

# Web-based Analysis with R-sem

*Keon-Woong Moon*

*2018-08-07 13:01:07*



# Contents

<b>1 Where to test</b>	<b>5</b>
<b>2 Getting Started</b>	<b>7</b>
Perform SEM In A Minute . . . . .	7
The first screen : Select language . . . . .	7
Steps for SEM . . . . .	7
Easier step . . . . .	19
Download Results . . . . .	21
<b>3 Analyze Your Own Data</b>	<b>23</b>
Upload data . . . . .	23
Edit data . . . . .	23
Insert/remove row . . . . .	27
<b>4 Insert/Edit Structural Equation</b>	<b>29</b>
<b>5 Direct edit the equation</b>	<b>35</b>
<b>6 Edit A Mediation Effect Equation</b>	<b>37</b>
check the Mediation Effect Analysis . . . . .	37
Select variables . . . . .	37
Do analysis . . . . .	40
<b>7 A complete example</b>	<b>43</b>
Do it at once . . . . .	43
Step 1. Define latent variables . . . . .	43
Define the latent variable <code>knowledge</code> . . . . .	44
Define latent variables - <code>empathy</code> and <code>intervention</code> . . . . .	44
Step 2. Define the mediation effect . . . . .	48

<b>8 Select Plot Preview</b>	<b>55</b>
Select Data and Edit Structural Equation . . . . .	56
Select <b>group</b> option . . . . .	56
Results of Analysis(1) . . . . .	64
Results of Analysis(2) . . . . .	64
Results of Analysis(3) . . . . .	64
Plots for Multiple Groups . . . . .	64
Measurement Invariance . . . . .	68
Select Data and Edit Structural Equation . . . . .	70
Enter the 2nd Equation . . . . .	72
Results of Analysis(1) . . . . .	72
Results of Analysis(2) . . . . .	72
Plots for Two Models . . . . .	76

# **Chapter 1**

## **Where to test**

<http://r-meta.org:3838/r-sem>



# Chapter 2

## Getting Started

Welcome to the “Structural Equation Modeling(SEM) with R”. In this chapter, you can perform the first structural equation modeling of your own using the sample data in a minute.

### Perform SEM In A Minute

#### The first screen : Select language

When you load the SEM app, you can see this screen. Currently, this app support English and Korean. You can select your preferred language(arrow).

### Steps for SEM

Performing SEM with sample data is very simple. You can finish in five steps.

#### 1. Select/Upload Data

... `HolzingerSwineford1939` was selected as a default data.

If you want to know about the data, press the `show help Data` button.

In the popup window, the informations about the data will be displayed.

**Select Language Here !**

With this app, you can perform **structural equation modeling** with **just one-click**. You can perform the **confirmatory factor analysis**, fit a **structural equation model**, fit a **growth curve model**, and fit a **partial least square(PLS) model**. Additionally, you can obtain beautiful plots in png, svg or pdf format. You can download the results with html or PDF format. You can also download the powerpoint file with **just one click**.

**Select Language**

English  한국어(Korean)

R-sem.com SEM How to ▾ Citation About

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
파일 선택 선택한 파일 없음

**Select Data**

- HolzingerSwineford1939
- PoliticalDemocracy
- example1
- example2
- Demo.growth
- ADHD
- uploaded\_file

**Select Example**

None

Reset

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

Figure 2.1: 1.png

**Structural Equation Modeling with R**

With this app, you can perform **structural equation modeling** with just one-click. You can perform the **confirmatory factor analysis**, fit a **structural equation model**, fit a **growth curve model**, and fit a **partial least square(PLS) model**. Additionally, you can obtain beautiful plots in png, svg or pdf format. You can download the results with html or PDF format. You can also download the powerpoint file with **just one click**.

Select Language  
 English  한국어(Korean)

R-sem.com SEM How to ▾ Citation About

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

Figure 2.2: 2.png

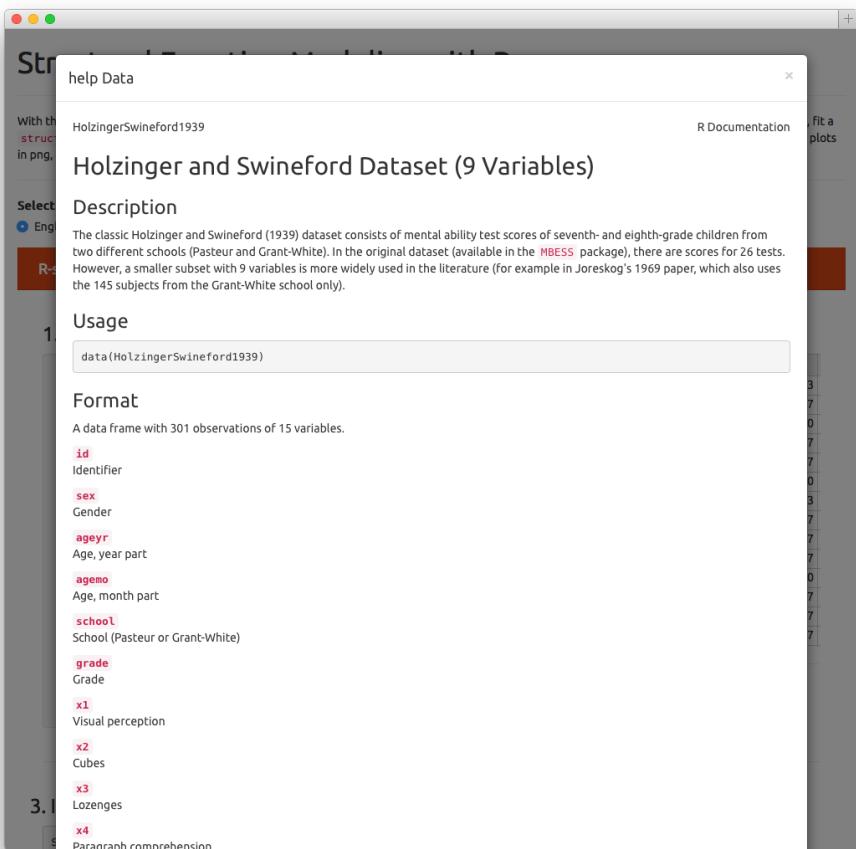


Figure 2.3: 3.png

## 2. Edit Data

... No action required.

## 3. Insert/Edit Structural Equation

The classic Holzinger and Swineford (1939) dataset consists of mental ability test scores of seventh- and eighth-grade children from two different schools (Pasteur and Grant-White). In the original dataset (available in the MBESS package), there are scores for 26 tests. However, a smaller subset with 9 variables is more widely used in the literature. A Confirmatory Factor Analysis(CFA) model that is often proposed for these 9 variables consists of three latent variables (or factors), each with three indicators:

- a **visual** factor measured by 3 variables: x1, x2 and x3
- a **textual** factor measured by 3 variables: x4, x5 and x6
- a **speed** factor measured by 3 variables: x7, x8 and x9

You can insert/edit the structural equation easily by the following steps.

1. Choose left side variable(s) or enter the latent variable
2. Select operator
3. Choose right side variable(s)

(1) First, please enter the latent variable **visual** in the text input(arrow).

As you enter the latent variable **visual**, the left side of equation will be made and the operator **=~** will be added(arrow). The operator **=~** is used for latent variable definition which means **is measured by**.

The current set of operators is summarized in the table below.

formula type	operator	mnemonic
latent variable selection	<b>=~</b>	is measured by
regression	<b>~</b>	is regressed on
(residual) (co)variance	<b>~~</b>	is correlated with
intercept	<b>~1</b>	intercept
defined parameter	<b>:=</b>	is predefined as
equality constraint	<b>==</b>	equals
non-equality constraint	<b>&lt;</b>	is less than
non-equality constraint	<b>&gt;</b>	is greater than

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var

operator  
  $\approx$   
  $\sim$   
  $\sim\sim$   
  $\doteq$   
  $\doteq\doteq$   
  $<$   
  $>$

Enter Latent Variable

right var

equation  
  
The 2nd Equation

Mediation Effect Analysis

Figure 2.4: 4.png

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

**3. Insert/Edit Structural Equation**

visual =~  
**left var**   
**Enter Latent Variable**   
**operator**  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

**right var**   
  
id  
sex  
ageyr  
agemo  
school  
grade  
x1  
x2

equation  
The 2nd Equation

Mediation Effect Analysis

Figure 2.5: 5.png

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
파일 선택 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
 Confirmatory Factor Analysis

Reset

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

2 visual ~

left var

operator  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

Enter Latent Variable  
 visual

right var  
 id  
sex  
ageyr  
agemo  
school  
grade  
x1  
x2

**add to equation**

reset the equation

equation

The 2nd Equation

Figure 2.6: 6.png

- (2) And then, please select the right side variables - x1,x2 and x3 - among the variables displayed in the selectInput.
- (3) After selection of three variables, press the add to equation button.

The temporary equation just made will be added to the equation. The latent variable input box(1), temporary equation(2) and the selectInput(for right side variables) will be initialized.

Please repeat the step (1)-(3) to add the equation:

```
textual =~ x4 + x5 + x6
```

```
speed =~ x7 + x8 + x9
```

### 3. Insert/Edit Structural Equation

visual =~ x1+x2+x3

**left var**  
Select...  
**Enter Latent Variable**  
visual

**operator**  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

**right var**  
x1 x2 x3 |  
id  
sex  
ageyr  
agemo  
school  
grade  
x4  
x5

**add to equation**  
**reset the equation**

equation

The 2nd Equation

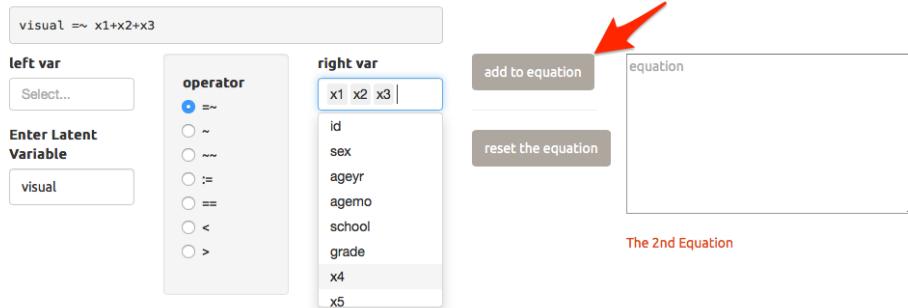


Figure 2.7: 7.png

### 3. Insert/Edit Structural Equation

2 Select variables and operators to make a equation !

**left var**  
Select...  
**Enter Latent Variable**  
1

**operator**  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

**right var**  
3 Select...  
**add to equation**  
**reset the equation**

visual =~ x1+x2+x3

The 2nd Equation

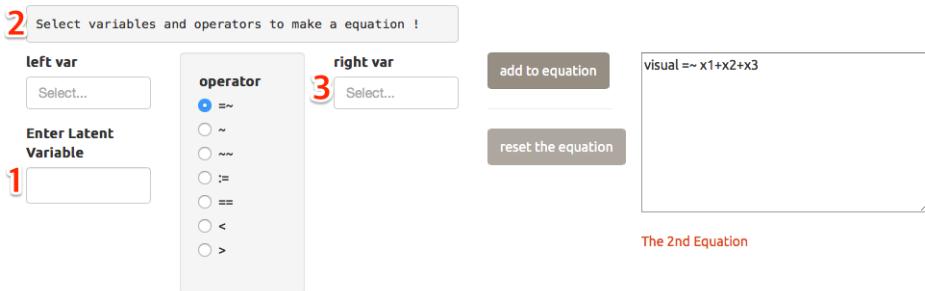


Figure 2.8: 8.png

#### **4. Analysis/Summary options**

... No action required.

#### **5. Plot options**

... No action required.

#### **6. Press the Do analysis button(arrow).**

You can get the analysis results followed by the plot(s) representing SEM.

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

**left var**: Select...

**operator**:   $\approx$      $\sim$      $\approx\approx$      $\doteq$      $\equiv$      $<$      $>$

**right var**: Select...

**add to equation**

**reset the equation**

visual  $\approx x_1 + x_2 + x_3$   
textual  $\approx x_4 + x_5 + x_6$   
speed  $\approx x_7 + x_8 + x_9$

The 2nd Equation

Mediation Effect Analysis

**4. Analysis/Summary Options**

**Analysis options**:  
 Fit a Structural Equation Model  
 Fit a Confirmatory Factor Analysis Models  
 Fit a Growth Curve Model  
 Fit a Partial Least Squares Model  
Edit Analysis Order  
 Edit Analysis Order

**group**: Select...  
group.equal

**se**: default

**Summary Options**:  
 standardized  
 fit.measures  
 rsquare  
 modindices  
Others  
 show coefficient  
 show Measurement Invariance

