Structural Equation Modeling

JMP PRO Use Structural Equation Modeling (SEM) to test causal theories and analyze relationships between observed variables and underlying latent constructs. SEM combines principles from factor analysis, which identifies factors from observed variables, and multiple regression analysis, which assesses how variables relate to each other.

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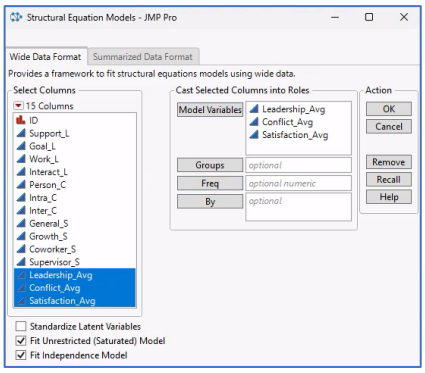
Note: SEM provides a framework to perform a wide range of multivariate analysis including Mediation Analysis, Path Analysis, Confirmatory Factor Analysis, Latent Growth Curve Analysis, among others. This guide illustrates just one – Mediation Analysis. This technique is used to test a causal theory where a predictor is posed to cause an outcome through its effect on a mediator. Mediation analysis allows you to investigate the mechanisms by which a variable influences an outcome through statistical tests and estimation of indirect effects.

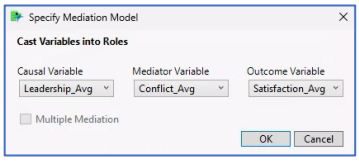
Job Satisfaction.jmp (Help > Sample Data Folder)

1. From an open JMP® data table, select **Analyze > Multivariate Methods > Structural Equation Models**.

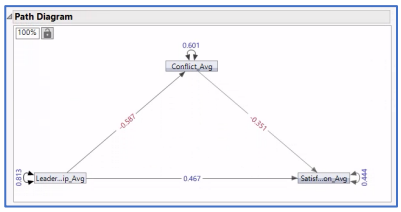


2. Select the numeric variables for the model. Click **OK**.
   The SEM interactive report will open.

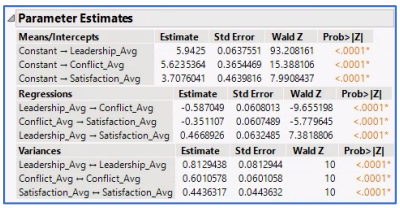
3. From the Model Shortcuts red triangle at the bottom, select **Cross-Sectional (classics) > Mediation Analysis**.



4. Select one of the variables as the Causal Variable (here we chose 'Leadership_Avg'), a variable as the Mediator ('Conflict_Avg'), and a variable for the outcome ('Satisfaction_Avg'). These roles specify a model describing the effect that 'Leadership' has on 'Job Satisfaction' through its effect on 'Conflict'. Click **OK**.
   The path diagram will be added.



5. Click **Run** to fit the model.
   The model coefficients will be added to the Path Diagram, and a table of parameter estimates and statistical tests will be generated.



Parameter Estimates

Means/Intercepts	Estimate	Std Error	Wald Z	Prob>|Z|
Constant → Leadership_Avg	5.9425	0.0637551	93.208161	<.0001*
Constant → Conflict_Avg	5.6235364	0.3654469	15.388106	<.0001*
Constant → Satisfaction_Avg	3.7076041	0.4639816	7.9908437	<.0001*
Regressions	**Estimate**	**Std Error**	**Wald Z**	**Prob>|Z|**
Leadership_Avg → Conflict_Avg	-0.587049	0.0608013	-9.655198	<.0001*
Conflict_Avg → Satisfaction_Avg	-0.351107	0.0607489	-5.779645	<.0001*
Leadership_Avg → Satisfaction_Avg	0.4668926	0.0632485	7.3818806	<.0001*
Variances	**Estimate**	**Std Error**	**Wald Z**	**Prob>|Z|**
Leadership_Avg ↔ Leadership_Avg	0.8129438	0.0812944	10	<.0001*
Conflict_Avg ↔ Conflict_Avg	0.6010578	0.0601058	10	<.0001*
Satisfaction_Avg ↔ Satisfaction_Avg	0.4436317	0.0443632	10	<.0001*

Interpretation:

- For one unit increase in leadership, conflict decreases by 0.59 units whereas satisfaction increases by 0.47 units.
- Conflict has a negative effect on satisfaction, such that one unit increase in the former results in a 0.35 decrease in the latter.
- The indirect effect of leadership to satisfaction through conflict is positive and statistically significant (b = 0.21, SE = 0.04). Thus, leadership has a positive impact on satisfaction through its effect on conflict.

- Other models can be fit and compared in the same report via the Model Comparison table (e.g., one without the direct effect from leadership to satisfaction to test if the effect of leadership to satisfaction is fully or partially mediated by conflict).
- The red triangle menu of the fitted model includes options to display total and indirect effects along with their standard errors. Bootstrap for standard errors is also available in the main red triangle menu.

Visit **Multivariate Methods > Structural Equation Models** in **JMP Help** to learn more.