Middle-East Journal of Scientific Research 15 (7): 1028-1034, 2013
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2013.15.7.11033

Factor Model of Parenting Style Using Exploratory and Confirmatory Factor Analysis

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Abstract: This research attempts to address a paradox in the literature involving the parenting style of North Americans. Recently, there has been recognition in the literature that there are several facets to parental influences on children. A subset of data set from National Longitudinal Survey 97, prepared by the Bureau of Labour Statistics, U.S. Department of Labour is used to study the parenting style with exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA). Three factors (latent construct) parental monitoring, parental closeness and parental control related to parental style will be used to analyze. The main objective is to specify how many factors to retain in EFA and to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome. Once the underlying factor structure is identified, CFA technique is used to test the fit of model to parenting style data. It is hypothesized that 2 or 3 factors are sufficient for this data and there is no common factor. The results of the analysis proposed that the 3 factor model with modification is the best model for factoring parental style.

Key words: Parenting style · Factor analysis · Factor model

INTRODUCTION

Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA) are powerful statistical tools used to examine the internal reliability of measurements and to investigate the theoretical constructs, or factors that might be represented by a set of items [1]. Exploratory factor analysis is generally used to discover the factor structure of a measure and to examine its internal reliability [2] and is often recommended when researchers have no hypotheses about the nature of the underlying factor structure of their measure. Exploratory factor analysis has normally three basic decision points first, to decide the number of factors, then selecting an extraction method and finally choosing a rotation method. On the other hand Confirmatory factor analysis allows the researcher to test the hypothesis that a relationship between the observed variables and their underlying latent construct(s) exists. The researcher uses knowledge of the theory, empirical research, or both, postulates the relationship pattern a priori and then tests the hypothesis statistically.

A parenting style is a psychological construct representing standard strategies that parents use in their child rearing. There are many different theories and opinions on the best ways to rear children, as well as different levels of time and effort that parents are willing to invest. Many aspects of parenting play roles in the socialization of children. Certain discipline strategies are among those clearly implicated in the development and maintenance of children's externalizing behavior disorders.

The primary objective of this research is to specify how many factors to retain in EFA, to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome, once the underlying factor structure is identified, CFA technique is used to test the fit of model to parenting style data. The secondary purpose of this research is to factor items related to parental style and to identify dimensions of parenting like parental monitoring, parental closeness and parental control.

In this study seventeen multiple items associated with parental styles reported by youth in the National Longitudinal Survey 97, prepared by the Bureau of Labour

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Statistics, U.S. Department of Labour. The hypothesis to be tested is H_0: N factors are sufficient with H_1: more factors are needed and H_0: No common factors with H_1: at least one common factor.

Review of Literature: Many studies exist that examine parenting styles [3-8] discussed three parenting styles of authoritarian, permissive and authoritative are often used in studies investigating parenting styles in relation to diverse child outcome variables, such as academic achievement, self-confidence, aggression, delinquent behavior and substance abuse [9]. Parental knowledge has often been conceptualized as primarily a function of parenting practices, such as parental monitoring and parental control [10].

There is a considerable amount of research that examines parental monitoring during adolescence [11-13]. Because parents enable or restrict access to peers by monitoring, monitoring is considered to be a parenting practice with which parents manage peer relationships [14]. There is strong support in the literature for the relation between parental monitoring and involvement with deviant peers during adolescence [15]. Several studies reported a significant relation between low levels of parental monitoring and delinquent child behavior.

MATERIALS AND METHODS

The data set used in this study is from the National Longitudinal Survey 97, prepared by the Bureau of Labour Statistics, U.S. Department of Labour. Seventeen multiple items associated with parental styles are selected for fitting CFA and studying EFA. Response on these items from youth on parenting style are selected on five point scale as, 1=never, 2=rarely, 3=sometime, 4=often and 5=always. A total of 5,539 young adult respondents, were participated who were 14 to 22 years old when surveyed in 1997. There were 2763 young men and 2776 young women at the time of data collection. Due to missing information the total number of cases left for the analysis on this study is 4250.

Child Trends, Inc., an organization involved in the NLSY97 questionnaire design process, created a number of indexes and scales from variables used in the round 1 NLSY97 survey. The NLSY97 sample design enabled researchers to study experiences of different parental style reported by the youth.

Using SAS, a subset of data from National Longitudinal Survey 97 were used to explore the parenting style under the framework of EFA and CFA.