**5. Plot Options**

**Plot Options**

1  Plot Preview

**Do Analysis** (highlighted with a red arrow)

**download Report**

**Report Format As**:  
 PDF    HTML

**download Plot(s)**

**Format As**:  
 png    svg    pdf

**Format**:  
 wide    normal

**width height**: 7 5

Figure 2.9: 9.png

Do Analysis +/-

**Report Format As**  
 PDF  HTML

**Format As**  
 png  svg  pdf

**Format**  
 wide  normal

**width height**  
 7  5

---

## Results of Analysis

```

## Results of Analysis
fit<- sem(input$equation,data=df())
summary(fit,standardized= TRUE ,fit.measures= FALSE ,rsquare= FALSE ,modindices= FALSE )

lavaan (0.5-28) converged normally after  35 iterations

Number of observations                           301
Estimator                                         ML
Minimum Function Test Statistic                85.306
Degrees of freedom                                24
P-value (Chi-square)                            0.000

Parameter Estimates:

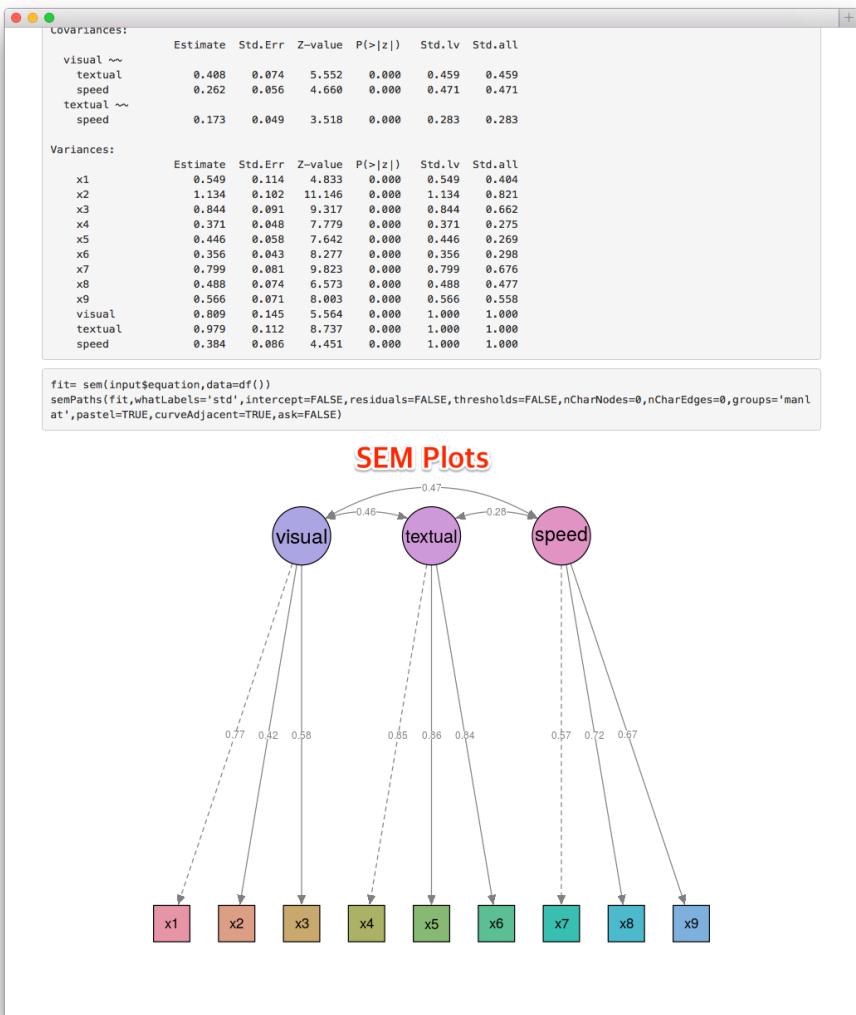
Information                                         Expected
Standard Errors                                     Standard

Latent Variables:
Estimate   Std.Err  Z-value P(>|z|) Std.lv Std.all
visual =~
  x1        1.000
  x2       0.554  0.100  5.554  0.000  0.498  0.424
  x3       0.729  0.109  6.685  0.000  0.656  0.581
textual =~
  x4        1.000
  x5      1.113  0.065 17.014  0.000  1.102  0.855
  x6       0.926  0.055 16.703  0.000  0.917  0.838
speed =~
  x7        1.000
  x8      1.180  0.165  7.152  0.000  0.731  0.723
  x9       1.082  0.151  7.155  0.000  0.670  0.665

Covariances:
Estimate   Std.Err  Z-value P(>|z|) Std.lv Std.all
visual ~-
  textual   0.408  0.074  5.552  0.000  0.459  0.459
  speed     0.262  0.056  4.660  0.000  0.471  0.471
textual ~-
  speed     0.173  0.049  3.518  0.000  0.283  0.283

Variances:
Estimate   Std.Err  Z-value P(>|z|) Std.lv Std.all
  x1       0.549  0.114  4.833  0.000  0.549  0.484
  x2       1.134  0.102 11.146  0.000  1.134  0.821
  x3       0.844  0.091  9.317  0.000  0.844  0.662
  x4       0.371  0.044  7.779  0.000  0.371  0.275
  x5       0.446  0.058  7.642  0.000  0.446  0.269
  x6       0.356  0.043  8.277  0.000  0.356  0.298
  x7       0.799  0.081  9.823  0.000  0.799  0.676
  x8       0.488  0.074  6.573  0.000  0.488  0.477
  x9       0.566  0.071  8.003  0.000  0.566  0.558
  visual   0.809  0.145  5.564  0.000  1.000  1.000
  textual   0.979  0.112  8.737  0.000  1.000  1.000
  speed     0.384  0.086  4.451  0.000  1.000  1.000

```



## Easier step

You can bypass all the steps by select **Example**. If you choose the example **Confirmatory Factor Analysis**, the equation will be made automatically. And then, you can press the **do Analysis** button.

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
파일 선택 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
 Confirmatory Factor Analysis  
 Structural Equation Model  
 Growth Curve Model  
 Partial Least Squares Model  
 Mediation Effect Analysis

Reset show help Data Export to CSV

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var right var add to equation reset the equation

operator  
 >  
 ~  
 -  
 =  
 <  
 >

Enter Latent Variable

The 2nd Equation  
 visual =~ x1 + x2 + x3  
 textual =~ x4 + x5 + x6  
 speed =~ x7 + x8 + x9

Mediation Effect Analysis

**4. Analysis/Summary Options**

Analysis options  
 fit a Structural Equation Model  
 fit a Confirmatory Factor Analysis Models  
 fit a Growth Curve Model  
 fit a Partial Least Squares Model  
 Edit Analysis Order  
 Edit Analysis Order

group  
 Select...  
 group.equal  
 se  
 default

Summary Options  
 standardized  
 fit.measures  
 rsquare  
 modindicis  
 Others

Figure 2.10: 12.png

## **Download Results**

You can download Report(1) as PDF(\*.pdf), HTML(\*.html,default) format. You can download plots(2) with png, svg or pdf format. You can download plot(s) as a powerpoint file(\*.pptx)(3).

Do Analysis

**1** download Report  PDF  HTML

**2** download Plot(s)  png  svg  pdf

**3** download ptx  wide  normal

width height  
7  5

## Results of Analysis

```

## Results of Analysis
fit<- sem(input$equation,data=df())
summary(fit,standardized= TRUE ,fit.measures= FALSE ,rsquare= FALSE ,modindices= FALSE )

lavaan (0.5-28) converged normally after  35 iterations

Number of observations               301
Estimator                           ML
Minimum Function Test Statistic    85.306
Degrees of freedom                  24
P-value (Chi-square)                0.000

Parameter Estimates:
Information                                Expected
Standard Errors                            Standard

Latent Variables:
Estimate   Std.Err  Z-value P(>|z|) Std.lv Std.all
visual =~
  x1      1.000
  x2     0.554  0.100  5.554  0.000  0.498  0.424
  x3     0.729  0.109  6.685  0.000  0.656  0.581
textual =~
  x4      1.000
  x5     1.113  0.065 17.814  0.000  1.102  0.855
  x6     0.926  0.055 16.703  0.000  0.917  0.838
speed =~
  x7      1.000
  x8     1.180  0.165  7.152  0.000  0.731  0.723
  x9     1.082  0.151  7.155  0.000  0.670  0.665

Covariances:
Estimate   Std.Err  Z-value P(>|z|) Std.lv Std.all
visual ~ textual
  textual   0.408  0.074  5.552  0.000  0.459  0.459
  speed     0.262  0.056  4.660  0.000  0.471  0.471
  textual ~ speed
  speed     0.173  0.049  3.518  0.000  0.283  0.283

Variances:
Estimate   Std.Err  Z-value P(>|z|) Std.lv Std.all
  x1      0.549  0.114  4.833  0.000  0.549  0.484
  x2      1.134  0.102 11.146  0.000  1.134  0.821
  x3      0.844  0.091  9.317  0.000  0.844  0.662
  x4      0.371  0.048  7.779  0.000  0.371  0.275
  x5      0.446  0.058  7.642  0.000  0.446  0.269
  x6      0.356  0.043  8.277  0.000  0.356  0.298
  x7      0.799  0.081  9.823  0.000  0.799  0.676
  x8      0.488  0.074  6.573  0.000  0.488  0.477
  x9      0.566  0.071  8.003  0.000  0.566  0.558
  visual   0.889  0.145  5.564  0.000  1.000  1.000
  textual   0.979  0.112  8.737  0.000  1.000  1.000
  speed     0.384  0.086  4.451  0.000  1.000  1.000

```

Figure 2.11: 13.png

# Chapter 3

## Analyze Your Own Data

In this chapter, I will discuss how to upload your own data to the Structural Equation Modeling(SEM) with R app and edit the data.

### Upload data

You can upload your own data by clicking the `choose file` button(1). In the popup window, you can select your own data file(2). A data file with Microsoft excel format(\*.xlsx) or comma-separate value format(\*.csv) is allowed. Because an excel file contains calculations, functions or macros may cause error, the \*.csv format is preferred. You can save an excel file with a \*.csv format by “save as...” menu on excel. The limitation of file size is 30 MB. After selection of you data file, press `choose` button(3).

After a few seconds, the upload completed. You should select the `uploaded_file`(1) among the `Select Data` radio buttons. Your file is displayed at `Edit Data` window.

### Edit data

You can edit your data by click a cell in the table. You can use your data table as a spreadsheet.

**1. Select/Load Data**

upload data(\*  
Choose File N

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
 None

Reset Example

**2. View Data**

CSV  
download the results

ADHD.csv  
Created 12/19/15, 4:07 PM  
Modified 12/19/15, 4:07 PM  
Last opened 12/19/15, 4:07 PM  
Add Tags...

	x1	x2	x3	x4	Pasteur	x5	x6
3	3	2	13	1	Pasteur	7	4.50
4	4	1	13	2	Pasteur	7	5.33
5	5	2	12	2	Pasteur	7	4.83
6	6	2	14	1	Pasteur	7	5.33
7	7	1	12	1	Pasteur	7	2.83
8	8	2	12	2	Pasteur	7	5.67
9	9	2	13	0	Pasteur	7	4.50
10	11	2	12	5	Pasteur	7	3.50
11	12	1	12	2	Pasteur	7	3.67
12	13	1	12	11	Pasteur	7	5.83
13	14	2	12	7	Pasteur	7	5.67
14	15	2	12	8	Pasteur	7	6.00

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  
Select...

operator  
 ~  
 ~  
 :=  
 ==  
 <  
 >

right var  
Select...

add to equation

reset the equation

equation

The 2nd Equation

Figure 3.1: 14.png

The screenshot shows the R-sem.com web application interface. At the top, there is a navigation bar with tabs for SEM, How to, Citation, and About. Below the navigation bar, the main content area is divided into three sections:

- 1. Select/Upload Data**: This section contains a file upload form. A red arrow points to the "uploaded\_file" option in the "Select Data" dropdown menu.
- 2. Edit Data**: This section displays a table of data with 14 rows and 13 columns. The columns are labeled: id, gender, age, general, symptoms, treatmt, cognitiv, emotion, deposit, attitude, classrm, inst. The data includes various numerical values.
- 3. Insert/Edit Structural Equation**: This section allows users to input structural equations. It has fields for left var, operator, right var, and equation. A red arrow points to the "operator" dropdown menu, which includes options like  $\hat{=}$ ,  $\sim$ ,  $\sim\sim$ ,  $\hat{=}$ ,  $\hat{=}$ ,  $<$ , and  $>$ .

Figure 3.2: 15.png

**R-sem.com**

**Structural Equation Modeling with R**

With this app, you can perform structural equation modeling with just one-click. You can perform the confirmatory factor analysis, fit a structural equation model, fit a growth curve model, and fit a partial least square(PLS) model. Additionally, you can obtain beautiful plots in png, svg or pdf format. You can download the results with html or PDF format. You can also download the powerpoint file with just one click.

Select Language  
 English  한국어(Korean)

**SEM** How to Citation About

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 Choose File ADHD.csv

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file  
Select Example

**2. Edit Data**

	id	gender	age	general	symptoms	treatmt	cognitiv	emotion	disposit	attitude	classrm	inst
1	1	1	4	8	7	3	30	21	49	31	26	
2	3	2	2	7	7	6	28	29	51	29	26	
3	4	2	2	8	8	5	26	28	39	28	28	
4	5	1	1	8	5	6	32	34	52	35	32	
5	6	1	2	3	5	3	19	23	38	23	15	
6	7	1	1	5	6	3	20	22	37	21	20	
7	8	2	3	11	8	7	26	21	40	21	17	
8	9	2	3	7	6	7	31	35	52	32	32	
9	10	2	3	8	5	5	25	30	45	28	20	
10	11	2	3	8	5	4	27	26	40	32	19	
11	12	1	2	3	4	6	26	29	48	29	13	
12	13	2	4	2	2	1	24	29	46	28	19	
13	14	1	2	5	4	3	24	26	41	24	20	
14	15	1	3	6	3	3	27	31	45	30	24	

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var

operator  
  $\approx$   
 ~  
  $\sim$   
 :=  
 ==  
 <  
 >

right var

equation

Figure 3.3: 16.png

## **Insert/remove row**

By right click the table, you can insert row or remove row.

R-sem.com

Keon-Woong

## Structural Equation Modeling with R

With this app, you can perform structural equation modeling with just one-click. You can perform the confirmatory factor analysis, fit a structural equation model, fit a growth curve model, and fit a partial least square(PLS) model. Additionally, you can obtain beautiful plots in png, svg or pdf format. You can download the results with html or PDF format. You can also download the powerpoint file with just one click.

