

Supplement to Chapter 10

Manifest and Latent Variable Path or Mediation Models

Supplement Part 1:

Testing Mediation with LISREL: Some Further Considerations

Tables 15-2 and 15-4 present the LISREL results for testing mediation with manifest and latent variables. The results are presented in three parts. The first part is the regression weights (path coefficients) from the Beta matrix. This information continues to be very useful, and should be reported.

The second part of the output presented in Tables 15-2 and 15-4 relates to the Total Effects of Y on Y (or Eta on Eta). Included in this part of the table is information that is equivalent to the effect the X variable would have on the Y variable if the mediator were not in the model; that is, this is the estimate of τ . For the example described in Tables 15-2 and 15-4, this would be the effect of Posatt7 and Likepar7 on the DV, Alc8, if the mediator, rebel7, were not in the model. This also continues to be an important part of the output, and should continue to be reported.

The third part of the output is both more valuable and less valuable than described originally in Chapter 10. These indirect effects are less valuable in that the standard errors presented are based on the Sobel method (Sobel 1982; 1986). I have already argued that these standard errors are too conservative, and that it is better to base one's statistical conclusions regarding the mediated effect on an estimate of the asymmetrical confidence interval (e.g., see MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; or Shrout & Bolger, 2002), or on the joint significance of the individual parts of mediation, α and β (see MacKinnon et al., 2002).

On the other hand, the information provided in this third section of Tables 15-2 and 15-4 is even more valuable than I previously implied, because it represents the total mediation of the X variable predicting the Y variable. In this case, for example, it is the total mediation of likepar7 predicting alc8. In this particular instance, the total mediation is the same as the specific effect of likepar7 on alc8, mediated by rebel7. So in this particular instance, there is really no particular advantage of looking at this part of the output. However, if there were two or more mediators, this information could be very important, despite the conservativeness of the statistical test.

If there are two or more correlated mediators, the effect of the mediators on the outcome are underestimated. This is true in any multiple regression model with two or more correlated predictors. In this case, not all of the prediction shows up in the b-weights. Even with multiple,

correlated mediators, however, this overall indirect (mediated) effect is correct.¹ This fact is important for the following reason. There may be situations for which the b-weights are non-significant for all of the M => Y effects. If this is true, then all of the individual mediated effects will be non-significant. However, what if one or more of these M=>Y effects are inappropriately too small because the mediators are correlated? Under these circumstances, the overall indirect effect, displayed in this section of output, may be significant, indicating that the lack of mediation is simply an artifact of the correlated mediators.

Other, more detailed, solution may be possible for the problem of correlated mediators (e.g., see Budescu, 1993; Graham & Olchowski, 2004; Johnson, 2000). However, in the meantime, examination of this section of output may provide some important clues about the significance of mediation.

The bottom line for this section is that if you are using LISREL, you should go ahead and present all of the sections as originally described in Chapter 9. The only caveat to this is that if there is only a single mediator, I would suggest dropping the third section (indirect effects), and focus instead on the significance of the two parts of mediation, i.e., the X=>M and M=>Y effects.

Supplement Part 2: Testing Mediation with AMOS

In this section, I will describe presentation of comparable results based on output from the Amos program. I will focus on the equivalent of Table 15-2, but what I say here is easily extended to what should be presented in Table 15-4.

First, as will be obvious to anyone who has used both Amos and LISREL, the two programs present the output in quite different ways. Rather than trying to force fit the Amos regression and mediation results into the LISREL-like matrix format, it makes sense to stay a bit closer to how the output actually looks in Amos. Thus, for the results presented in the original Table 15-2, I might modify the table so to look like Table 15-2a, below.

Table 15-2a
Regression Weights (Path Coefficients)

Maximum Likelihood Estimates

		Estimate	S.E.	C.R.	P
REBEL7	<--- LIKEPAR7	-.3534	.0133	-26.5513	***
REBEL7	<--- POSATT7	.3055	.0133	23.0374	***
ALC8	<--- REBEL7	.7169	.0347	20.6818	***
ALC8	<--- LIKEPAR7	-.0180	.0309	-.5825	.5603
ALC8	<--- POSATT7	.4269	.0302	14.1246	***

¹ This situation is similar to the idea that the R² in multiple regression is correct in depicting the overall extent to which the total set of predictors account for variance in the DV.

