How to determine the appropriate sample size for structural equation modeling

Sample Size

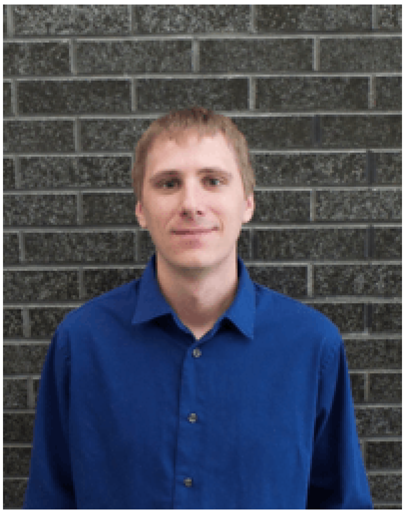
Structural equation modeling (SEM) is an increasingly popular choice for quantitative statistical analyses, as it allows researchers to model complex relationships while taking into account measurement error of latent variables. Although there are great advantages to using SEM, the complexity of the analysis can be daunting, especially for students or beginning researchers. One of the most troublesome issues students face when using SEM is determining an appropriate sample size. For simple analyses like *t*-tests, ANOVAs, or regressions, reputable power analysis tools such as G*Power allow researchers to calculate an appropriate sample size using only a few basic parameters (i.e., power level, significance level, and effect size). For SEM, however, determining sample size is not as straightforward.

dissertation editing services.

- Bring dissertation editing expertise to chapters 1-5 in timely manner.
- Track all changes, then work with you to bring about scholarly writing.
- Ongoing support to address committee feedback, reducing revisions.

Most researchers agree that SEM requires “large” sample sizes, but what exactly does this mean? A number that gets tossed around a lot is 300 (see Comrey & Lee, 2013; Tabachnick & Fidell, 2013), but a one-size-fits-all answer like this probably will not fly with most reviewers. As there is no single correct or universally-accepted calculation or method for determining sample size for SEM, researchers and students alike often rely on “rules of thumb.” For instance, some statistics scholars have recommended using the ratio of observations to estimated parameters (*N:q*) as a guide. Specifically, Kline (2015) recommended that the *N:q* ratio should be 20 to 1, or 20 observations (participants) for each estimated parameter in the model. Others hav gested that the *N:q* ratio can be as low as 10 to 1 (Schreiber et al., 20 1987). Clearly, there is a lot of variance and uncertainty e SEM scholars.

So, what if your reviewers require some kind of hard calc thumb) to determine your sample size? Th ere are some easy-to-use online tools that have academic support (for an example see Daniel Soper's sample size calculation tool based on the work of Westland, 2010). However, Monte Carlo simulation is becoming an increasingly preferred method (for an in-depth discussion, see Wolf et al., 2013). In short, the Monte Carlo simulation method allows you to construct a model to your exact specifications and then test the model on thousands of "random" datasets of varying sample sizes. This lets you see approximately how often the effects in your model will be significant (i.e., statistical power) in a sample of any given size. The main advantage of this method is that it allows you to determine an appropriate sample size for the specific model you are testing. However, this method requires a high level of expertise in specific statistical software (such as Mplus) to conduct properly. Keep an eye out for future blogs where we may cover Monte Carlo methods in more detail!



Author: David

References

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods & Research, 16*(1), 78-117.

Comrey, A. L., & Lee, H. B. (2013). *A first course in factor analysis*. Psychology Press.

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford publications.

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research, 99*(6), 323-338.

Soper, D.S. (2018). A-priori Sample Size Calculator for Str
Available from http://www.danielsoper.com/statcalc

Tabachnick, B. & Fidell, L. (2013). *Using multivariate stat*
Education.

Westland, J.C. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications, 9*(6), 476-487.

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement, 73*(6), 913-934.

You may also be interested in these articles:

View All

October 23, 2018

Sample Size Calculation: A Few Considerations

An important aspect of writing your methodology is determining an appropriate sample size. While it is a good idea to review past studies to see what previous researchers have estimated and achieved in terms of sample size, you should base your sample size estimations on your unique study parameters and what is feasible in terms of your population and procedures.... Continue Reading

Sample Size

Read Now

September 06, 2018

Common Doctoral Study Limitations

Every study that has ever been conducted, or will ever be conducted, has limitations. Identifying the limitations inherent to your study is not only an