Select Language  
 English  한국어(Korean)

[R-sem.com](#) [SEM](#) [How to](#) [Citation](#) [About](#)

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 Choose File ADHD.csv [Upload complete](#)

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	gender	age	general	symptoms	treatmt	cognitiv	emotion	deposit	attitude	classrm	inst
1	1	1	4	8	7	3	30	21	49	31	26	
2	3	2	2	7	7	6	28	29	51	29	26	
3	4	2	2	8	8	5	26	28	39	28	28	
4	5	1	1	8	5	6	32	34	52	35	32	
5	6	1	2	3	5	3	19	23	38	23	15	
6	7	1	1	5	6	3	20	22	37	21	20	
7	8	2	3	11	8	7	26	21	40	21	17	
8	9	2	3	7	6	7	31	35	52	32	32	
9	10	2	3	8	5	5	25	30	45	28	20	
10	11	2	3	8	5	4	27	26	40	32	19	
11	12	1	2	3	4	6	26	29	48	29	13	
12	13	2	4	2	2	1	24	29	46	28	19	
13	14	1	2	5	4	3	24	26	41	24	20	
14	15	1	3	6	3	3	27	31	45	30	24	

Insert row above  
 Insert row below  
 Remove row  
 Undo  
 Redo  
 Alignment  
 Insert column on the left  
 Insert column on the right  
 Remove column  
 Remove all rows except 1

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  operator   $\approx$  right var  [add to equation](#)

Enter Latent Variable

equation   
 The 2nd Equation

Figure 3.4: 17.png

## Chapter 4

# Insert/Edit Structural Equation

The classic Holzinger and Swineford (1939) dataset consists of mental ability test scores of seventh- and eighth-grade children from two different schools (Pasteur and Grant-White). In the original dataset (available in the MBESS package), there are scores for 26 tests. However, a smaller subset with 9 variables is more widely used in the literature. A Confirmatory Factor Analysis(CFA) model that is often proposed for these 9 variables consists of three latent variables (or factors), each with three indicators:

- a **visual** factor measured by 3 variables: x1, x2 and x3
- a **textual** factor measured by 3 variables: x4, x5 and x6
- a **speed** factor measured by 3 variables: x7, x8 and x9

You can insert/edit the structural equation easily by the following steps.

1. Choose left side variable(s) or enter the latent variable
2. Select operator
3. Choose right side variable(s)

(1) First, please enter the latent variable **visual** in the text input(arrow).

As you enter the latent variable **visual**, the left side of equation will be made and the operator **=~** will be added(arrow). The operator **=~** is used for latent variable definition which means **is measured by**.

The current set of operators is summarized in the table below.

formula type	operator	mnemonic
latent variable selection	$=\sim$	is measured by
regression	$\sim$	is regressed on
(residual) (co)variance	$\sim\sim$	is correlated with
intercept	$\sim 1$	intercept
defined parameter	$:=$	is predefined as
equality constraint	$==$	equals
non-equality constraint	$<$	is less than
non-equality constraint	$>$	is greater than

- (2) And then, please select the right side variables - `x1,x2` and `x3` - among the variables displayed in the `selectInput`.
- (3) After selection of three variables, press the `add to equation` button.

The temporary equation just made will be added to the equation. The latent variable input box(1), temporary equation(2) and the `selectInput`(for right side variables) will be initialized.

Please repeat the step (1)-(3) to add the equation:

```
textual =~ x4 + x5 + x6
speed =~ x7 + x8 + x9
```

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var

operator  
  $\equiv$   
  $\sim$   
  $\sim\sim$   
  $\models$   
  $\equiv\equiv$   
  $<$   
  $>$

right var

equation

Mediation Effect Analysis

Figure 4.1: 4.png

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

**3. Insert/Edit Structural Equation**

visual =~  
**left var**   
**Enter Latent Variable**   
**operator**  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

**right var**   
  
id  
sex  
ageyr  
agemo  
school  
grade  
x1  
x2

equation  
The 2nd Equation

Mediation Effect Analysis

Figure 4.2: 5.png

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
 Confirmatory Factor Analysis

Reset

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

2 visual =~

left var

operator  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

Enter Latent Variable  
 visual

right var  
 **add to equation** red arrow points here

equation

reset the equation

The 2nd Equation

1

□ Mediation Effect Analysis

Figure 4.3: 6.png

### 3. Insert/Edit Structural Equation

visual =~ x1+x2+x3

left var

operator  
 =~  
 ~  
 ~~  
 :=  
 ==  
 <  
 >

Enter Latent Variable  
 visual

right var  
 **x1 x2 x3 | add to equation** red arrow points here

equation

reset the equation

The 2nd Equation

x4  
x5

Figure 4.4: 7.png

### 3. Insert/Edit Structural Equation

2 Select variables and operators to make a equation !

left var

Enter Latent Variable

operator   $\approx$    $\sim$    $\approx\approx$    $\coloneqq$    $\equiv$    $<$    $>$

right var

visual  $\approx x_1+x_2+x_3$

The 2nd Equation

This figure shows a user interface for defining a structural equation. The process is numbered 1 through 3. Step 1, 'Enter Latent Variable', has a red number '1' over a text input field containing '1'. Step 2, 'Select variables and operators to make a equation !', has a red number '2' over a button labeled 'Select...'. Step 3, 'Insert/Edit Structural Equation', has a red number '3' over the 'operator' section which contains a radio button for the approximate symbol ( $\approx$ ). To the right, there's a preview area showing the visual representation of the equation as  $\approx x_1+x_2+x_3$ , along with buttons for 'add to equation' and 'reset the equation'.

Figure 4.5: 8.png

# Chapter 5

## Direct edit the equation

You can directly type the equation in the equation window just as a word processor.

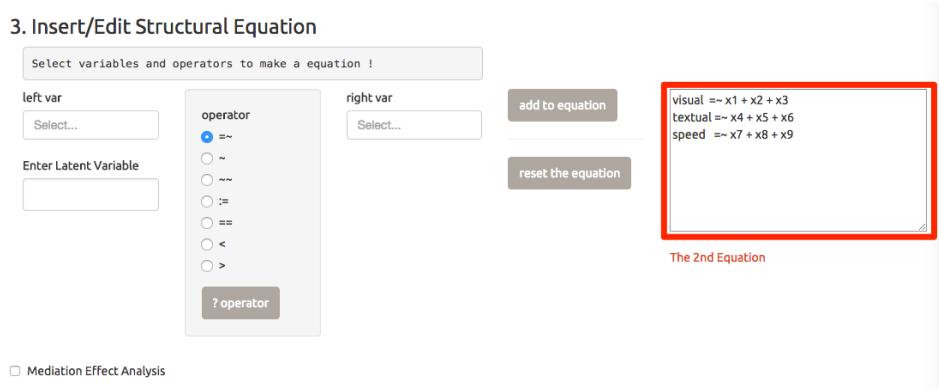


Figure 5.1: 18.png



# Chapter 6

## Edit A Mediation Effect Equation

In this chapter, I will use the data and explanation described in lavaan homepage(<http://lavaan.ugent.be/tutorial/mediation.html>).

Consider a classical mediation setup with three variables: Y is the dependent variable, X is the predictor, and M is a mediator. For illustration, we create a toy dataset containing these three variables, and fit a path analysis model that includes the direct effect of X on Y and the indirect effect of X on Y via M.

Please select `example2` among the `select Data` radio buttons(1). If we wanted to konw how the data be made, just click the `show data Help` button(arro).

### check the Mediation Effect Analysis

To insert the mediation effect easily, please select the `Mediation effect Analysis` checkbox(arro).

### Select variables

Please select X as a independent variable, select M as a mediator and select Y as a response variable. Press `Make Equation` button and you can get the mediation

With this app, you can fit a structural equation model, fit a growth model, with html or PDF format.

Select Language: English (한국어)

Sample Data Made By the Following Code

```
set.seed(1234)
X <- rnorm(100)
M <- 0.5*X + rnorm(100)
Y <- 0.7*M + rnorm(100)
example2 <- data.frame(X, Y, M)
```

**1. Select/**

upload data(\*.xlsx or \*.csv)  
Choose File: No file chosen

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
**1**  example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
None

Reset Example

**2. View Data**

	X	Y	M
1	-1.21	0.35	-0.19
2	0.28	0.46	-0.34
3	1.08	0.61	0.61
4	-2.35	-0.47	-1.68
5	0.43	-0.12	-0.61
6	0.51	1.05	0.42
7	-0.57	1.01	-1.18
8	-0.55	1.04	-0.11
9	-0.56	0.08	0.07
10	-0.89	-1.46	-0.50
11	-0.48	0.11	-0.43
12	-1.00	-1.20	-1.15
13	-0.78	0.45	-1.50
14	0.06	-0.99	0.88

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  
Select...

operator  
 ~  
 ~  
 :  
 ==  
 <  
 >

right var  
Select...

add to equation

reset the equation

equation

The 2nd Equation

Figure 6.1: 19.png

**R-sem.com** SEM How to Citation About Keon-Woong

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
Choose File No file chosen

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
None

Reset Example

**2. Edit Data**

	X	Y	M
1	-1.21	0.35	-0.19
2	0.28	0.46	-0.34
3	1.08	0.61	0.61
4	-2.35	-0.47	-1.68
5	0.43	-0.12	-0.61
6	0.51	1.05	0.42
7	-0.57	1.01	-1.18
8	-0.55	1.04	-0.11
9	-0.56	0.98	0.07
10	-0.89	-1.46	-0.50
11	-0.48	0.11	-0.43
12	-1.00	-1.20	-1.15
13	-0.78	0.45	-1.50
14	0.06	-0.99	0.88

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  
Select...  
Enter Latent Variable

operator  
  $\equiv$   
  $\sim$   
  $\sim\sim$   
  $\doteq$   
  $\equiv\equiv$   
  $<$   
  $>$

? operator

right var  
Select...  
add to equation  
reset the equation

equation

The 2nd Equation

**1**  Mediation Effect Analysis

**4. Analysis/Summary Options**

Analysis options  
 fit a Structural Equation Model  
 fit a Confirmatory Factor Analysis Models

group  
Select...

Summary Options  
 standardized  
 fit measures

Figure 6.2: 20.png

### 3. Insert/Edit Structural Equation

Select variables and operators to make a equation !

left var: Select... Enter Latent Variable

operator:   $\equiv$

right var: Select... add to equation reset the equation

Y  $\sim$  b\*M + c\*X  
M  $\sim$  a\*X  
indirect effect:=a\*b  
total effect:=c+(a\*b)

Mediation Effect Analysis

1 independent variable: X  
2 mediator: M  
3 response variable: Y

show correlation  
 perform sober test

Make Equation

The 2nd Equation

Figure 6.3: 21.png

equation (arrow).

Of course, you can type the equation directly in the equation textbox.

## Do analysis

Press the **do Analysis** button and you can get the analysis result. You can get the result of the total effect and indirect effect(1) as well as the result of so-called Sobel test for the mediation effect(2).

You can also get the plot for mediation effect.

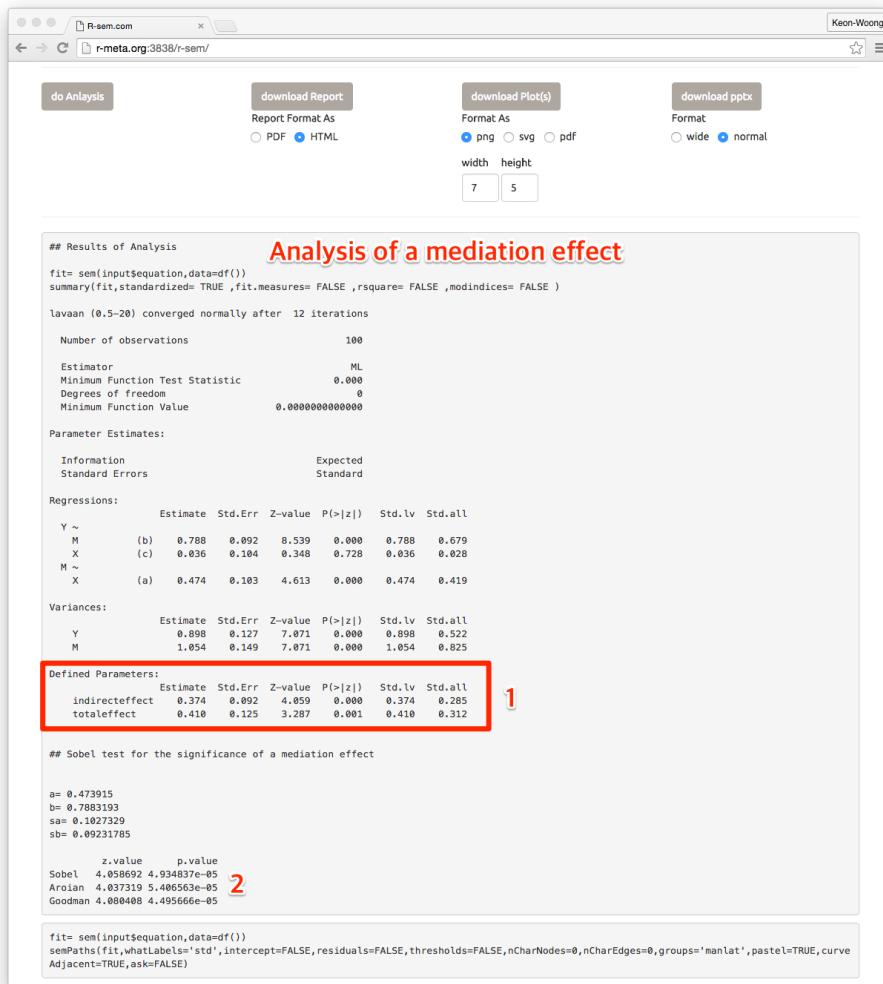


Figure 6.4: 22.png

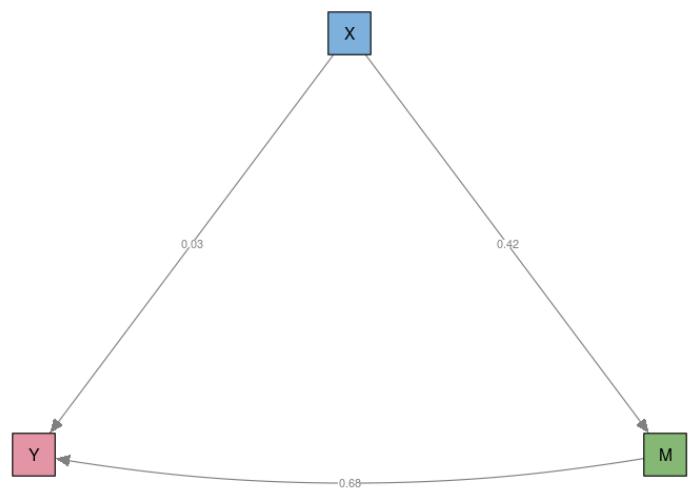


Figure 6.5: 23.png

## Chapter 7

### A complete example

In this chapter, I will show the complete example using the ADHD data. This data is a dataset contains measures about the 334 teacher's knowlege, empathy and intervention about attention-deficit hyperactivity disorder(ADHD).The figure below contains a graphical representation of the model that we want to fit.