Although it is possible to present the Total, and Indirect Effects based on the standard Amos output (e.g., see Tables 15-2b and 15-2c), these values are not as useful as they are in the LISREL output, mainly because they lack the standard errors and critical ratios provided in LISREL. Thus one quick conclusion is that would NOT present the material shown below in Tables 15-2b and 15-2c.

Table 15-2b

Total Effects

1.	POSATT7	LIKEPAR7	REBEL7
REBEL7	.3055	-.3534	.0000
ALC8	.6459	-.2713	.7169

Table 15-2c

Indirect Effects

	POSATT7	LIKEPAR7	REBEL7
REBEL7	.0000	.0000	.0000
ALC8	.2190	-.2533	.0000

The Total Effects can be calculated in Amos, however, simply by estimating a model without the mediating variables. If there are no missing data, this new model, in addition to being somewhat simpler than the full mediation model, yields the correct estimates for the total effect. However, if there are missing data, this simpler model may yield somewhat incorrect estimates of the total effect, because these parameters will be estimated using slightly different data. This latter problem can rather easily be remedied, however, by including the missing mediating variable as an auxiliary variable (see Collins, Schafer, & Kam, 2001; Graham, 2003; Graham, Cumsille, & Elek-Fiske, 2003). The "saturated correlates" model suggested by Graham (2003) for this case appears in Figure 1a. The key feature of the model shown in Figure 1a is that the parameter estimates of interest (likepar7=>alc8 and posatt7=>alc8) are not affected by the presence of rebel7, except with regard to missing data. The Total Effects based on this model appear in Table 15-2d.

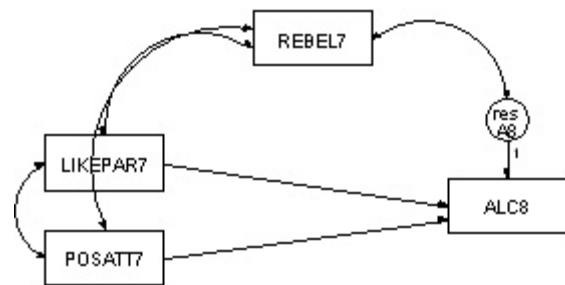


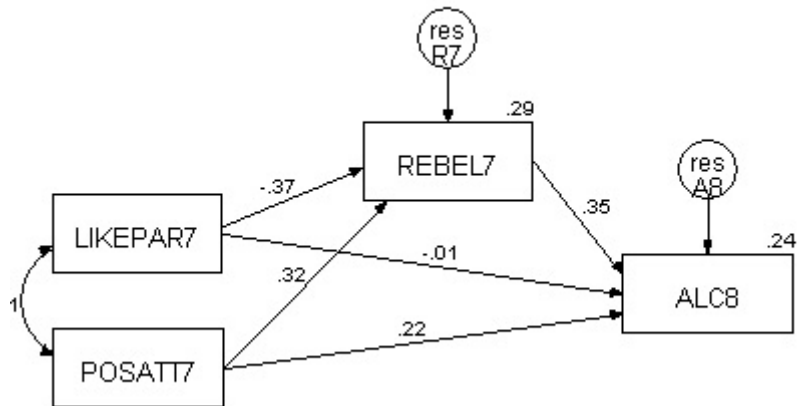
Table 15-2d
Total Effects

			Estimate	SE	CR	P
Alc8	<====	Likepar7	-.2713	.0300	-9.05	***
Alc8	<====	Posatt7	.6459	.0299	21.63	***

Information about the Total Effects could definitely be presented in a table like Table 15-2d. Or, if there are not too many predictor variables, the total effects could simply be presented in the text of the Results section.

Unfortunately, I don't know of a convenient way to obtain the standard error for the total indirect effects corresponding to the values appearing in Table 15-2c. Fortunately, however, most of the important information about the mediated effects is contained in the regression weights themselves (see Table 15-2a). Thus, I would suggest that Amos users simply report the regression weights in a way similar to what I have shown in Table 15-2a, and then just talk about the parts of mediation in the body of the results section. It would be an easy matter to talk specifically about the significant mediation, for example, for the Likepar7 => Rebel7 => Alc8 path, by referring to the significant Likepar7 => Rebel7 path, and the significant Rebel7 => Alc8 path.

As an alternative to presenting the regression weights in table form, one could consider presenting them in a figure such as that depicted in Figure 1b. One way this makes most sense is to present the unstandardized regression weights (path coefficients), along with the corresponding standard errors and CR values, etc., plus a figure displaying just the standardized path coefficients, as shown in Figure 1b.



References

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