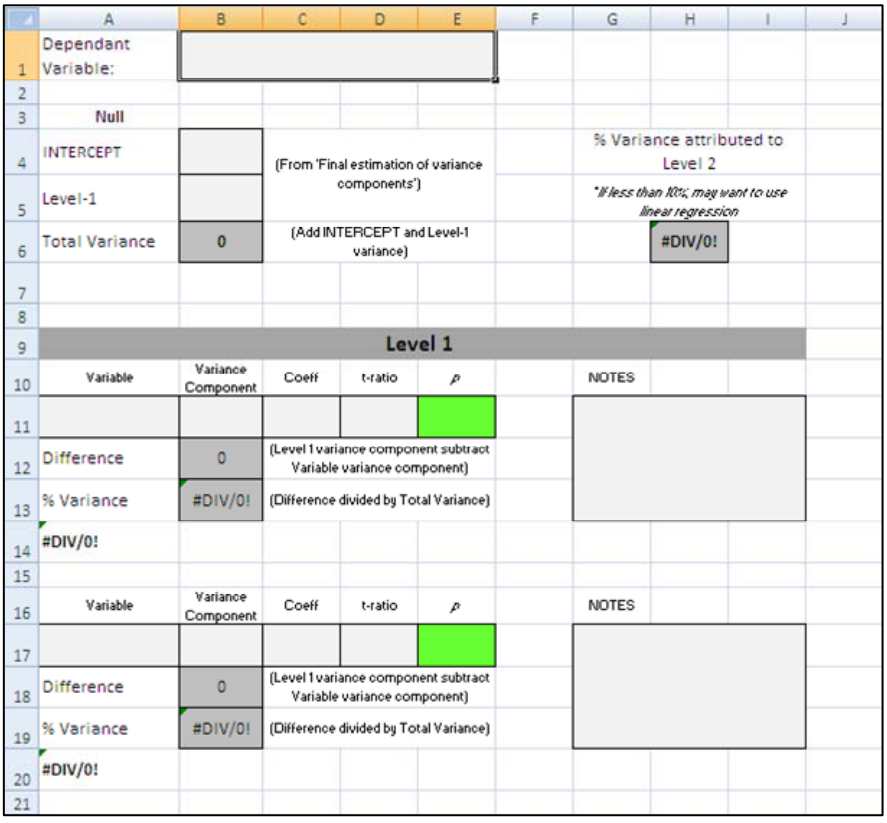
HLM

Learning and Research Community

HLM Excel Tracking Sheets



	A	B	C	D	E	F	G	H	I	J
1	Dependant Variable:									
2										
3	Null									
4	INTERCEPT		(From 'Final estimation of variance components')				% Variance attributed to Level 2			
5	Level-1						*"If less than 10%, may want to use linear regression*			
6	Total Variance	0	(Add INTERCEPT and Level-1 variance)					#DIV/0!		
7										
8										
9	Level 1									
10	Variable	Variance Component	Coeff	t-ratio	*p*		NOTES			
11										
12	Difference	0	(Level 1 variance component subtract Variable variance component)							
13	% Variance	#DIV/0!	(Difference divided by Total Variance)							
14	#DIV/0!									
15										
16	Variable	Variance Component	Coeff	t-ratio	*p*		NOTES			
17										
18	Difference	0	(Level 1 variance component subtract Variable variance component)							
19	% Variance	#DIV/0!	(Difference divided by Total Variance)							
20	#DIV/0!									
21										

A support document for use with the HLM Excel Tracking Sheets developed by Greg Rousell

Prepared by Chris Conley

HLM Excel Tracking Sheets:

This document is to support the use of the HLM Excel tracking sheets which were designed as part of the HLM-LRC School Board Project group by Greg Rousell, Research Analyst with the Halton Catholic District School Board. The data used for the screen shots in this document were drawn from HLM Workbook 1.