#### Do it at once

You can finish the analysis using above model at once. Select **ADHA data** among **Select Example** select Input. By selecting the example, the data will be changed to **ADHD** and the equation will be made automatically(arrows).

Press the **do Analysis** button and you will be able to get the anlaysis results and plot.

Press the **reset example** button to reset the equation. I will show you how to make the structural equations in this study.

#### Step 1. Define latent variables

First of all, let's start from defining the latent variables.

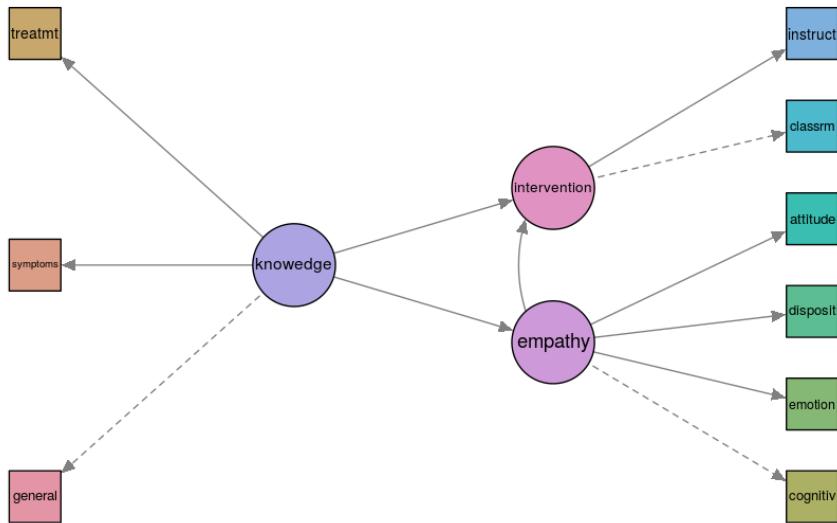


Figure 7.1: ADHD2.png

### Define the latent variable knowledge

Please type the **knowledge** in the Enter latent variable textbox. The operator **=~** will be added to the left variable.

Select the **general**,**symptoms** and **treatmt** among the right var select input. The right var(s) you selected is added to the temporary equation. Press the add to equation button(arrow).

The temporary equation is added to equation.

### Define latent variables - empathy and intervention

Please define the latent variable **empathy**. The **empathy** is measured by **attitude**, **disposit**, **emotion** and **cognitiv**. The **intervention** is measured by **classrm** and **instruct**.

```
empathy =~ cognitiv + emotion + disposit + attitude
```

```
intervention =~ classrm + instruct
```

http://127.0.0.1:6101 | Open in Browser | ↗

R-sem.com SEM How to → Citation About

→/ownCloud/Documents/r-sem - Shiry

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
Choose File no file selected

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
ADHD data

Reset Example

**2. Edit Data**

	id	gender	age	general	symptoms	treatmt	cognitiv	emotion	disposit	attitude	classrm	instruct
1	1	1	4	8	7	3	30	21	49	31	26	25
2	3	2	2	7	7	6	28	29	51	29	26	25
3	4	2	2	8	8	5	26	28	39	28	28	31
4	5	1	1	8	5	6	32	34	52	35	32	26
5	6	1	2	3	5	3	19	23	38	23	15	17
6	7	1	1	5	6	3	20	22	37	21	20	19
7	8	2	3	11	8	7	26	21	40	21	17	16
8	9	2	3	7	6	7	31	35	52	32	32	24
9	10	2	3	8	5	5	25	30	45	28	20	19
10	11	2	3	8	5	4	27	26	40	32	19	15
11	12	1	2	3	4	6	26	29	48	29	13	18
12	13	2	4	2	2	1	24	29	46	28	19	19
13	14	1	2	5	4	3	24	26	41	24	20	18
14	15	1	3	6	3	3	27	31	45	30	24	24

Show help Data Export to CSV

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  
Select...

Enter Latent Variable

operator  
  $\Rightarrow$   
 ~  
  $\sim$   
  $\neq$   
  $\leq$   
  $\geq$

right var  
Select...

add to equation

reset the equation

knowledge  $\Rightarrow$  general+symptoms+treatmt  
 empathy  $\Leftarrow$   
 cognitiv+emotion+disposit+attitude  
 intervention  $\Leftarrow$  classrm+instruct  
 intervention  $\rightarrow$  empathy + c\*knowledge  
 empathy  $\rightarrow$  a\*knowledge  
 indirect effect:=a\*b  
 total effect:=c\*(a\*b)

The 2nd Equation

Figure 7.2: 24.png

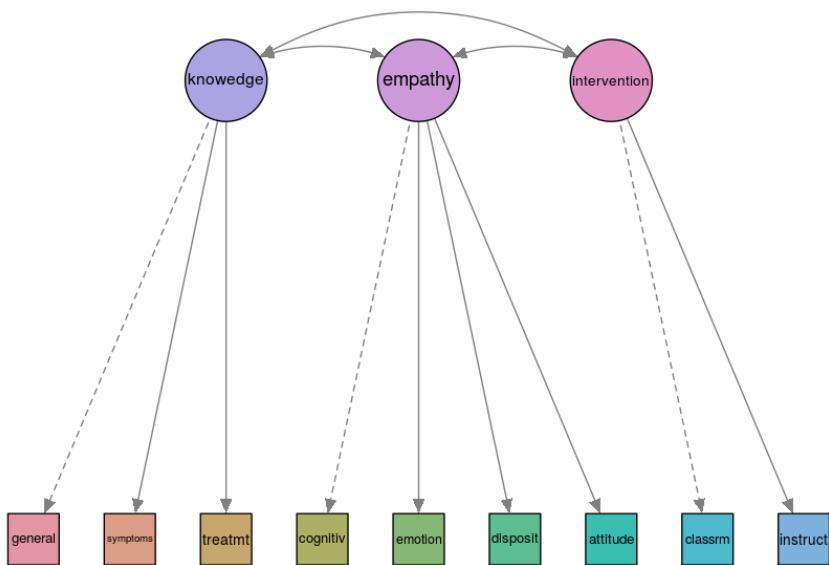


Figure 7.3: ADHD1.png

### 3. Insert/Edit Structural Equation

left var
Select...
right var
Select...

**Enter Latent Variable**

operator
add to equation

?
operator
reset the equation

equation

The 2nd Equation

Mediation Effect Analysis

Figure 7.4: 25.png

### 3. Insert/Edit Structural Equation

knowledge ~ general+symptoms+treatmt

**left var**  
Select...  
**Enter Latent Variable**  
knowledge

**operator**  
? operator

**right var**  
general symptoms  
treatmt |  
id  
gender  
age  
cognitiv  
emotion  
disposit  
attitude  
mood

**add to equation**   
**reset the equation**

equation

The 2nd Equation

Mediation Effect Analysis

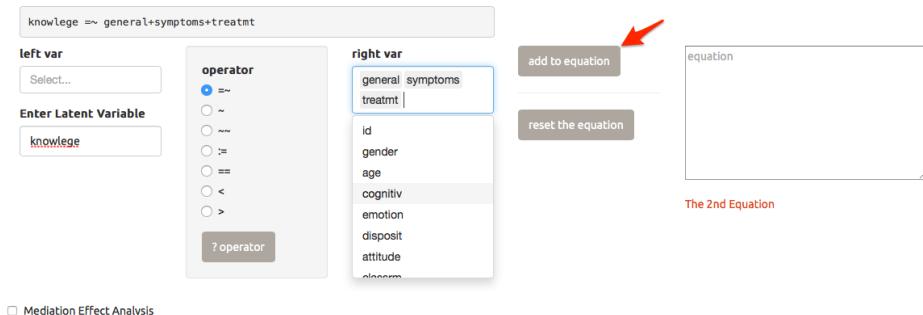


Figure 7.5: 26.png

### 3. Insert/Edit Structural Equation

Select variables and operators to make a equation !

**left var**  
Select...  
**Enter Latent Variable**  
knowledge

**operator**  
? operator

**right var**  
Select...  
**add to equation**  
**reset the equation**

knowledge ~ general+symptoms+treatmt

The 2nd Equation

Mediation Effect Analysis

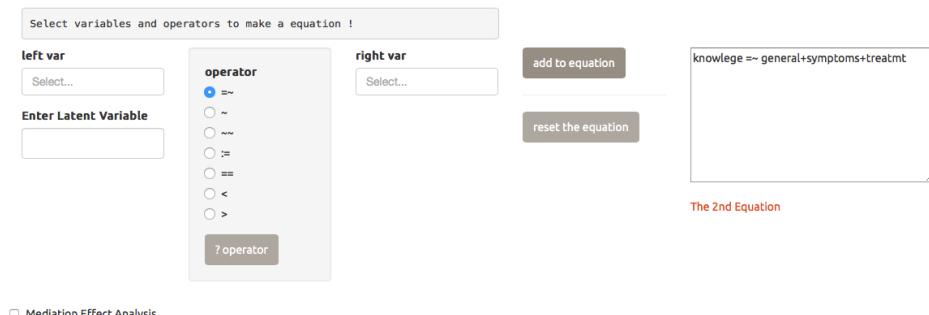


Figure 7.6: 27.png

~ /ownCloud/Documents/r-sem - Shiny

http://127.0.0.1:6101 | Open in Browser | ⌂

[Publish](#)

### 3. Insert/Edit Structural Equation

Select variables and operators to make a equation !

<b>left var</b> Select...	<b>operator</b> <input checked="" type="radio"/> = <input type="radio"/> ~ <input type="radio"/> ~ <input type="radio"/> != <input type="radio"/> == <input type="radio"/> < <input type="radio"/> >	<b>right var</b> Select...	<a href="#">add to equation</a>
		<a href="#">reset the equation</a>	

knowledge =~ general+symptoms+treatmt  
 empathy =~ cognition+emotion+disposit+attitude  
 intervention =~ classrm+instruct

The 2nd Equation

Mediation Effect Analysis

### 4. Analysis/Summary Options

<b>Analysis options</b> <input checked="" type="radio"/> Fit a Structural Equation Model <input type="radio"/> Fit a Confirmatory Factor Analysis Models <input type="radio"/> Fit a Growth Curve Model <input type="radio"/> Fit a Partial Least Squares Model	<b>group</b> Select... group.equal	<b>Summary Options</b> <input checked="" type="checkbox"/> standardized <input type="checkbox"/> fit.measures <input type="checkbox"/> rsquare <input type="checkbox"/> modindics
<b>Edit Analysis Order</b> <input type="checkbox"/> Edit Analysis Order	<b>se</b> default	<b>Other Options</b> <input type="checkbox"/> show coefficient <input type="checkbox"/> show measurement invariance

### 5. Plot Options

[Plot Options show/hide](#)

Plot Preview



Figure 7.7: 28.png

After completion of defining the latent variables, the equation should be like as follows.

If you select the plot preview checkbox (arrow), you will be able to get the following plot.

## Step 2. Define the mediation effect

Please select the **Mediation Effect Analysis** checkbox(1). Select **knowledge** as the independent variable(2), select **empathy** as mediator(3) and select **intervention** as the response variable(4). And press the **Make Equation** button.

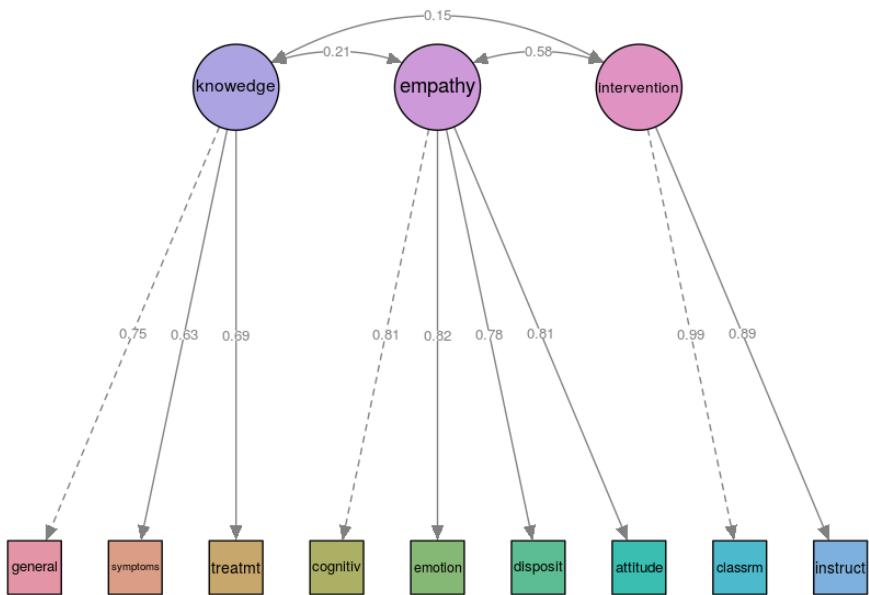


Figure 7.8: 29.png

The mediation effect equation will be added to the equation. The final equation will be as follows.

```

knowledge =~ general+symptoms+treatmt
empathy =~ cognitiv+emotion+disposit+attitude
intervention =~ classrm+instruct

intervention ~ b*empathy + c*knowledge
empathy ~ a*knowledge
indirect effect:=a*b
total effect:=c+(a*b)

```

By pressing the **do Analysis** button, you will get the results of analysis as well as the following plot.

### 3. Insert/Edit Structural Equation

Select variables and operators to make a equation !

