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Editorial

Use of Factor analysis for Best Practices in Behavioral Sciences

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Factor analysis is basically done to study or establish construct validity.[1] Construct validity is one of the multiple categories of validity most commonly addressed and established in social sciences, psychology and education.[2] Construct validity is an extent to which an instrument computes theoretical construct of any tool.[3] Construct validity is an aspect that is studied to elude unreliable or contradictory outcomes.[4]

Factor analysis is helpful to judge the relevance of any tool items with specific domains of that tool. Therefore, this technique has great implications in data diminution as well as abolition of questions which are not much relevant to any culture.[5] Researchers should try to establish construct validity of an already developing instrument instead of developing and validating a new tool.[6] Factor analysis comprised of two categories - Exploratory and Confirmatory factor analysis.

Exploratory Factor Analysis (EFA) is a multivariate statistical technique that achieved significant fame in formulation and authentication of psychological theories and dimensions.[7]

There are two goals of Exploratory Factor Analysis. These are understanding structure of correlation among variables and data reduction. Moreover, inclusion of irrelevant items in each domain of inventory may lead to emergence of spurious common factors. Accuracy of results drawn from EFA is enhanced when each common factor /domain comprises of at least 3-5 variables.[8] Moreover, it is preferable to have as large sample because the time required for fitness of EFA model is reduced to two third by working on massive sample.[9]

Principal Component Analysis (PCA) is extensively used for factor extraction in the first phase of EFA. It extracts uncorrelated linear combinations of the variables.[10]

The Eigen value for a given factor is meant to determine the variance in all the variables which is attributed to that specific factor. Factors with largest Eigen values have most variance while factors with small or negative Eigen *values* are omitted from the solutions.[11] Eigen values greater than 1 can best be retained by consideration of Kaiser Criterion.[12]

Confirmatory Factor Analysis (CFA) helps researcher in testing the hypothesis pertaining to the relationship between observed variables and latent constructs. In addition, it makes easy interpretation of model fit indices.[13] CFA is a preferred method when there is ample theoretical and empirical foundation to specify a model.[14] It is recommended to check for EFA findings in case of poor fitting CFA model.[15]

Absolute and relative fit indices are calculated for the model designed in Confirmatory Factor Analysis (CFA). Absolute fit Indices include Root Mean Square Error of Approximation (RMSEA), chi-square test of model fit, Goodness-of-Fit index (GFI), Adjusted Goodness-of-Fit index (AGFI), Root Mean Square Residual (RMR) and Standardized Root Mean Square Residual (SRMR).[16] GFI is computed to compare the fitness between the hypothesized model and the observed covariance matrix. AGFI is in fact correction of GFI. RMR and SRMR are the square root of the difference between the covariance matrix of model and sample.[17] Relative fit indices for Confirmatory Factor Analysis (CFA) are Normed fit index (NFI), Non-Normed fit index (NNFI), comparative fit index (CFI). There are certain values specified for these indices indicative of their acceptable, marginal or poor fit.[18]

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References

1. Brown JD. Testing in language programs. Upper Saddle River, NJ: Prentice Hall, 1996.

2. Shuttleworth M. Construct Validity. (Accessed on 12th June 2020) Available from URL: http://explorable.com/construct-validity
3. DeVon HA, Block ME, Moyle-Wright P, Ernst DM, Lazzara DJ. A psychometric toolbox for testing validity and reliability. J Nurs Scholarsh 2007; 39: 155-164.
4. Mochon D, Schwartz J. The importance of construct validity in consumer research. J Consumer Psychol 2020; 30(1): 208-14.
5. Messick S. Standards of validity and the validity of standards in performance assessment. Educational Measurement 1995; 14(4): 5-8.
6. Kimberlin CL, Winterstein AG. Validity and reliability of measurement instruments used in research. Am J Health-Syst Pharm 2008; 65: 2276-84.
7. Watkins MW. Exploratory Factor Analysis: A Guide to Best Practice. J Black Psychol 2018. 44(3): 219-46.
8. MacCallum RC, Widaman KF, Zhang S, Hong S. Sample size in factor analysis. Psychological Methods 1999; 4: 84-89.
9. Trendafilov NT, Fontanella S. Exploratory factor analysis of large data matrices. Statistical Analysis and Data Mining 2019; 12(1): 5-11.
10. Wold S, Esbensen K, Geladi P. Principal Component Analysis. Chemometr Intell Lab Syst1987; 2(1-3): 37-52.
11. Tabachnick BG, Fidell LS. Using Multivariate Statistics (3rd ed.) New York: Harper Collins. 1996.
12. Braeken J, Van Assen MALM. An Empirical Kaiser Criterion. Psychol Methods 2017; 22(3): 450-66.
13. Schumacker RE, Lomax RG. A Beginner's guide to Structural Equation Modeling. Mahwah, New Jersey: Lawrence Erlbaum Associates, 1996.
14. Finch JF, West SJ. The investigation of personality structure: Statistical models. J Res Personal 1997; 31: 439-85.
15. Schmitt TA. Current methodological considerations in exploratory and confirmatory factor analysis. J Psycho Educ Assess 2011; 29(4): 304-21.
16. Hu L, Bentler PM. Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Modeling 1999; 6(1): 1-55.
17. Hooper D, Coughlan J, Mullen MR. Structural equation modelling: Guidelines for determining model fit. J Bus Res Methods 2008; 6: 53-60.
18. Bentler PM. Comparative fit indexes in structural models. Psychol. Bull 1990; 107(2): 238-46.