In EFA, Scree plot is generated to decide the number of factors and tells us the importance of the factors. Eigenvalues are produced by a process of principal components analysis (PCA) and represent the variance accounted for by each underlying factor. Once the numbers of factors are decided we then run another factor analysis to get the loadings for each of the factors by maximum likelihood approaches of extraction.

The varimax rotating approach is used to rotate the loadings. Once we gone through the EFA we are able to know the fitted model, number of constructs (factor), which items load on each factors, weather fitted model supported by previous research and explicitly of errors. We then determine a criterion a priori to access model fit and confirm the factor structure. Some of the criteria indicate acceptable model fit while other are close to meeting values for acceptable fit.

For CFA, a Chi-square statistics is used to describe a goodness of fit model and indicated by a chi-square probability greater than or equal to 0.05. A large chi-square value and rejection of the null hypothesis indicates that the proposed model does not fit well with the sample dataset. Conversely, a small chi-square value and failure to reject the null hypothesis indicates good model fit. However, it is important to remember that chi-square is sensitive to sample size, meaning that as sample size increases; it will become increasingly difficult to retain the null hypothesis. [16] applied factor analysis to Persian version of SF-36, a health related quality of life questionnaire in Iran.

Simulation studies by [17] employing a set of four measures of model fit and recommended that the root mean square error of approximation (RMSEA) statistic is commonly used as it includes the penalties for model complexity and it is relatively insensitive to sample size. The RMSEA lies between 0 and 1, with lower value indicating better fit. Conventional cut-offs state that RMSEA values that are .05 or less usually indicate that the model is a close fit in relation to the degrees of freedom. Values that are equal or closer to 1 indicate poor fit. However, these cut-off values should not be blindly or strictly adhered to; rather, judgment of acceptable cut-off values for fit indices should depend on one's knowledge of the research field.

The comparative fit index (CFI) is used as it is sensitive to model misspecification and has values that fall between 0 and 1, with higher values being indicative of better fit. However, this fit index is also sensitive to sample size, meaning that the results could vary greatly between samples.

The (Tucker-Lewis Index (TLI) or non-normed fit index (NNFI) is used to compare the fit of a proposed model to that of a baseline model in which all variables are assumed to be uncorrelated. Higher TLI values indicate better fit and the TLI also has the additional benefit of including penalties for model complexity.

Finally, the standardized root mean square residual (SRMSR) is used to get the standardized difference between the observed and predicted correlations. This is an absolute measure of fit with lower values indicating better fit. Because the SRMSR does not include penalties for model complexity, it is often recommended that SRMSR be reported in combination with incremental indices such as the CFI or NNFI.

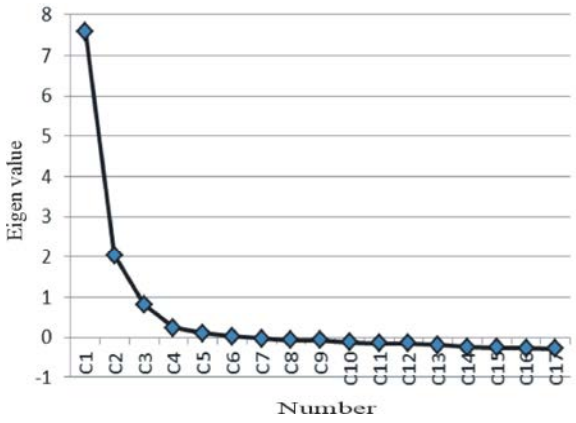


Fig. 1: Scree plot

RESULTS

Using SAS we have run a code, with PROC FACTOR procedure which provides us the cumulative variance, preliminary eigenvalues and variance explained by each of the factor. Table 1 gives the descriptive analysis for each of the variables (C1-C17).

Mardia's multivariate kurtosis (85.2204), might suggest a potential departure from normality. This could constitute a problem, namely because of potential bias in parameter estimates and because it can raise questions related to the estimation technique used, as maximum likelihood depends on the assumption of multivariate normality. However, according to [18], a large sample size, which is the case in this analysis, tend to mitigate violations of the normality assumption.

It can be seen from the Table-2 that initially two factors are retained, cumulative variance is 1.071, preliminary eigenvalues rounded up to three decimal places are 7.575 and 2.035 and each factor explains 84.40% and 22.68% of the variance and the scree plot in Figure-1 indicates 2 or 3 factors. The significance tests based on 4250 observations show that the hypothesis of having no common factors and having 2 factors are sufficient are rejected. In practice, we want to reject the first hypotheses and accept the second hypothesis.