**left var** Select...      **operator**   $\approx$       **right var** Select...      **add to equation**

**Enter Latent Variable**

**reset the equation**

knowledge  $\approx$  general+symptoms+treatmt  
empathy  $\approx$  cognitiv+emotion+disposit+attitude  
intervention  $\approx$  classrm+instruct

The 2nd Equation

1  Mediation Effect Analysis

2 independent variable knowledge

3 mediator empathy

4 response variable intervention

show correlation

perform sober test

**Make Equation**

Figure 7.9: 30.png

```

summary(fit,standardized= TRUE ,fit.measures= FALSE ,rsquare= FALSE ,modindices= FALSE )

lavaan (0.5-20) converged normally after  68 iterations

Number of observations                           334

Estimator                                         ML
Minimum Function Test Statistic                  31.185
Degrees of freedom                                24
P-value (Chi-square)                            0.149

Parameter Estimates:

Information                                         Expected
Standard Errors                                     Standard

Latent Variables:
    Estimate Std.Err Z-value P(>|z|) Std.lv Std.all
knowledge ~
  general      1.000
  symptoms     0.582  0.068  8.508  0.000  1.077  0.635
  treatmt     0.746  0.066  8.631  0.000  1.380  0.692
  empathy~
  cognitiv     1.000
  emotion      0.958  0.058  16.371 0.000  2.558  0.821
  disposit      1.491  0.091  15.396 0.000  3.772  0.781
  attitude      0.964  0.068  16.155 0.000  2.593  0.812
intervention ~
  classrm      1.000
  instruct     0.853  0.046  18.628 0.000  4.934  0.886

Regressions:
    Estimate Std.Err Z-value P(>|z|) Std.lv Std.all
intervention ~
  empathy (b)  1.241  0.128  10.356 0.000  0.578  0.578
  knowledge (c) 0.186  0.174  0.688  0.543  0.034  0.034
  empathy ~
  knowledge (a) 0.384  0.100  3.033  0.002  0.209  0.209

Variances:
    Estimate Std.Err Z-value P(>|z|) Std.lv Std.all
  general      2.691  0.485  6.649  0.000  2.691  0.448
  symptoms     1.718  0.179  9.626  0.000  1.718  0.597
  treatmt     2.076  0.252  8.244  0.000  2.076  0.522
  cognitiv     3.735  0.386  9.683  0.000  3.735  0.348
  emotion      3.100  0.400  7.750  0.000  3.100  0.366
  disposit     9.110  0.682  10.330 0.000  9.110  0.398
  attitude      3.480  0.359  9.692  0.000  3.480  0.341
  classrm      0.652  1.584  0.433  0.665  0.652  0.019
  instruct     6.638  1.289  5.488  0.000  6.638  0.214
  knowledge     3.423  0.549  6.240  0.000  1.000  1.000
  empathy      6.934  0.812  8.542  0.000  0.956  0.956
  intervention 21.955  2.353  9.331  0.000  0.657  0.657

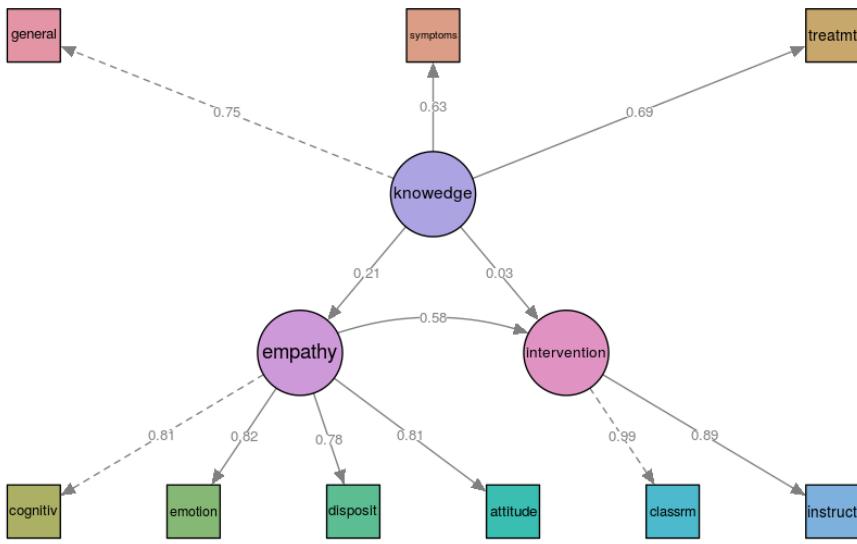
Defined Parameters:
    Estimate Std.Err Z-value P(>|z|) Std.lv Std.all
  indirecteffect 0.377  0.128  2.952  0.003  0.121  0.121
  totaleffect     0.483  0.202  2.393  0.017  0.154  0.154

## Sobel test for the significance of a mediation effect

a= 0.7458843
b= 1
sa= 0.0864117
sb= 0

      z.value   p.value
Sobel  0.630826 6.001075e-18
Aroian 0.630826 6.001875e-18
Goodman 0.630826 6.051075e-18

```



To customize your plot, please read the `customize you plot` chapter.

In this chapter, I will show you how to customize your plot. Please select the `Structural Equation Model` among the `Select Example` `selectInput`. This selection will set the data to `Political Democracy`(arrow) and make the structural equation as follows(arrow).

```
# measurement model
ind60 =~ x1 + x2 + x3
dem60 =~ y1 + y2 + y3 + y4
dem65 =~ y5 + y6 + y7 + y8
# regressions
dem60 ~ ind60
dem65 ~ ind60 + dem60
# residual correlations
y1 ~~ y5
y2 ~~ y4 + y6
y3 ~~ y7
y4 ~~ y8
y6 ~~ y8
```

**Structural Equation Modeling with R**

With this app, you can perform structural equation modeling with just one-click. You can perform the confirmatory factor analysis, fit a structural equation model, fit a growth curve model, and fit a partial least square(PLS) model. Additionally, you can obtain beautiful plots in png, svg or pdf format. You can download the results with html or PDF format. You can also download the powerpoint file with just one click.

Select Language  
 English  한국어(Korean)

R-sem.com SEM How to Citation About

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
 Structural Equation Model

**2. Edit Data**

	y1	y2	y3	y4	y5	y6	y7	y8	x1	x2	x3
1	2.50	0.00	3.33	0.00	1.25	0.00	3.73	3.33	4.44	3.64	2.56
2	1.25	0.00	3.33	0.00	6.25	1.10	6.67	0.74	5.38	5.06	3.57
3	7.50	8.80	10.00	9.20	8.75	8.09	10.00	8.21	5.96	6.26	5.22
4	8.90	8.80	10.00	9.20	8.91	8.13	10.00	4.62	6.29	7.57	6.27
5	10.00	3.33	10.00	6.67	7.50	3.33	10.00	6.67	5.86	6.82	4.57
6	7.50	3.33	6.67	6.67	6.25	1.10	6.67	0.37	5.53	5.14	3.89
7	7.50	3.33	6.67	6.67	5.00	2.23	8.27	1.49	5.31	5.08	3.32
8	7.50	2.23	10.00	1.50	6.25	3.33	10.00	6.67	5.35	4.85	4.26
9	2.50	3.33	3.33	3.33	6.25	3.33	3.33	3.33	5.52	5.24	4.12
10	10.00	6.67	10.00	8.90	8.75	6.67	10.00	10.00	5.83	5.37	4.45
11	7.50	3.33	10.00	6.67	8.75	3.33	10.00	6.67	5.92	6.42	3.79
12	7.50	3.33	6.67	6.67	8.75	3.33	6.67	6.67	5.40	6.25	4.54
13	7.50	3.33	10.00	6.67	7.50	3.33	6.67	10.00	6.62	7.87	4.91
14	7.50	7.77	10.00	6.67	7.50	0.00	10.00	0.00	5.20	5.23	4.56

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var

operator  
  $\Rightarrow$   
 ~  
 ...  
  $\bowtie$   
 ==  
 <  
 >

right var

# measurement model  
 ind60 ~ x1 + x2 + x3  
 dem60 ~ y1 + y2 + y3 + y4  
 dem65 ~ y5 + y6 + y7 + y8  
# regressions  
 dem65 ~ ind60 + dem60  
# residual correlations

The 2nd Equation

Figure 7.10: 33.png



# Chapter 8

## Select Plot Preview

Please Select the Plot Preview checkbox. You can see the Plot. To customize your plot, Press the Plot Options show/hide(arrows).

In the Plot Options window, you can adjust all about the plots.

If you wanted your plot in black and white, just delete the groups(7) selectInput. To rotate your plot, please select the rotation(6) from 1 to 2. Rotation is an integer indicating the rotation of the layout when “tree” or “tree2” layout is used. 1, 2, 3 and 4 indicate that exogenous variables are placed at the top, left side, bottom and right side respectively.

Again, select the `manlat` among groups selectInput(1). You can hide your label by select `hide` among whatLabels selectInput(2).

You can select `col` among what selectInput and `est` among whatLabels selectInput to label unstandardized estimates.

You can select `std` and `col` among what selectInput(1) and select `std` among whatLabel selectInput(2) to label standardized estimate. In this example, the `tree2` layout was selected(3).

Other possible layouts are circle, spring and circle2. In this example, `circle` layout was selected(1) and `residual` checkbox was selected(3).

In this chapter, I will show you how to perform multiple group analysis.

## 5. Plot Options

Plot Options show/hide 

Plot Preview

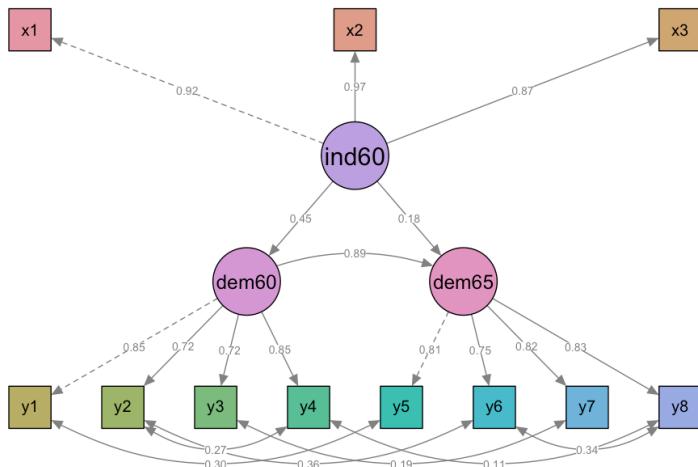


Figure 8.1: 34.png

## Select Data and Edit Structural Equation

Please select the Confirmatory Factor Analysis among the Select Example selectInput. This selection will set the data to HolzingerSwineford1939(arrow) and make the structural equation as follows(arrow).

```
visual  =~ x1 + x2 + x3
textual =~ x4 + x5 + x6
speed   =~ x7 + x8 + x9
```

## Select group option

Among the Analysis/Summary Options, please select school as a group variable(1). Press do Analysis button(arrow).

