load onto a general factor (self-esteem) and one grouping factor (positive self-esteem or negative self-esteem). Within a bifactor model, the grouping factors are restricted to be uncorrelated with each other and uncorrelated with the general self-esteem factor. For the purposes of model identification, the variance of each factor is set to 1.0.

The following six models were specified and estimated as follows: (a) Model 1, a 10-item unidimensional model; (b) Model 2, 10 items and two correlated factors (positively and negatively orientated items); (c) Model 3, 10 items and two independent factors (positively and negatively orientated items); (d) Model 4, one global self-esteem factor and two correlated method factors that includes the positive items on the one hand and the negative

items on the other; (e) Model 5, one global self-esteem factor and one method factor that includes the positive items; (f) Model 6, one global self-esteem factor and one method factor that includes the negative items (see Fig. 1). In all cases measurement error terms remained uncorrelated as per recommendations (Brown, 2006).

[INSERT FIGURE 1 HERE]

The overall fit of each model and the relative fit between models were assessed using a range of goodness-of-fit statistics and assessment of the appropriateness of the model parameters. The chi-square ($\chi 2$) statistic assessed the sample and implied covariance matrix and a good fitting model is indicated by a non-significant result. However the chi-square statistic is strongly associated with sample size, and as such good models tend to be over-rejected. Therefore Tanaka (1987) suggested that a model should not be rejected simply on the basis of a significant chi-square result. Accordingly, it is recommended that researchers examine the ratio of the chi-square value to the degrees of freedom (df), and according to Kline (1994), any model with a $\chi 2$-to-df ratio of less than 3:1 represents a good fitting model. The Comparative Fit Index (CFI; Bentler, 1990) and the Tucker Lewis Index (TLI; Tucker & Lewis, 1973) are measures of how much better the model fits the data compared to a baseline model where all variables are uncorrelated. For these indices values above .95 indicated good model fit (Bentler, 1990; Hu & Bentler, 1999). In addition, two more absolute indices are presented; the standardized root mean-square residual (SRMR; Joreskog & Sorborn, 1981) and the root mean-square error of approximation (RMSEA; Steiger, 1990). Ideally these indices should be less than .05 (Bentler, 1990; Hu & Bentler, 1999; Joreskog & Sorbom, 1993). Furthermore, Akaike Information Criterion (AIC; Akaike, 1974) was used to evaluate the alternative models, with the smaller value indicating the best fitting model.

RESULTS

The mean RSES score for the entire sample was 30.58 (*SD = 4.88*). The mean scores for boys (*M = 30.82, SD = 4.75*) and girls (*M = 30.31, SD = 5.02*) were similar and not significantly different, t(657) = 1.33, p = .18.

Model Results and Test of Factorial Invariance

Table 1 reports the fit indices and comparative fit indices of the six alternative models of the RSES. Based on these results, Model 1 and 3 were rejected as a poor approximation of the data. The model 2, 4, 5, and 6 were found to be a good representation of the data, however, substantial improvements were observed across all fit indices for the Model 4. This model which includes a single SE factor and two grouping factors (P and N) was determined to be the best approximation of the covariation matrix in the obtained data based upon all fit indices. This model also displayed a considerably lower AIC value than the alternative models further indicating its statistical superiority.

[INSERT TABLE 1 HERE]

[INSERT TABLE 2 HERE]

The adequacy of this model can also be determined in relation to its parameter estimates. As can be seen in Table 2 all items displayed statistically significant ($p < .001$) factor loadings on the general SE factor. Further inspection of the factor loadings for the two grouping factors (P and N) provides critical information regarding the appropriateness of including these factors in the scoring of the RSES. Reise et al. (2010) advise that when items

load strongly onto a general factor, and comparatively weaker on each of the grouping factors, this provides support for consideration of a unidimensional scoring scheme. Alternatively when items load as strongly, or more strongly, onto each of the respective grouping factors than they do the general factor, creation of subscales is appropriate.

As outlined in Table 2, factor loadings on the general SE factor were in the expected direction and were comparatively stronger than those on the grouping factors. Most of the negatively worded items (N factor) have statistically non-significant factor loadings ($p > .05$); however the P factor in particular displayed robust factor loadings. These parameter estimate results provide strong support for the supremacy of a single SE latent factor, and the presence of two meaningful method effect factors.