Tucker and Lewis's Reliability Coefficient was almost 89%, which indicates a good reliability. It is to be noted that the reliability is a value between 0 and 1 with a larger value indicating better reliability. Since we do not want to be under- factoring which can be a problematic and liable to yield factors hard to interpret, or worse, open to

Table 1: Covariance Structure Analysis: Descriptive Statistics

	Variable	Mean	S.D	Skewness	Kurtosis
C1	My parents smile at me	4.26172	0.83602	-1.28460	1.97670
C2	My parents want to know what I'm doing	4.27680	0.93545	-1.30310	1.31960
C3	My parents forget a rule they have made	2.35948	1.12585	0.49811	-0.56444
C4	My parents praise me	3.72132	1.18558	-0.76954	-0.21389
C5	My parents let me go out any evening	2.71260	1.18538	0.13535	-0.85654
C6	My parents tell me what time to be home	4.31284	1.03571	-1.60593	1.92444
C7	My parents nag me about little things	2.76207	1.26391	0.20717	-0.94867
C8	My parents listen to my ideas and opinions	4.02450	1.02115	-0.97219	0.44708
C9	My parents and I solve problem together	3.62309	1.12076	-0.46933	-0.51204
C10	My parents keep rules when it suits them	2.80495	1.34701	0.16334	-1.12693
C11	Parents make sure I know I'm appreciated	4.10671	1.01736	-1.03125	0.42569
C12	Parents threaten to punish more than do	2.30459	1.24091	0.57975	-0.75105
C13	Parents enforce rule depending on mood	2.51779	1.19513	0.30801	-0.77317
C14	My parents seem proud of things I do	4.29446	0.94174	-1.40374	1.61890
C15	My parents get angry and yell	2.39576	0.96951	0.51496	0.05263
C16	My parents seem too busy	2.30530	1.17128	0.64001	-0.43284
C17	My parents interested in whom I'm with	4.20730	0.98905	-1.28350	1.24497

Table 2: Eigen values for preliminary and weighted reduced correlation matrices

	Preliminary Eigenvalues				Weighted Reduced Correlation Matrix			
	Eigen value	*Diff.*	*Prop.*	*Cum. Prop.*	*Eigen value*	*Diff.*	*Prop.*	*Cum. Prop.*
C1	7.5748	5.5396	0.8440	0.8440	8.8107	6.3826	0.7155	0.7155
C2	2.0352	1.2194	0.2268	1.0708	2.4280	1.3526	0.1972	0.9127
C3	0.8158	0.5726	0.0909	1.1617	1.0755	0.7609	0.0873	1.0000
C4	0.2432	0.1444	0.0271	1.1888	0.3145	0.0725	0.0255	1.0255
C5	0.0988	0.0741	0.0110	1.1998	0.2421	0.0671	0.0197	1.0452
C6	0.0247	0.0558	0.0027	1.2026	0.1749	0.1054	0.0142	1.0594
C7	-0.0311	0.0366	-0.0035	1.1991	0.0695	0.0261	0.0056	1.0651
C8	-0.0677	0.0023	-0.0075	1.1916	0.0434	0.0364	0.0035	1.0686
C9	-0.0700	0.0541	-0.0078	1.1838	0.0070	0.0323	0.0006	1.0691
C10	-0.1241	0.0224	-0.0138	1.1699	-0.0253	0.0087	-0.0021	1.0671
C11	-0.1465	0.0054	-0.0163	1.1536	-0.0341	0.0174	-0.0028	1.0643
C12	-0.1519	0.0295	-0.0169	1.1367	-0.0515	0.0182	-0.0042	1.0601
C13	-0.1814	0.0538	-0.0202	1.1165	-0.0697	0.0613	-0.0057	1.0545
C14	-0.2352	0.0156	-0.0262	1.0903	-0.1310	0.0050	-0.0106	1.0438
C15	-0.2508	0.0227	-0.0279	1.0623	-0.1359	0.0317	-0.0110	1.0328
C16	-0.2735	0.0123	-0.0305	1.0318	-0.1676	0.0689	-0.0136	1.0192
C17	-0.2858	--------	-0.0318	1.0000	-0.2365	---------	-0.0192	1.0000

interpretation because of loadings from variables that ought to have been linked to separate factors and the factors it did yield might not include something that were potentially valuable, also loading were liable to be less accurate than would have been the case if a proper number of factors had been extracted. In this situation we may go with 3 factors.