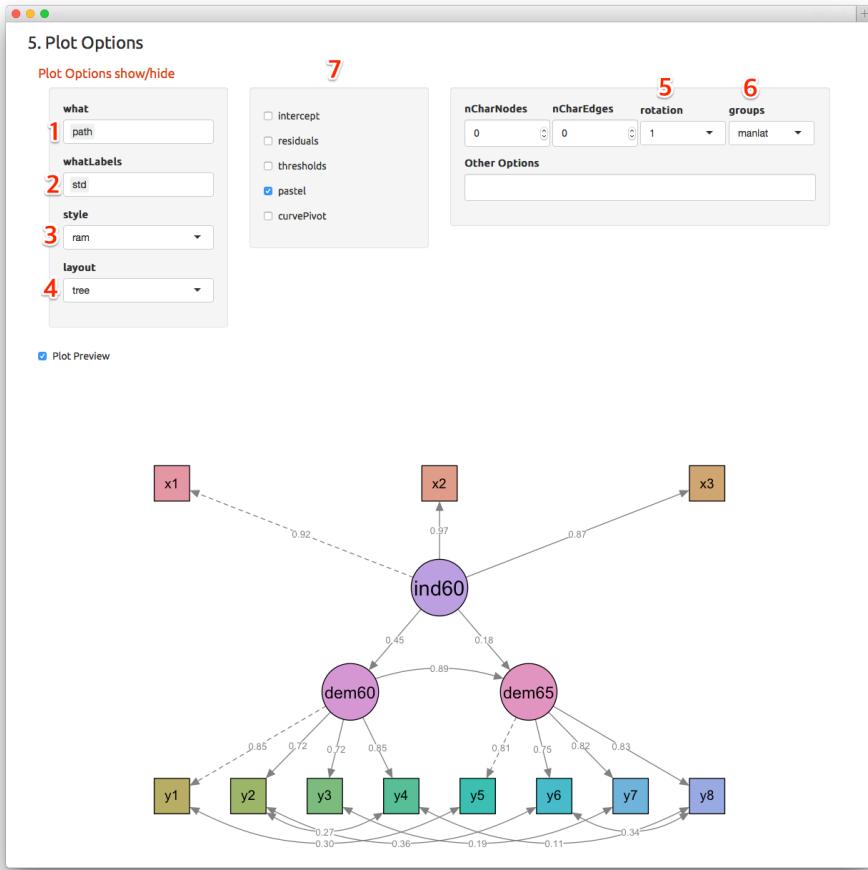


Figure 8.2: 35.png

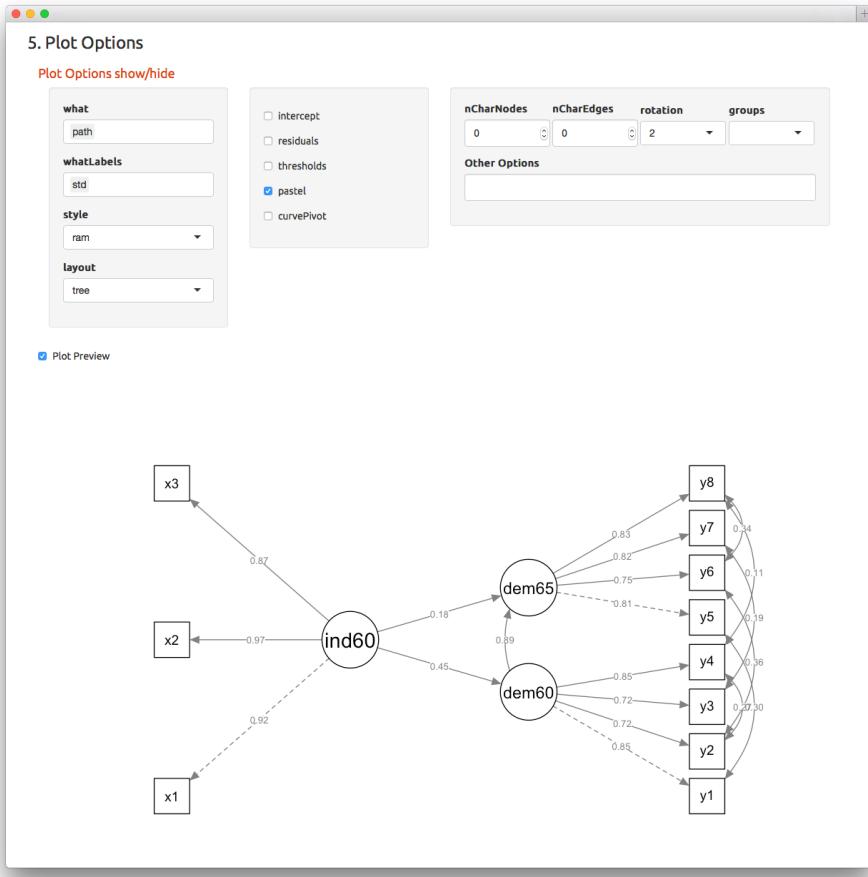


Figure 8.3: 36.png

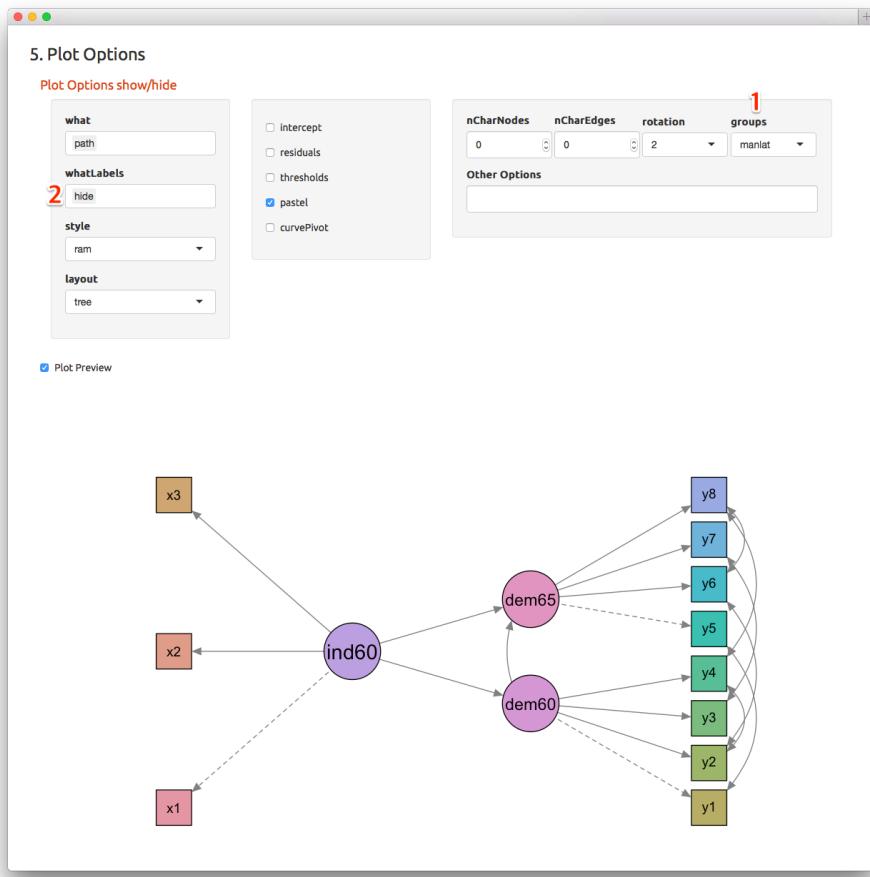


Figure 8.4: 37.png

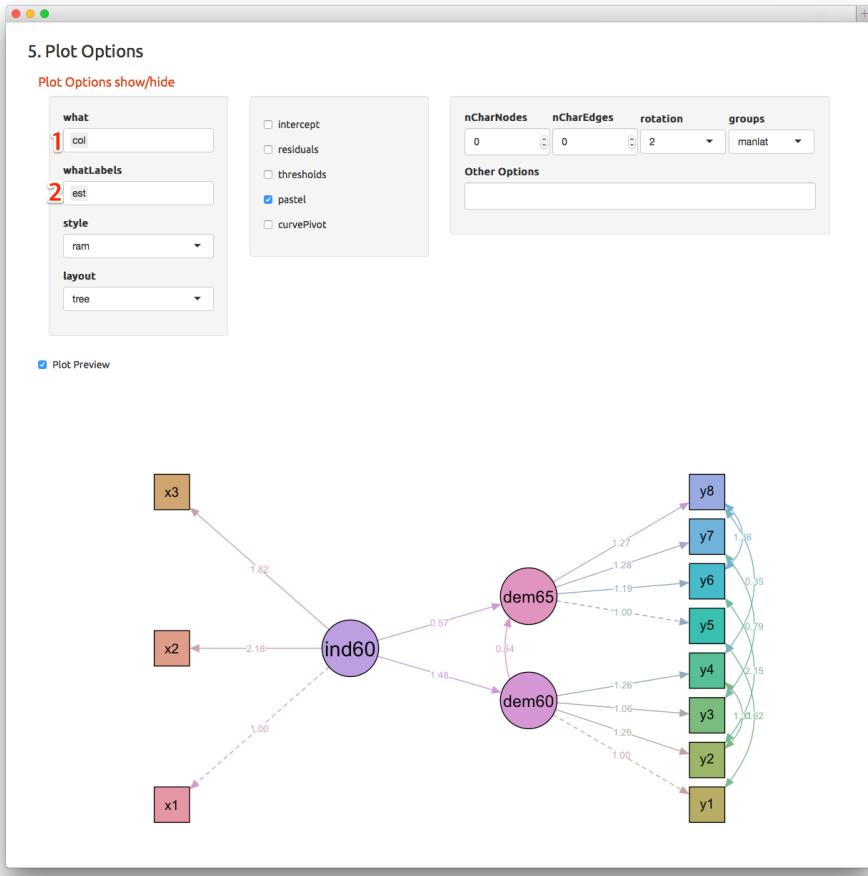


Figure 8.5: 38.png

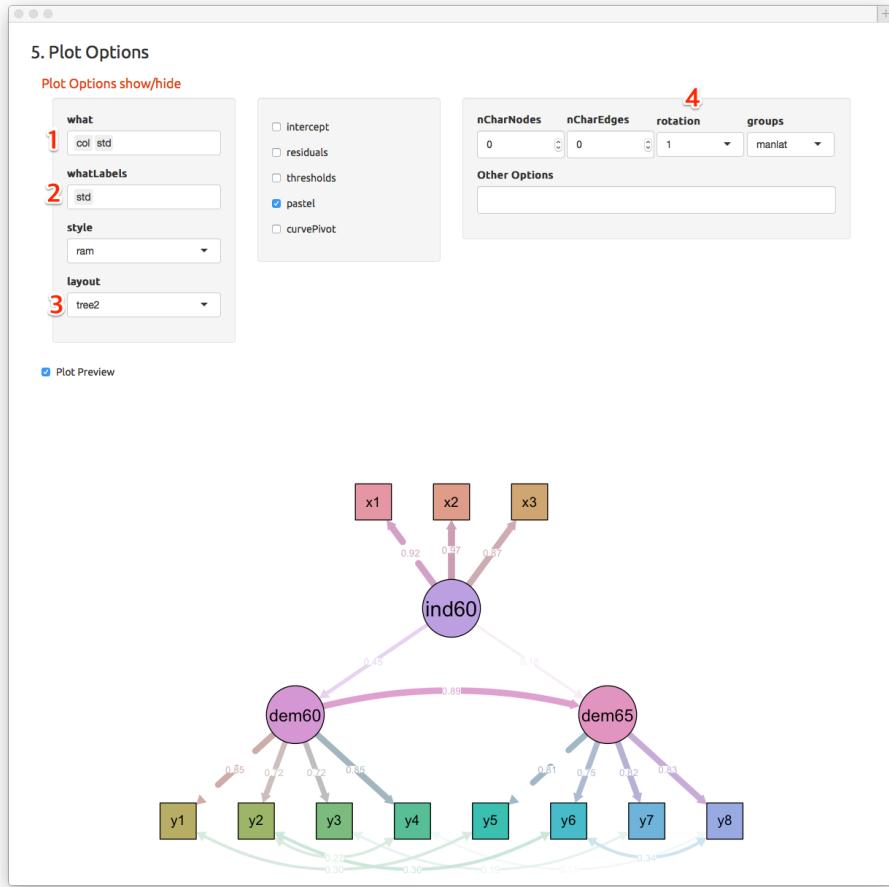


Figure 8.6: 39.png

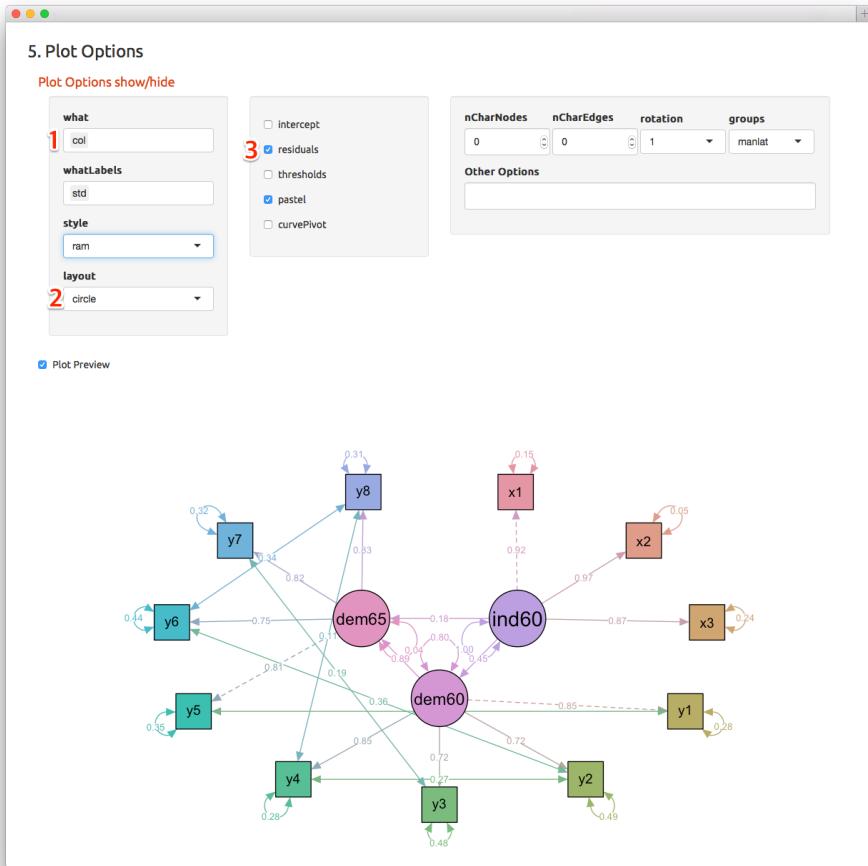


Figure 8.7: 40.png

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
 no file selected

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example

**2. Edit Data**

	id	sex	ageyr	agemo	school	grade	x1	x2	x3	x4	x5	x6
1	1	1	13	1	Pasteur	7	3.33	7.75	0.38	2.33	5.75	1.29
2	2	2	13	7	Pasteur	7	5.33	5.25	2.13	1.67	3.00	1.29
3	3	2	13	1	Pasteur	7	4.50	5.25	1.88	1.00	1.75	0.43
4	4	1	13	2	Pasteur	7	5.33	7.75	3.00	2.67	4.50	2.43
5	5	2	12	2	Pasteur	7	4.83	4.75	0.88	2.67	4.00	2.57
6	6	2	14	1	Pasteur	7	5.33	5.00	2.25	1.00	3.00	0.86
7	7	1	12	1	Pasteur	7	2.83	6.00	1.00	3.33	6.00	2.86
8	8	2	12	2	Pasteur	7	5.67	6.25	1.88	3.67	4.25	1.29
9	9	2	13	0	Pasteur	7	4.50	5.75	1.50	2.67	5.75	2.71
10	11	2	12	5	Pasteur	7	3.50	5.25	0.75	2.67	5.00	2.57
11	12	1	12	2	Pasteur	7	3.67	5.75	2.00	2.00	3.50	1.57
12	13	1	12	11	Pasteur	7	5.83	6.00	2.88	2.67	4.50	2.71
13	14	2	12	7	Pasteur	7	5.67	4.50	4.13	2.67	4.00	2.29
14	15	2	12	8	Pasteur	7	6.00	5.50	1.75	4.67	4.00	1.57

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var

operator  
  $\approx$   
  $\sim$   
  $\approx\approx$   
  $\doteq$   
  $\doteq\doteq$   
  $<$   
  $>$

Enter Latent Variable

right var

visual  $\approx x_1 + x_2 + x_3$   
textual  $\approx x_4 + x_5 + x_6$   
speed  $\approx x_7 + x_8 + x_9$

The 2nd Equation

□ Mediation Effect Analysis

Figure 8.8: 41.png

#### 4. Analysis/Summary Options

The screenshot shows the 'Analysis/Summary Options' section with three main panels:

- Analysis options:**
  - fit a Structural Equation Model
  - fit a Confirmatory Factor Analysis Models
  - fit a Growth Curve Model
  - fit a Partial Least Squares Model
- Edit Analysis Order:**
  - Edit Analysis Order
- group:** school  
group.equal:  
se: default
- Summary Options:**
  - standardized
  - fit.measures
  - rsquare
  - modindices
- Other Options:**
  - show coefficient
  - show measurement invariance

#### 5. Plot Options

The screenshot shows the 'Plot Options' interface with several buttons and controls:

- do Anlaysis** (highlighted with a red arrow)
- download Report**
- Report Format As:**
  - PDF
  - HTML
- download Plot(s)**
- Format As:**
  - png
  - svg
  - pdf
- Format:**
  - wide
  - normal
- width height:** 7, 5
- download pptx**

Figure 8.9: 42.png

## Results of Analysis(1)

You can get the results of analysis followed by results for group 1 and group 2 separately.