Subsequently tests of factorial invariance were conducted between boys (N = 393) and girls (N = 331) using the bifactor solution as the baseline model. Following the procedure of Bollen (1989), a hierarchy of increasingly restrictive models was specified and tested. The test of invariance of form, or that the bifactor model held in both samples, was supported, $\chi^2 = 80.91$, df = 50, $p = .004$ (RMSEA = .04 [90% CI = .02/.06]; CFI = .99; TLI = .97; SRMR = .03), as was the test of equal factor loadings, $\chi^2 = 94.85$, df = 70, $p = .03$ (RMSEA = .03 [90% CI = .01/.05]; CFI = .98; TLI = .98; SRMR = .05). Assessment of invariance in factor variances could not be conducted due to the necessity to constrain factor variances to 1 in order that a bifactor solution could be identified. These results indicate that the RSES is factorially invariant between boys and girls.

Reliability Analysis

The use of traditional measures of internal reliability such as Cronbach's alpha have been criticised within a latent variable modelling context given the propensity to over- or under-estimate scale reliability (see Raykov, 1998). In order to provide a more rigorous

assessment of the internal reliability of the RSES the current study investigated the composite reliability of the measurement properties of the scale. Composite reliability was calculated using the formula:

$$\rho_c = \frac{\left(\sum_{i=1}^{m} \lambda_i\right)^2}{\left(\sum_{i=1}^{m} \lambda_i\right)^2 + \left(\sum_{i=1}^{m} (\theta_i)\right)}$$

Where ρ_c = reliability of the factor score, λ_i = standardized factor loading, and θ_i = standardised error variance. Values greater than .60 are generally considered acceptable (Bagozzi & Yi, 1988; Diamantopoulos & Siguaw, 2000). Current results indicate that the general SE factor of the RSES possesses good internal consistency (ρ_c = .84). In contrast, the internal reliability for the two grouping factors were lower (P, ρ_c = .68; N, ρ_c = .38).

DISCUSSION

Previous literature suggests that there is utility in studying the impact of parental imprisonment on children's self-esteem, especially to identify factors that might mediate the potential for adverse outcomes (Hanlon et al., 2005; Springer, Lynch & Rubin, 2000). Despite this, relatively few studies have administered standardised measures of self-esteem to this group of children. Therefore, the aim of the present study was to advance knowledge with regards to the application of standardised self-esteem measures to children of prisoners, namely the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989). Six alternative models of the RSES were specified and tested using conventional CFA techniques and a confirmatory bifactor modelling approach. Based on several fit indices, a bifactor model comprising of a single common self-esteem factor and positive and negative grouping factors

was considered to provide an adequate fit, and was superior to alternative solutions. Item loadings and composite reliability scores were comparatively better for the single factor than the grouping factors, further reinforcing the supremacy of a general self-esteem factor.

These findings are consistent with Rosenberg's (1965) initial unidimensional conceptualisation of self-esteem, and also previous research conducted within general population samples of children and young people that has revealed superior fit for solutions incorporating a unidimensional self-esteem factor with the addition of either positive and/or negative method effects (e.g. Corwyn, 2000; Marsh, Scalas & Nagengast, 2010; Tomás & Oliver, 1999). In contrast, little support was found for the existence of two distinct positive and negative self-esteem factors as evidenced among samples of prisoners (Boduszek et al., 2013; Boduszek et al., 2012). Therefore, the underlying latent variable structure of the RSES amongst the present sample of children of prisoners was found to be more similar to that of their peers than that of their imprisoned parents.

It follows that the calculation of total RSES scores is appropriate for children of prisoners (and children more generally), but researchers should be aware that results might be contaminated by the presence of method effects. Simply calculating a unidimensional score with no consideration of method effects might give rise to false interpretations, for example, in relation to the effectiveness of interventions in mediating the impact of parental imprisonment on children's self-esteem. This study has highlighted the importance of allowing for methods effects by appropriately including them in latent variable models, and has demonstrated the application of a bifactorial modelling approach as a potential solution.

It should be noted that in order to meaningfully test for gender differences, any standardised instrument should produce the same or "invariant" factor structures for males and females (Rock, Werts & Flaugher, 1978). Indeed, the present study revealed that the bifactor model with a general self-esteem factor and positive and negative grouping factors

provided an adequate fit for both boys and girls, therefore permitting the comparison of RSES scores between girls and boys affected by parental imprisonment.