We have Look for an “elbow” in the scree plot in Figure-1 to determine the number of factors. It can be observed that factor 3 is the “elbow” so we can run factor analysis with three factors.

The eigenvalues of the weighted reduced correlation matrix, Proportion of variance explained and cumulative variance for 3 factors. The factor loadings illustrate correlations between items and factors.

Factor scores are calculated without weights. A factor is calculated by using the mean or sum of variables that load, are highly correlated with the factor. Factor scores are calculated with a mean as below.

Factor1 = mean (C14, C8, C11, C1, C9, C4);
Factor2 = mean (C7, C15, C12, C13, C3, C10, C16);
Factor3 = mean (C2, C6, C17, C5);

Using SAS, we have checked whether the variables under study are distributed normally. It can be seen from Table-1, that skewness and kurtosis of all measurements falls within the limits of ±2 criteria of normality, therefore non-normality is not an issue in our case of EFA and CFA.

In 3 factors analysis Table-2 provides us the Eigenvalues of the weighted reduced correlation matrix and are 8.811, 2.423 and 1.075, Proportion of variance explained are 0.715, 0.198 and 0.087 and Cumulative variance for 3 factors is 100%. Table-3 shows the factor loadings illustrate correlations between items and factors and arranged from largest to smallest value.

We tried some conceptual meaning for each factor for example

Factor1 could be called parental closeness.
Factor2 could be called inconsistent control.
Factor3 could be call parental monitoring.

We have run a code in SAS, with PROC TCALIS procedure with 3 factor model, which results in different fit indices that determine criteria a priori to access model fit and confirm the factor structure. It can be see form fitted model statistics,

The overall model fit for the three-factors was poor. The x^2 statistic was 1577.298 (df=116), which was large enough to reject the null hypothesis that the observed model was equivalent to the proposed model (p<.0001). The RMSEA was 0.054 with a confidence

Table 3:

	Variable label	Factor1	Factor2	Factor3
C14	My parents seem proud of things I do	0.74993	-0.19240	0.09536
C8	My parents listen to my ideas and opinions	0.74671	-0.21165	0.07003
C11	Parents make sure I know I'm appreciated	0.74167	-0.16264	0.14828
C1	My parents smile at me	0.66599	-0.12374	0.11688
C9	My parents and I solve problem together	0.63761	-0.20462	0.13446
C4	My parents praise me	0.60897	-0.08142	0.08090
C7	My parents nag me about little things	-0.18233	0.59916	0.07569
C15	My parents get angry and yell	-0.33232	0.58783	0.05873
C12	Parents threaten to punish more than do	-0.13982	0.57896	0.00847
C13	Parents enforce rule depending on mood	-0.05681	0.55378	-0.00816
C3	My parents forget a rule they have made	-0.03917	0.46312	-0.24789
C10	My parents keep rules when it suits them	0.00026	0.36088	-0.01527
C16	My parents seem too busy	-0.25819	0.35325	0.01156
C2	My parents want to know what I'm doing	0.30972	0.12030	0.51402
C6	My parents tell me what time to be home	0.24619	0.04550	0.49333
C17	My parents interested in whom I'm with	0.44063	-0.00823	0.49150
C5	My parents let me go out any evening	0.18683	0.16031	-0.36061

interval of (0.052 0.057), which is not very bad and just a little higher than the cut-off value of .05 that was chosen to indicate close fit, which indicates the model had not very bad fit. The McDonald's CI value was 0.842, the SRMSR value was 0.0634 and the NNFI value was 0.913.