The objective of the tracking sheets is to simplify the organization of HLM analyses and support a logical and progressive exploration of data using a two level HLM model. The Excel file contains5 worksheets:

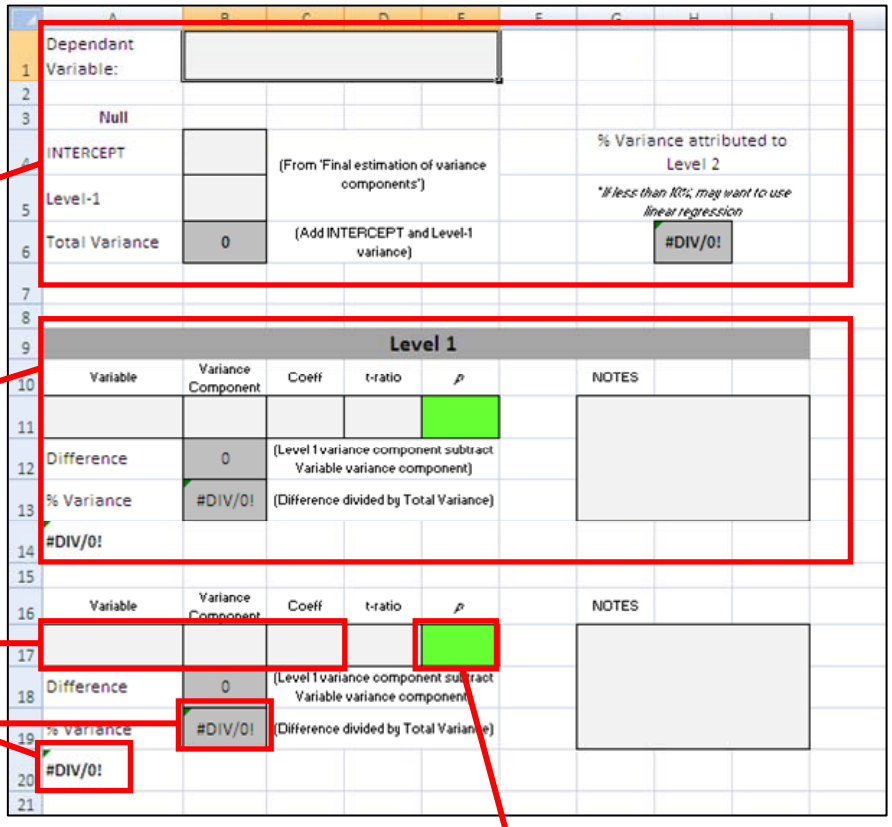
- Level 1 Ind. Variables
- Level 1 Final Model
- Level 2 Ind. Variables
- Level 2 Final Model
- Final Model

Level 1 Ind. Variables Sheet

The Level 1 Independent Variable Sheet is divided into two sections.

The top area is for information about the dependent variable and the Null model.

The bottom area is for the independent variables.

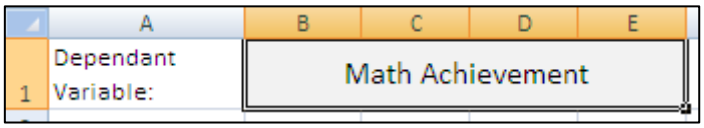


In each of the worksheets:

- cells that are light grey are areas for you to enter information.
- Cells that are dark grey or contain "#DIV/0!" are automated calculations.
- Cells that are green or use other colors are have conditional formatting applied

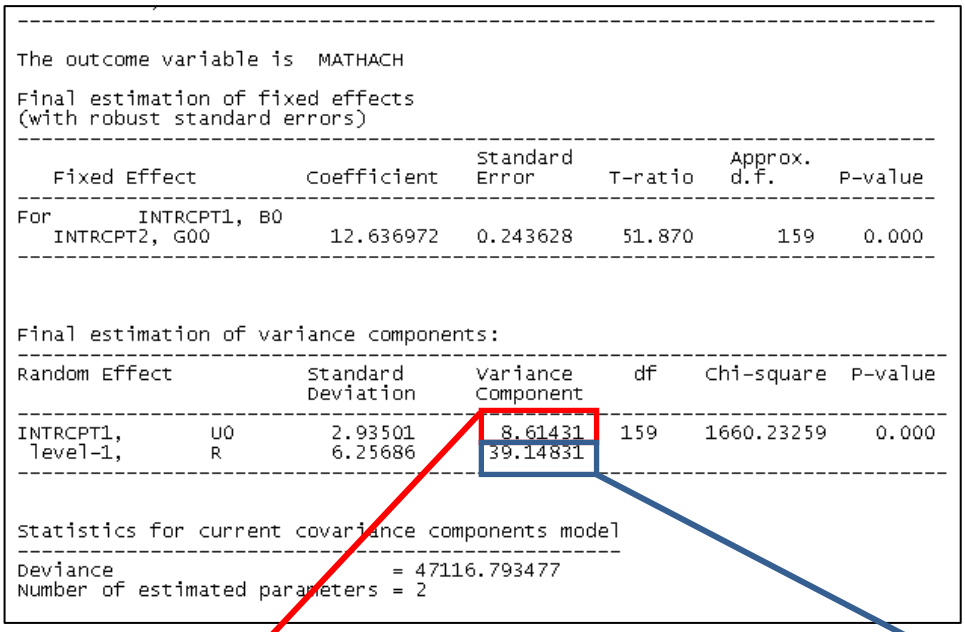
Level 1 Dependent Variable and Null Model

In the Excel tracking sheet, type the name of the Dependent Variable that will be used at the top. In HLM, select the variable as an outcome measure and run the Model.