## Results of Analysis(2)

## Results of Analysis(3)

## Plots for Multiple Groups

You can also get the resultant plots separately (In this example, you will be able to get 2 plots).

## 5. Plot Options

[Plot Options show/hide](#)

Plot Preview

do Analysis
download Report
download Plot(s)
download pptx

Report Format As
Format As

PDF
 HTML
 png
 svg
 pdf

Format

wide
 normal

width
height

7
5

Results of Analysis

```
## Results of Analysis
fit<-cfa(input$equation,data=df(),group='school')
summary(fit,standardized= TRUE ,fit.measures= FALSE ,rsquare= FALSE ,modindices= FALSE )
lavaan (0.5-20) converged normally after  57 iterations

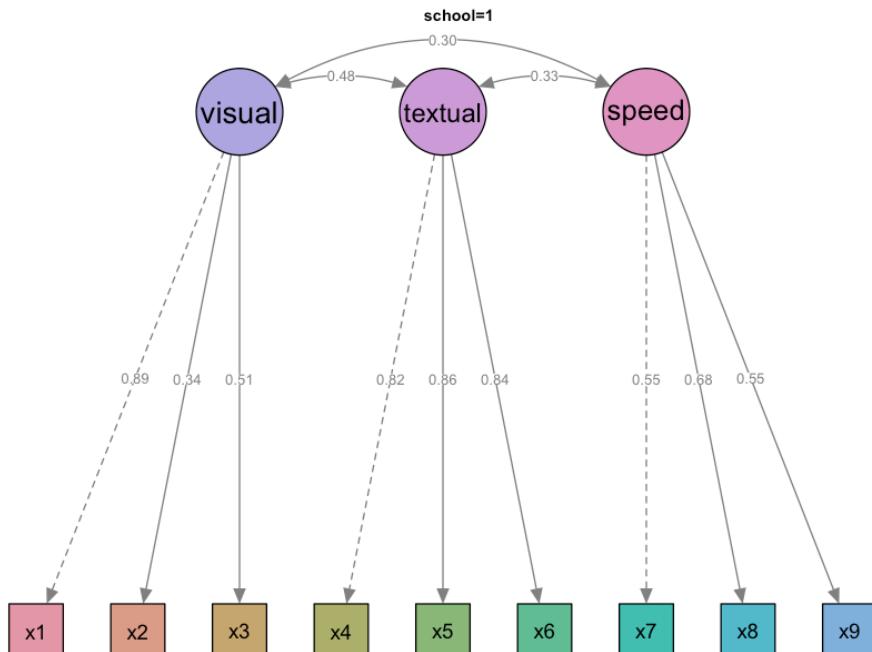
Number of observations per group
Pasteur                      156
Grant-White                   145

Estimator                     ML
Minimum Function Test Statistic 115.851
Degrees of freedom                  48
P-value (chi-square)            0.000

Chi-square for each group:
Pasteur                      64.309
Grant-White                   51.542

Parameter Estimates:
Information           Expected
Standard Errors          Standard
```

Figure 8.10: 43.png



Results for Group 1 [Pasteur]						
Latent Variables:						
visual =~	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
x1	1.000				1.047	0.887
x2	0.394	0.122	3.220	0.001	0.412	0.336
x3	0.578	0.140	4.076	0.000	0.597	0.515
textual =~						
x4	1.000				0.946	0.823
x5	1.183	0.102	11.613	0.000	1.119	0.856
x6	0.875	0.077	11.421	0.000	0.827	0.838
speed =~						
x7	1.000				0.591	0.547
x8	1.125	0.277	4.057	0.000	0.665	0.682
x9	0.922	0.225	4.184	0.000	0.545	0.551
Covariances:						
visual ~~	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
textual	0.479	0.106	4.531	0.000	0.484	0.484
speed	0.185	0.077	2.397	0.017	0.299	0.299
textual ~~						
speed	0.182	0.069	2.628	0.009	0.325	0.325
Intercepts:						
x1	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
x1	4.941	0.095	52.249	0.000	4.941	4.183
x2	5.984	0.098	60.949	0.000	5.984	4.880
x3	2.487	0.093	26.778	0.000	2.487	2.144
x4	2.823	0.092	30.689	0.000	2.823	2.457
x5	3.995	0.105	38.183	0.000	3.995	3.857
x6	1.922	0.079	24.321	0.000	1.922	1.947
x7	4.432	0.087	51.181	0.000	4.432	4.098
x8	5.563	0.078	71.214	0.000	5.563	5.702
x9	5.418	0.079	68.440	0.000	5.418	5.480
visual	0.000				0.000	0.000
textual	0.000				0.000	0.000
speed	0.000				0.000	0.000
Variances:						
x1	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
x1	0.298	0.232	1.286	0.198	0.298	0.214
x2	1.334	0.158	8.464	0.000	1.334	0.887
x3	0.989	0.136	7.271	0.000	0.989	0.735
x4	0.425	0.069	6.138	0.000	0.425	0.322
x5	0.456	0.086	5.292	0.000	0.456	0.267
x6	0.290	0.050	5.780	0.000	0.290	0.297
x7	0.820	0.125	6.580	0.000	0.820	0.701
x8	0.510	0.116	4.406	0.000	0.510	0.535
x9	0.680	0.104	6.516	0.000	0.680	0.696
visual	1.097	0.276	3.967	0.000	1.000	1.000
textual	0.894	0.150	5.963	0.000	1.000	1.000
speed	0.350	0.126	2.778	0.005	1.000	1.000

Figure 8.11: 44.png

Group 2 [Grant-White]:

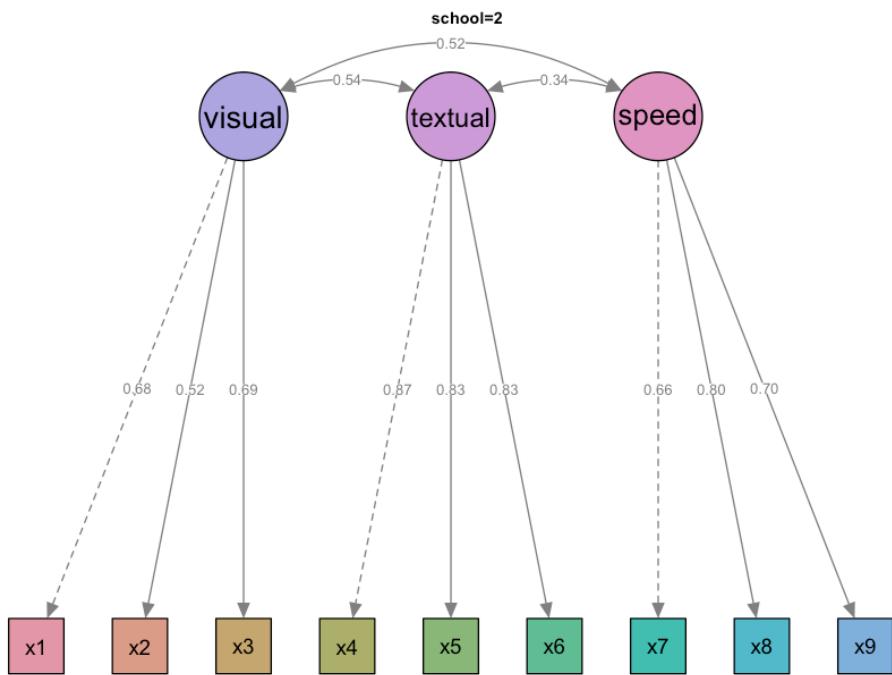
## Results for Group 2 [Glen-White]

	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
<b>Latent Variables:</b>						
visual =~						
x1	1.000				0.777	0.677
x2	0.736	0.155	4.760	0.000	0.572	0.517
x3	0.925	0.166	5.583	0.000	0.719	0.694
textual =~						
x4	1.000				0.971	0.866
x5	0.990	0.087	11.418	0.000	0.961	0.829
x6	0.963	0.085	11.377	0.000	0.935	0.826
speed =~						
x7	1.000				0.679	0.659
x8	1.226	0.187	6.569	0.000	0.833	0.796
x9	1.058	0.165	6.429	0.000	0.719	0.701
<b>Covariances:</b>						
visual ~~						
textual	0.408	0.098	4.153	0.000	0.541	0.541
speed	0.276	0.076	3.639	0.000	0.523	0.523
textual ~~						
speed	0.222	0.073	3.022	0.003	0.336	0.336
<b>Intercepts:</b>						
	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
x1	4.930	0.095	51.696	0.000	4.930	4.293
x2	6.280	0.092	67.416	0.000	6.200	5.599
x3	1.996	0.086	23.195	0.000	1.996	1.926
x4	3.317	0.093	35.625	0.000	3.317	2.959
x5	4.712	0.096	48.986	0.000	4.712	4.068
x6	2.469	0.094	26.277	0.000	2.469	2.182
x7	3.921	0.086	45.819	0.000	3.921	3.805
x8	5.488	0.087	63.174	0.000	5.488	5.246
x9	5.327	0.085	62.571	0.000	5.327	5.196
visual	0.000				0.000	0.000
textual	0.000				0.000	0.000
speed	0.000				0.000	0.000
<b>Variances:</b>						
	Estimate	Std.Err	Z-value	P(> z )	Std.lv	Std.all
x1	0.715	0.126	5.676	0.000	0.715	0.542
x2	0.899	0.123	7.339	0.000	0.899	0.733
x3	0.557	0.103	5.409	0.000	0.557	0.519
x4	0.315	0.065	4.870	0.000	0.315	0.251
x5	0.419	0.072	5.812	0.000	0.419	0.312
x6	0.486	0.069	5.880	0.000	0.406	0.317
x7	0.600	0.091	6.584	0.000	0.600	0.566
x8	0.481	0.094	4.249	0.000	0.401	0.367
x9	0.535	0.089	6.010	0.000	0.535	0.509
visual	0.684	0.168	3.762	0.000	1.000	1.000
textual	0.942	0.152	6.177	0.000	1.000	1.000
speed	0.461	0.118	3.910	0.000	1.000	1.000

## Average Variance Extracted

	AVE	SORTAVE
visual	0.3880013	0.6228975
textual	0.7044914	0.8393399
speed	0.3558272	0.5965126

Figure 8.12: 45.png



## Measurement Invariance

If you are interested in testing the measurement invariance of a CFA model across several groups, select the `measurementInvariance` checkbox and press the `do Analysis` button.

You can get the results of `measurementInvariance` function of `semTools` package.

#### 4. Analysis/Summary Options

<b>Analysis options</b> <input type="radio"/> fit a Structural Equation Model <input checked="" type="radio"/> fit a Confirmatory Factor Analysis Models <input type="radio"/> fit a Growth Curve Model <input type="radio"/> fit a Partial Least Squares Model  <b>Edit Analysis Order</b> <input type="checkbox"/> Edit Analysis Order	<b>group</b> school  <b>group.equal</b>   <b>se</b> default	<b>Summary Options</b> <input checked="" type="checkbox"/> standardized <input type="checkbox"/> fit.measures <input type="checkbox"/> rsquare <input type="checkbox"/> modindicis  <b>Other Options</b> <input type="checkbox"/> show coefficient <span style="color: red;">1</span> <input checked="" type="checkbox"/> show measurement invariance
---	--	---

#### 5. Plot Options

**Plot Options** [show/hide](#)

Plot Preview

<a href="#">do Analysis</a> <span style="color: red;">←</span>	<a href="#">download Report</a>	<a href="#">download Plot(s)</a>	<a href="#">download pptx</a>
<b>Report Format As</b> <input type="radio"/> PDF <input checked="" type="radio"/> HTML		<b>Format As</b> <input checked="" type="radio"/> png <input type="radio"/> svg <input type="radio"/> pdf <b>width height</b> 7 <span style="border: 1px solid black; padding: 2px;"> </span> 5 <span style="border: 1px solid black; padding: 2px;"> </span>	

Figure 8.13: 48.png

http://127.0.0.1:6554 | [Open in Browser](#) | [Publish](#)

```
measurementInvariance(input$equation,data=df(),group=' school ')
Measurement invariance models:
Model 1 : fit.configural
Model 2 : fit.loadings
Model 3 : fit.intercepts
Model 4 : fit.means

Chi Square Difference Test

          Df    AIC    BIC   Chisq   Chisq diff Df diff Pr(>Chisq)
fit.configural 48 7484.4 7706.8 115.85
fit.loadings   54 7480.6 7680.8 124.04     8.192      6    0.2244
fit.intercepts 60 7508.6 7686.6 164.10    40.059      6 4.435e-07 ***
fit.means      63 7543.1 7710.0 284.61    40.502      3 8.338e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Fit measures:

          cfi rmsea cfi.delta rmsea.delta
fit.configural 0.923 0.097      NA      NA
fit.loadings   0.921 0.093      0.002      0.004
fit.intercepts 0.882 0.107      0.038      0.015
fit.means      0.840 0.122      0.042      0.015

$fit.configural
lavaan (0.5-20) converged normally after  57 iterations

Number of observations per group
  Pasteur           156
  Grant-White       145

Estimator          ML
Minimum Function Test Statistic      115.851
Degrees of freedom                  48
P-value (Chi-square)                 0.000

Chi-square for each group:

  Pasteur           64.309
  Grant-White       51.542

$fit.loadings
```

The screenshot shows a Shiny application window with the URL <http://127.0.0.1:6554>. The title bar says "~/ownCloud/Documents/r-sem - Shiny". The main content area displays R output for three model fits: \$fit.loadings, \$fit.intercepts, and \$fit.means. Each fit includes convergence information, sample sizes, estimator, minimum function test statistic, degrees of freedom, and p-value.

```

$fit.loadings
lavaan (0.5-20) converged normally after 42 iterations

Number of observations per group
  Pasteur          156
  Grant-White      145

Estimator           ML
Minimum Function Test Statistic    124.044
Degrees of freedom                   54
P-value (Chi-square)               0.000

Chi-square for each group:

  Pasteur          68.825
  Grant-White      55.219

$fit.intercepts
lavaan (0.5-20) converged normally after 60 iterations

Number of observations per group
  Pasteur          156
  Grant-White      145

Estimator           ML
Minimum Function Test Statistic    164.103
Degrees of freedom                   60
P-value (Chi-square)               0.000

Chi-square for each group:

  Pasteur          90.210
  Grant-White      73.892

$fit.means
lavaan (0.5-20) converged normally after 60 iterations

Number of observations per group
  Pasteur          156
  Grant-White      145

Estimator           ML
Minimum Function Test Statistic    204.605
Degrees of freedom                   63
P-value (Chi-square)               0.000

Chi-square for each group:

  Pasteur          109.302
  Grant-White      95.304

```

In this chapter, I will show you how to compare two models using different structural equation.