This study has provided further clarification of the factor structure of the RSES and offers important directions for furthering research with children of prisoners; however it is not without limitations. The present study was unable to confirm the applicability of the measure to other sub-samples of children of prisoners. In particular, due to the lower rates of imprisonment of women in the four countries (approximately 5%; Aebi & Delgrande, 2013) it was comparatively more difficult to recruit children with a mother in prison. Also, since most children were recruited by NGOs designed to facilitate contact between children and their imprisoned parent, most children in the sample had contact on a regular basis.

In summary, the RSES was most effectively represented by a single common self-esteem factor and positive and negative grouping factors. This solution was found to be factorially invariant among boys and girls, facilitating the comparison of gender differences in responses to parental imprisonment. However, neglecting to take into consideration the potential for method effects by allowing for the method variance to be removed from the model might result in inaccurate conclusions.

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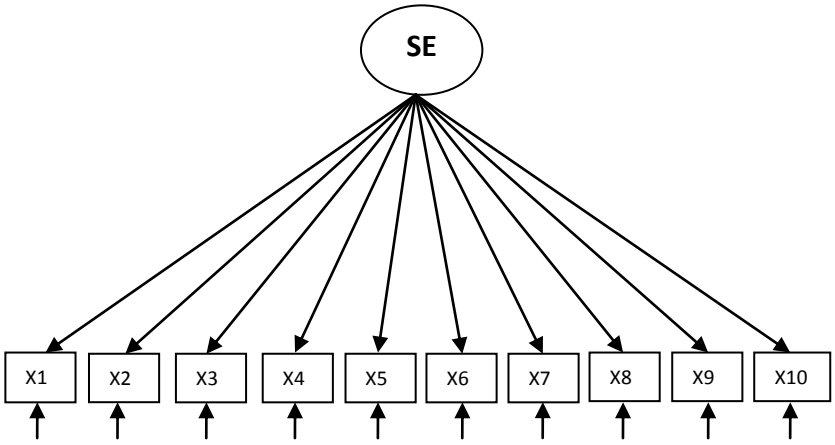
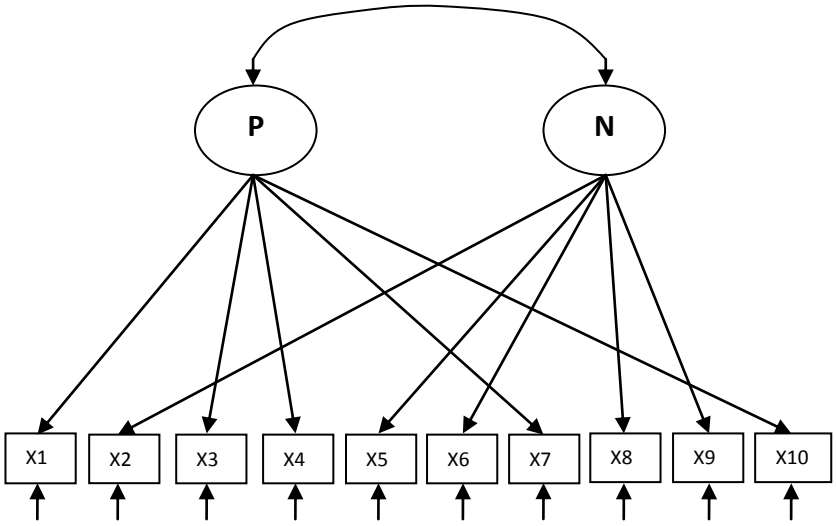
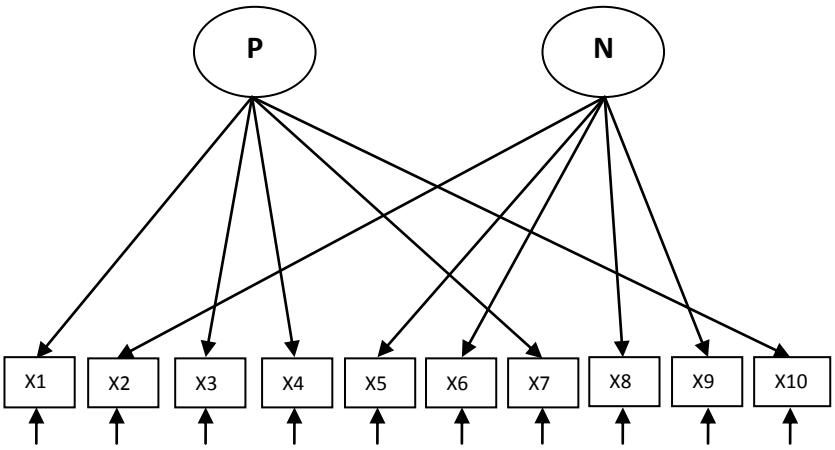