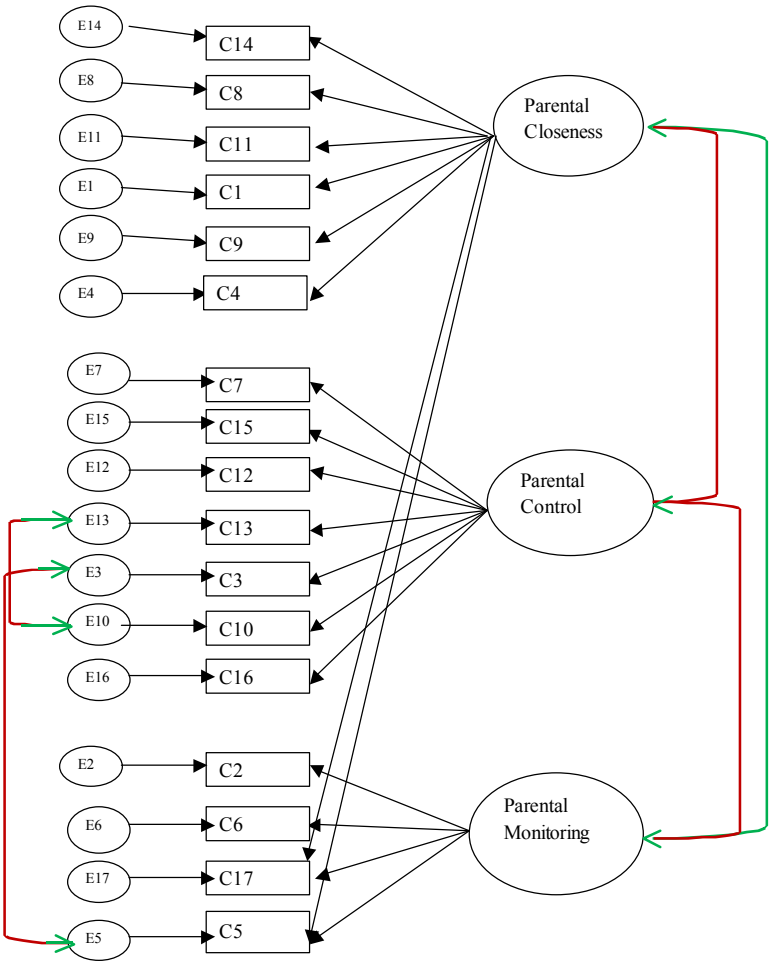
It can be seen after fitting three-factor model, the value of our chi-square does not show up, on the other hand some of the model fit indices are not in acceptable range, so it may does not account for all relationship in data this may be due to an item should load on to other factors, what we need to do in this situation is to add some paths that make sense to the model. This could be done after modification by keeping in mind testing repeated models increases type 1 error also post-hoc modification moves away from a priori approach.

Modified fitting of three factor model with CFA: After we had confirmed the poor fit of the model, we decided to re-examine the 17 items to see if they could be conceptually linked to other latent variables. Modification provides us two tests called LaGrange Multiplier test, testing weather we need to add any of the paths we left out that make sense and the Wald test, testing whether we need to drop any non-significant parameter or path we have added in order to improve the model.

The modification indices did suggest that three of our paths (items C5 and C17) would lead to a better chi-square value. Consequently, we add the paths for those two indicators so that in our modified model, C5 (My parents let me go out any evening) and C17 (My parents interested in whom I'm with) are all linked with Factor 1(Parental Closeness). We also decided to allow two (C13, C10 and C5, C3) highly correlated items C13 (Parents enforce rule depending on mood) and C10 (My parents keep rules when it suits them), C5 (My parents let me go out any evening) and C3 (My parents forget a rule they have made), after reading the wording it seems that these items theoretical make some sense with the covariance of error terms.

The overall modified fit for three-factor model was now better than three-factor model without modification fitted previously, but it was still poor. Although x^2 statistic drops down to 973.739 (df = 111), but still large enough to reject the null hypothesis that the observed model was equivalent to the proposed model (p<.0001). The RMSEA was 0.043 with a confidence interval of (0.040 0.045), which was much better and smaller than the cut-off value of .05 that was chosen to indicate close fit. The McDonald's CI value was 0.903 and statistically not very bad, the SRMSR value was 0.039 and good and the NNFI value was 0.946 and reasonable.

Graphical Representation of Best-Fitting Model:



CONCLUSION

Our results proposed that the 3 factor modified model is the best model for factoring parenting style used in this study from the National Longitudinal Survey 97, prepared by the Bureau of Labour Statistics, U.S. Department of Labour, although after losing the degree of freedom the value of Chi- square does not shown up, but still fitted indices are in acceptable range. Further refinement of the measure and assessment through EFA and CFA is recommended. It is also recommended that more studies are necessary to confirm and explore this investigation.

ACKNOWLEDGMENT

We are thankful to the Managing Editor and referees for their careful reading and for some helpful comments and suggestions that have greatly improved our original submission. We are also thankful to National Longitudinal Survey 97 prepared by the Bureau of Labor Statistics, U.S. Department of Labor, for granting permission to use the data for our work.

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