## Select Data and Edit Structural Equation

Please select the PoliticalDemocracy among the Select Data radio buttons(1). Make the structural equation as follows(2).

```

# measurement model
ind60 =~ x1 + x2 + x3
dem60 =~ y1 + y2 + y3 + y4
dem65 =~ y5 + y6 + y7 + y8
# regressions
dem60 ~ ind60
dem65 ~ dem60

```

**R-sem.com** SEM How to Citation About

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
파일 선택 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
None

Reset Example

**2. Edit Data**

	y1	y2	y3	y4	y5	y6	y7	y8	x1	x2	x3
1	2.50	0.00	3.33	0.00	1.25	0.00	3.73	3.33	4.44	3.64	2.56
2	1.25	0.00	3.33	0.00	6.25	1.10	6.67	0.74	5.38	5.06	3.57
3	7.50	8.80	10.00	9.20	8.75	8.09	10.00	8.21	5.96	6.26	5.22
4	8.90	8.80	10.00	9.20	8.91	8.13	10.00	4.62	6.29	7.57	6.27
5	10.00	3.33	10.00	6.67	7.50	3.33	10.00	6.67	5.86	6.82	4.57
6	7.50	3.33	6.67	6.67	6.25	1.10	6.67	0.37	5.53	5.14	3.89
7	7.50	3.33	6.67	6.67	5.00	2.23	8.27	1.49	5.31	5.08	3.32
8	7.50	2.23	10.00	1.50	6.25	3.33	10.00	6.67	5.35	4.85	4.26
9	2.50	3.33	3.33	3.33	6.25	3.33	3.33	3.33	5.52	5.24	4.12
10	10.00	6.67	10.00	8.90	8.75	6.67	10.00	10.00	5.83	5.37	4.45
11	7.50	3.33	10.00	6.67	8.75	3.33	10.00	6.67	5.92	6.42	3.79
12	7.50	3.33	6.67	6.67	8.75	3.33	6.67	6.67	5.40	6.25	4.54
13	7.50	3.33	10.00	6.67	7.50	3.33	6.67	10.00	6.62	7.87	4.91
14	7.50	7.77	10.00	6.67	7.50	0.00	10.00	0.00	5.20	5.23	4.56

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  
Select...

operator  
  $\sim$   
 ~  
  $\approx$   
  $\equiv$   
 <  
 >

right var  
Select...

add to equation  
reset the equation

# measurement model  
 ind60  $\sim$  x1 + x2 + x3  
 dem60  $\approx$  y1 + y2 + y3 + y4  
 dem65  $\approx$  y5 + y6 + y7 + y8  
# regressions  
 dem60  $\sim$  ind60  
 dem65  $\sim$  dem60

The 2nd Equation

Figure 8.14: 51.png

Click The 2nd Equation text(arrow).

## Enter the 2nd Equation

Insert the 2nd equation as follows. You can copy the 1st equation(1) and paste it to the 2nd equation(2) and insert `ind60 +` into the last line(box).

```
# measurement model  
ind60 =~ x1 + x2 + x3  
dem60 =~ y1 + y2 + y3 + y4  
dem65 =~ y5 + y6 + y7 + y8  
# regressions  
dem60 ~ ind60  
dem65 ~ ind60 + dem60
```

Please make sure that the `Compare Models` checkbox is selected(arrow). Press `Do Analysis` button.

## Results of Analysis(1)

You can get the results of analysis using the 1st equation followed by that using the 2nd equation and result of comparing two models.

## Results of Analysis(2)

**R-sem.com** SEM How to Citation About

**1. Select/Upload Data**

upload data(\*.xlsx or \*.csv)  
파일 선택 : 선택한 파일 없음

Select Data  
 HolzingerSwineford1939  
 PoliticalDemocracy  
 example1  
 example2  
 Demo.growth  
 ADHD  
 uploaded\_file

Select Example  
 None

Reset Example

**2. Edit Data**

	y1	y2	y3	y4	y5	y6	y7	y8	x1	x2	x3
1	2.50	0.00	3.33	0.00	1.25	0.00	3.73	3.33	4.44	3.64	2.56
2	1.25	0.00	3.33	0.00	6.25	1.10	6.67	0.74	5.38	5.06	3.57
3	7.50	8.80	10.00	9.20	8.75	8.09	10.00	8.21	5.96	6.26	5.22
4	8.90	8.80	10.00	9.20	8.91	8.13	10.00	4.62	6.29	7.57	6.27
5	10.00	3.33	10.00	6.67	7.50	3.33	10.00	6.67	5.86	6.82	4.57
6	7.50	3.33	6.67	6.67	6.25	1.10	6.67	0.37	5.53	5.14	3.89
7	7.50	3.33	6.67	6.67	5.00	2.23	8.27	1.49	5.31	5.08	3.32
8	7.50	2.23	10.00	1.50	6.25	3.33	10.00	6.67	5.35	4.85	4.26
9	2.50	3.33	3.33	3.33	6.25	3.33	3.33	3.33	5.52	5.24	4.12
10	10.00	6.67	10.00	8.90	8.75	6.67	10.00	10.00	5.83	5.37	4.45
11	7.50	3.33	10.00	6.67	8.75	3.33	10.00	6.67	5.92	6.42	3.79
12	7.50	3.33	6.67	6.67	8.75	3.33	6.67	6.67	5.40	6.25	4.54
13	7.50	3.33	10.00	6.67	7.50	3.33	6.67	10.00	6.62	7.87	4.91
14	7.50	7.77	10.00	6.67	7.50	0.00	10.00	0.00	5.20	5.23	4.56

show help Data Export to CSV

**3. Insert/Edit Structural Equation**

Select variables and operators to make a equation !

left var  
Select...

operator  
  $\sim$   
  $\sim$   
  $\sim\sim$   
  $\geq$   
  $=$   
  $<$   
  $>$

right var  
Select...

add to equation

reset the equation

# measurement model  
 $ind60 \sim x1 + x2 + x3$   
 $dem60 \sim y1 + y2 + y3 + y4$   
 $dem65 \sim y5 + y6 + y7 + y8$

# regressions  
 $dem60 \sim ind60$   
 $dem65 \sim dem60$

**The 2nd Equation**

# measurement model  
 $ind60 \sim x1 + x2 + x3$   
 $dem60 \sim y1 + y2 + y3 + y4$   
 $dem65 \sim y5 + y6 + y7 + y8$

# regressions  
 $dem60 \sim ind60$   
 $dem65 \sim ind60 + dem60$

Compare Models

□ Mediation Effect Analysis

Figure 8.15: 52.png

```

## Results of Analysis

fit= sem(input$equation,data=df())
summary(fit,standardized= TRUE ,fit.measures= FALSE ,rsquare= FALSE ,modindices= FALSE )
lavaan (0.5-20) converged normally after 44 iterations

Number of observations                                75

Estimator                                         ML
Minimum Function Test Statistic                  76.467
Degrees of freedom                                 42
P-value (Chi-square)                            0.001

Parameter Estimates:

Information                                         Expected
Standard Errors                                     Standard

Latent Variables:

    Estimate   Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
ind60 =~
  x1          1.000
  x2         2.179  0.139  15.685  0.000   1.460   0.973
  x3         1.818  0.152  11.968  0.000   1.218   0.872
dem60 =~
  y1          1.000
  y2         1.354  0.179   7.548  0.000   2.946   0.751
  y3         1.049  0.153   6.840  0.000   2.282   0.700
  y4         1.320  0.141   9.334  0.000   2.873   0.863
dem65 =~
  y5          1.000
  y6         1.289  0.170   7.570  0.000   2.647   0.790
  y7         1.308  0.164   7.983  0.000   2.686   0.823
  y8         1.335  0.160   8.342  0.000   2.741   0.850

Regressions:

    Estimate   Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
dem60 ~
  ind60       1.631  0.376   4.343  0.000   0.502   0.502
dem65 ~
  dem60       0.930  0.118   7.887  0.000   0.986   0.986

Variances:

    Estimate   Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
  x1         0.081  0.020   4.138  0.000   0.081   0.153
  x2         0.121  0.071   1.701  0.089   0.121   0.054
  x3         0.467  0.090   5.163  0.000   0.467   0.240
  y1         2.053  0.405   5.064  0.000   2.053   0.302
  y2         6.694  1.207   5.546  0.000   6.694   0.435
  y3         5.414  0.950   5.699  0.000   5.414   0.510
  y4         2.817  0.593   4.749  0.000   2.817   0.254
  y5         2.519  0.469   5.377  0.000   2.519   0.374
  y6         4.216  0.783   5.382  0.000   4.216   0.376
  y7         3.443  0.665   5.178  0.000   3.443   0.323
  y8         2.880  0.584   4.928  0.000   2.880   0.277
  ind60      0.449  0.087   5.174  0.000   1.000   1.000
  dem60      3.540  0.825   4.293  0.000   0.748   0.748
  dem65      0.117  0.205   0.569  0.570   0.028   0.028

```

## Results of analysis using the 1st equation

Figure 8.16: 53.png

```

## Results of Analysis using equation2
fit2= sem(input$equation2,data=df())
summary(fit2,standardized= TRUE ,fit.measures= FALSE ,rsquare= FALSE ,modindices= FALSE )
lavaan (0.5-20) converged normally after 72 iterations

Number of observations                               75

Estimator                                         ML
Minimum Function Test Statistic                  72.462
Degrees of freedom                                41
P-value (Chi-square)                            0.002

Parameter Estimates:

Information                                         Expected
Standard Errors                                     Standard

Latent Variables:
      Estimate   Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
ind60 =~
  x1        1.000
  x2       2.182  0.139  15.714  0.000   1.461  0.973
  x3       1.819  0.152  11.956  0.000   1.218  0.872
dem60 =~
  y1        1.000
  y2       1.354  0.175  7.755  0.000   2.980  0.760
  y3       1.044  0.150  6.961  0.000   2.298  0.705
  y4       1.300  0.138  9.412  0.000   2.860  0.860
dem65 =~
  y5        1.000
  y6       1.258  0.164  7.651  0.000   2.623  0.783
  y7       1.282  0.158  8.137  0.000   2.673  0.819
  y8       1.310  0.154  8.529  0.000   2.730  0.847

Regressions:
      Estimate   Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
dem60 ~
  ind60      1.474  0.392  3.763  0.000   0.448  0.448
dem65 ~
  ind60      0.453  0.220  2.064  0.039   0.146  0.146
  dem60      0.864  0.113  7.671  0.000   0.913  0.913

Variances:
      Estimate   Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
  x1       0.082  0.020  4.180  0.000   0.082  0.154
  x2       0.118  0.070  1.689  0.091   0.118  0.053
  x3       0.467  0.090  5.174  0.000   0.467  0.240
  y1       1.942  0.395  4.910  0.000   1.942  0.286
  y2       6.490  1.185  5.479  0.000   6.490  0.422
  y3       5.340  0.943  5.662  0.000   5.340  0.503
  y4       2.887  0.610  4.731  0.000   2.887  0.261
  y5       2.390  0.447  5.351  0.000   2.390  0.355
  y6       4.343  0.796  5.456  0.000   4.343  0.387
  y7       3.510  0.668  5.252  0.000   3.510  0.329
  y8       2.940  0.586  5.019  0.000   2.940  0.283
  ind60     0.448  0.087  5.169  0.000   1.000  1.000
  dem60     3.872  0.893  4.338  0.000   0.799  0.799
  dem65     0.115  0.200  0.575  0.565   0.026  0.026

## Compare Models
## call: anova(fit,fit2)
Chi Square Difference Test

  Df    AIC    BIC Chisq diff Df diff Pr(>Chisq)
fit2 41 3179.9 3237.9 72.462
fit  42 3181.9 3237.5 76.467     4.0052      1    0.04536 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

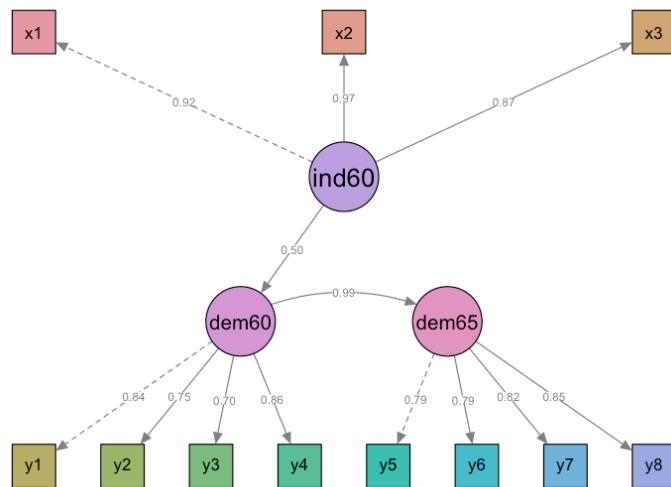
```

Figure 8.17: 54.png

## Plots for Two Models

```
fit= sem(input$equation,data=df())
semPaths(fit,what='path',whatLabels='std',intercept=FALSE,residuals=FALSE,thresholds=FALSE,nCharNodes=0,nCharEdges=0,
groups='manlat',pastel=TRUE,title=TRUE,curveAdjacent=TRUE,ask=FALSE)
```

Plot for the model using the 1st equation



```
fit= sem(input$equation2,data=df())
semPaths(fit,what='path',whatLabels='std',intercept=FALSE,residuals=FALSE,thresholds=FALSE,nCharNodes=0,nCharEdges=0,
groups='manlat',pastel=TRUE,title=TRUE,curveAdjacent=TRUE,ask=FALSE)
```

Plot for model using the 2nd equation