Model 1



Model 2



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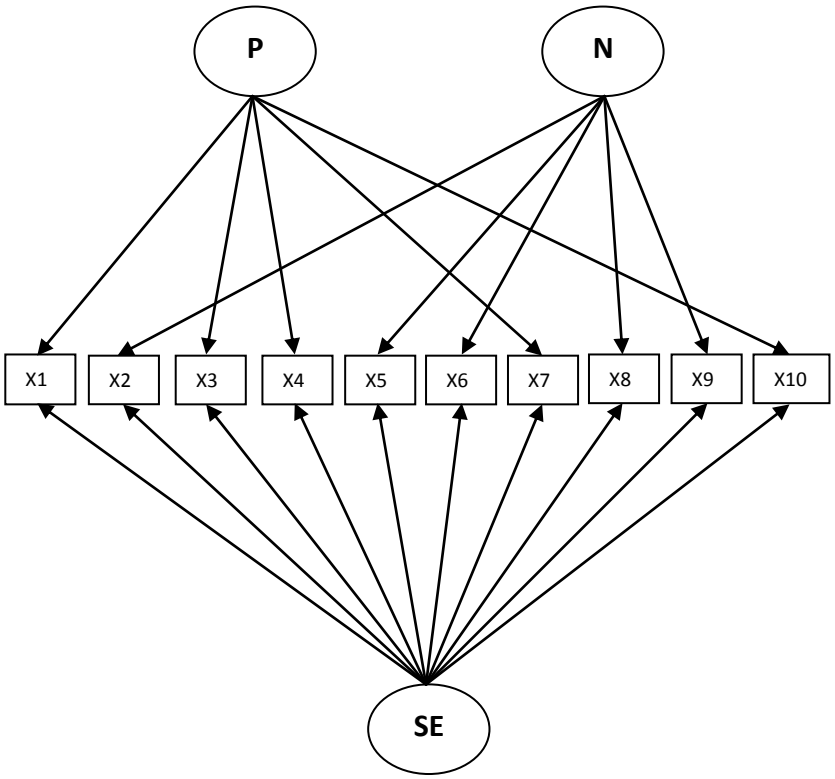