	A	B	C	D	E
1	Dependant Variable:	Math Achievement			

Using table "Final estimation of variance components" table in the HLM output (page 8 of workbook 1):



The outcome variable is MATHACH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	12.636972	0.243628	51.870	159	0.000

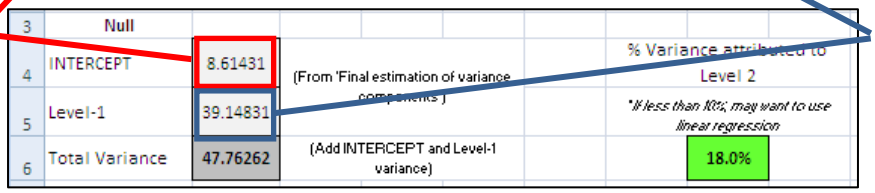
Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, level-1,	U0	2.93501	8.61431	159	1660.23259	0.000
	R	6.25686	39.14831			

Statistics for current covariance components model

Deviance = 47116.793477
Number of estimated parameters = 2

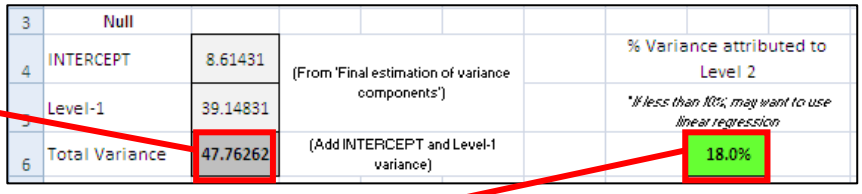
Enter the variance component of the INTRCPT1 U0



3	Null			
4	INTERCEPT	8.61431	(From 'Final estimation of variance components')	% Variance attributed to Level 2
5	Level-1	39.14831		*If less than 10%, may want to use linear regression
6	Total Variance	47.76262	(Add INTERCEPT and Level-1 variance)	18.0%

Enter the variance component of the level-1 R

Once you enter the INTERCEPT1 and level-1 variance components, the total variance and level 2 variance is calculated.



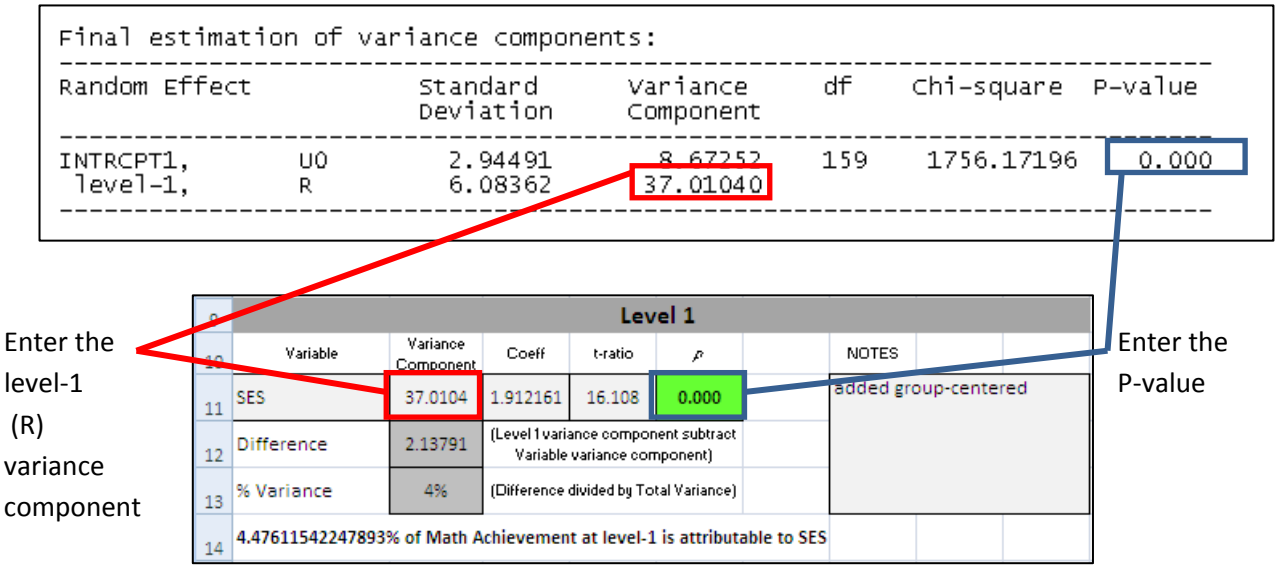
3	Null			
4	INTERCEPT	8.61431	(From 'Final estimation of variance components')	% Variance attributed to Level 2
5	Level-1	39.14831		*If less than 10%, may want to use linear regression
6	Total Variance	47.76262	(Add INTERCEPT and Level-1 variance)	18.0%

On the right hand side, is a conditionally formatted cell that calculates the percentage of variance of the level-2. When the calculation of the level-2 variance component is less than 10%, this cell will be shaded red. When it is greater than 10%, it will be shaded green. As can be seen in the example, 18.0% of the overall variance is attributable to level-2. As a rule of thumb, when the level-2 variance component is less than 10%, there is no particular advantage to conducting an HLM analysis over a straight linear regression.

Level 1 Independent Variable

In the Excel tracking sheet, type the name of the independent variable. In HLM, select the variable as a a level-1 predictor and run the Model.

Using the table "Final estimation of variance components" table in the HLM output (expanded from page 10 of workbook 1):



Final estimation of variance components:

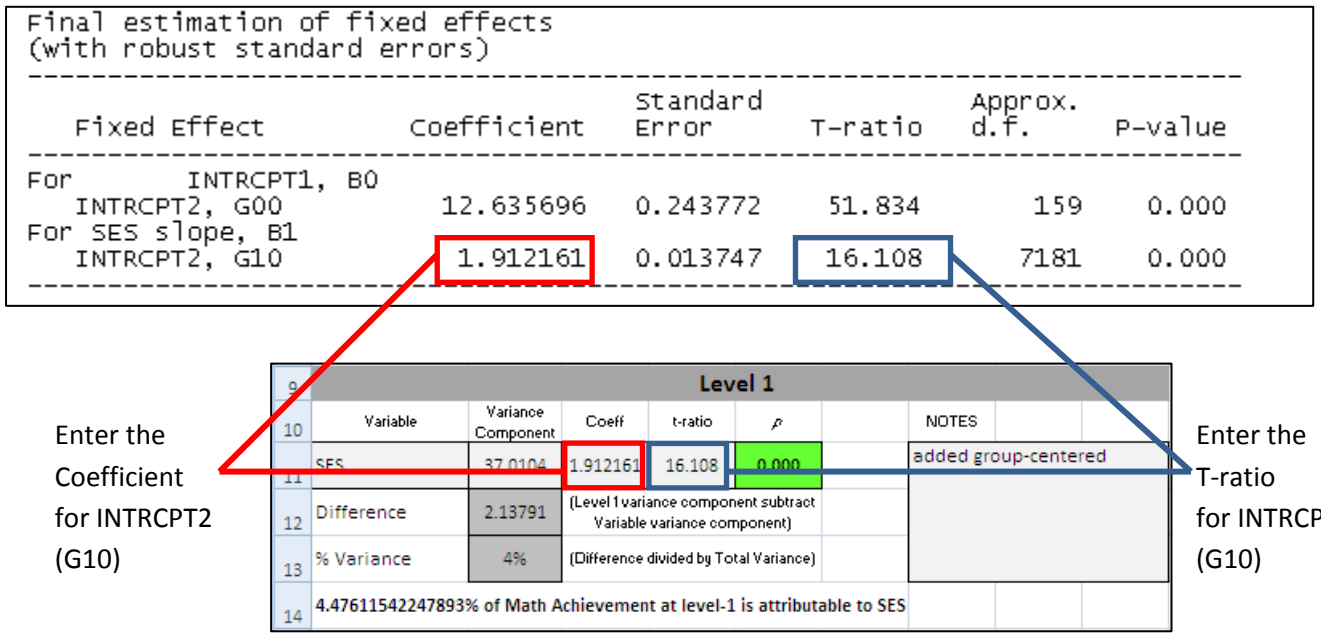
Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, level-1,	U0	2.94491	8.67252	159	1756.17196	0.000
	R	6.08362	37.01040			