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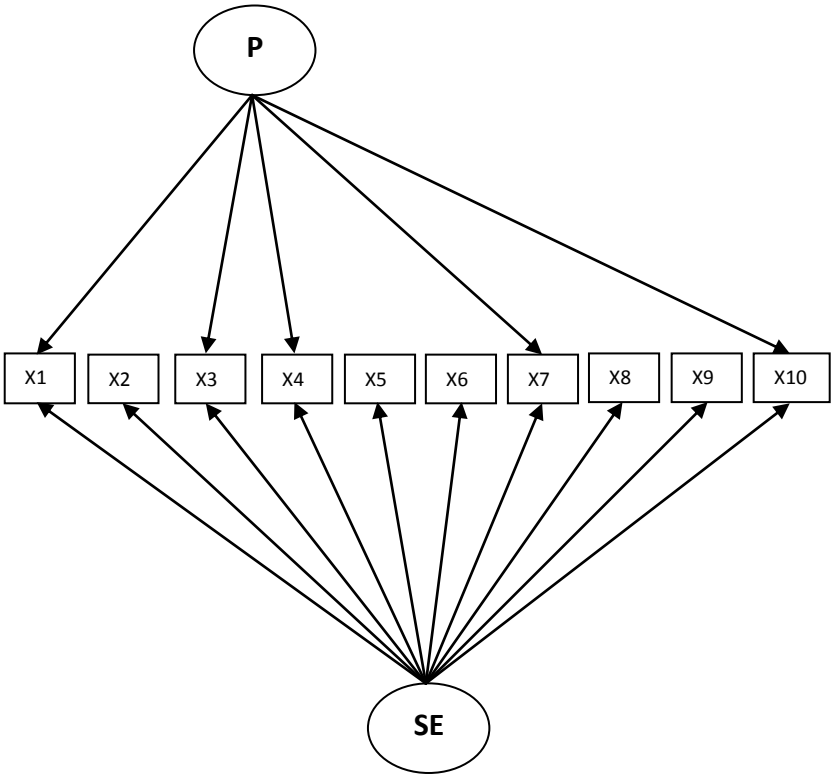
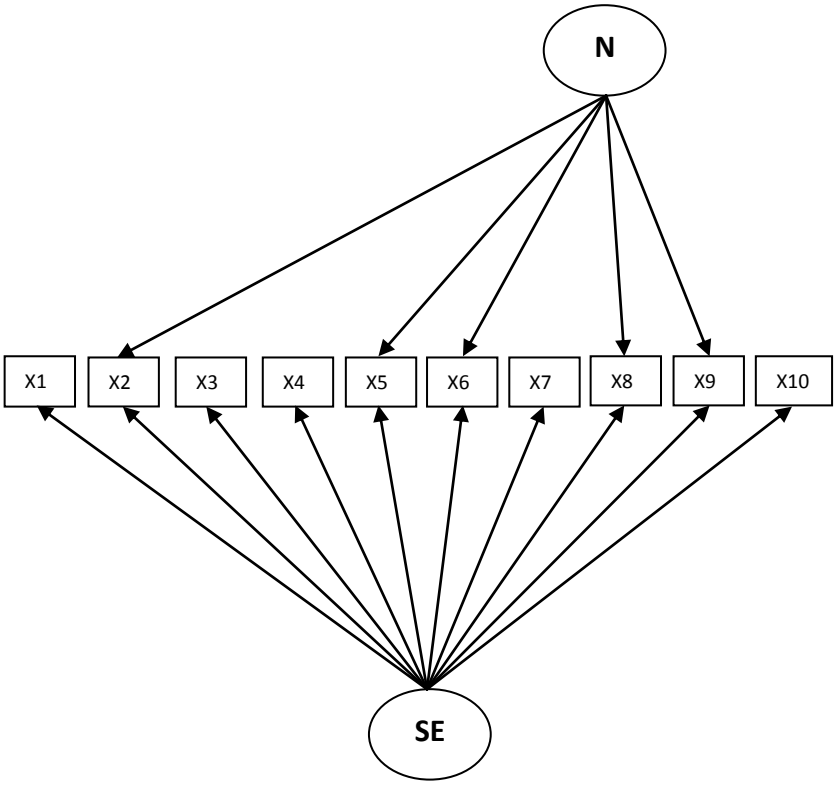


Model 5



Model 6

Figure 1 Alternative Factor Models of Rosenberg Self-Esteem Scale

Table 1: Fit Indices for Six Alternative Models of the Rosenberg Self-Esteem Scale

	χ^2	*df*	CFI	TLI	RMSEA	SRMR	AIC
Models							
Model 1	474.50*	35	.78	.72	.14	.09	14548.74
Model 2	99.94*	34	.97	.96	.05	.04	14176.18
Model 3	248.36*	35	.89	.86	.09	.16	14322.60
Model 4	48.30*	25	.99	.98	.04	.02	14142.54
Model 5	84.62*	30	.97	.96	.05	.03	14168.86
Model 6	79.90*	30	.98	.96	.05	.03	14164.14

Note: N = 724; χ^2 = chi square goodness of fit statistic; *df* = degrees of freedom; RMSEA = Root-Mean-Square Error of Approximation; CI = Confidence Interval; AIC = Akaike Information Criterion; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; SRMR = Standardized Square Root Mean Residual. * Indicates χ^2 are statistically significant ($p < .05$).

Table 2: Standardized Factor Loadings for the General Factor and two Method Factors of the Rosenberg Self-Esteem Scale

Items	***β*** (General factor)	***β*** (Positive method factor)	***β*** (Negative method factor)
1. On the whole, I am satisfied with myself	.42***	.41***	
2. At times, I think I am no good at all	.63***		.62***
3. I feel that I have a number of good qualities	.37***	.55***	
4. I am able to do things as well as most other people	.37***	.62***	
5. I feel I do not have much to be proud of	.60***		.13
6. I certainly feel useless at times	.68***		.31**
7. I feel that I'm a person of worth, at least on an equal plane with others	.30***	.52***	
8. I wish I could have more respect for myself	.61***		.10
9. All in all I am inclined to feel that I am a failure	.76***		.04
10. I take a positive attitude towards myself	.44***	.46***	

Note: Factor loadings statistically significant at *** $p < .001$, ** $p < .01$, * $p < .05$