Enter the level-1 (R) variance component

Enter the P-value

	Level 1					
10	Variable	Variance Component	Coeff	t-ratio	p	NOTES
11	SES	37.0104	1.912161	16.108	0.000	added group-centered
12	Difference	2.13791	(Level 1 variance component subtract Variable variance component)			
13	% Variance	4%	(Difference divided by Total Variance)			
14	4.47611542247893% of Math Achievement at level-1 is attributable to SES					

Using the table "Final estimation of fixed effects (with robust standard errors)" in the HLM output:



Final estimation of fixed effects (with robust standard errors)

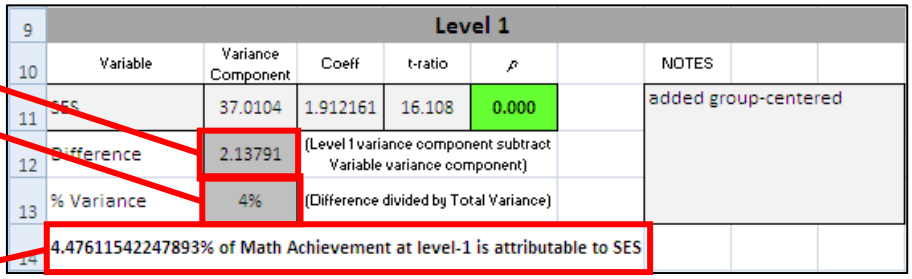
Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	12.635696	0.243772	51.834	159	0.000
For SES slope, B1					
INTRCPT2, G10	1.912161	0.013747	16.108	7181	0.000

Enter the Coefficient for INTRCPT2 (G10)

Enter the T-ratio for INTRCPT2 (G10)

	Level 1					
10	Variable	Variance Component	Coeff	t-ratio	p	NOTES
11	SES	37.0104	1.912161	16.108	0.000	added group-centered
12	Difference	2.13791	(Level 1 variance component subtract Variable variance component)			
13	% Variance	4%	(Difference divided by Total Variance)			
14	4.47611542247893% of Math Achievement at level-1 is attributable to SES					

In the dark grey cells, the difference in variance and % of variance for the independent variable has been calculated.



	Level 1					
10	Variable	Variance Component	Coeff	t-ratio	p	NOTES
11	SES	37.0104	1.912161	16.108	0.000	added group-centered
12	Difference	2.13791	(Level 1 variance component subtract Variable variance component)			
13	% Variance	4%	(Difference divided by Total Variance)			
14	4.47611542247893% of Math Achievement at level-1 is attributable to SES					

A summary of your Independent variable is also calculated based on the information you have entered.

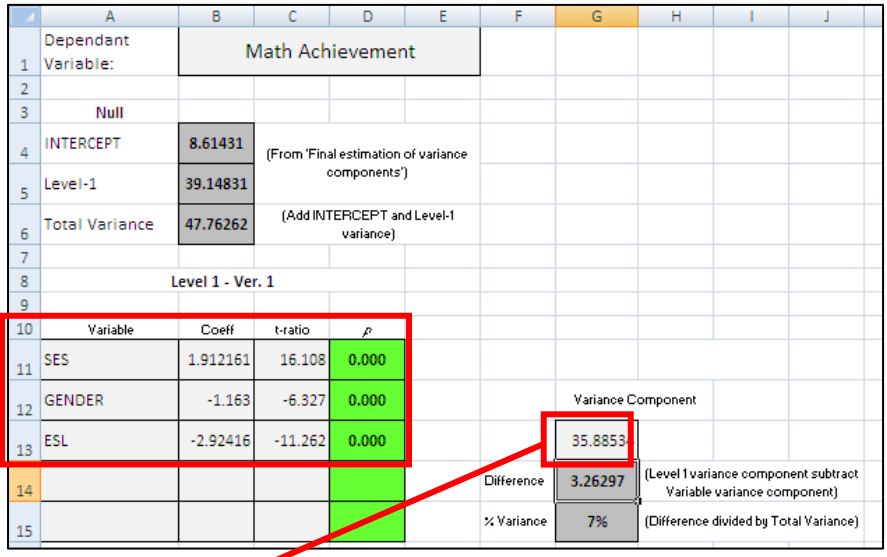
A space is also available on the right hand side for any notes.

Repeat this process for each of the level-1 independent variables in your data set.

Level-1 Final Model Worksheet

The Level-1 Final Model Worksheet is designed to explore the variance component for combinations of level-1 predictors (page 12 of workbook 1).

Using the information from the Level 1 Independent Variable Sheet, create a final level-1 model by adding variables with significant p-values in HLM and on your tracking sheet.

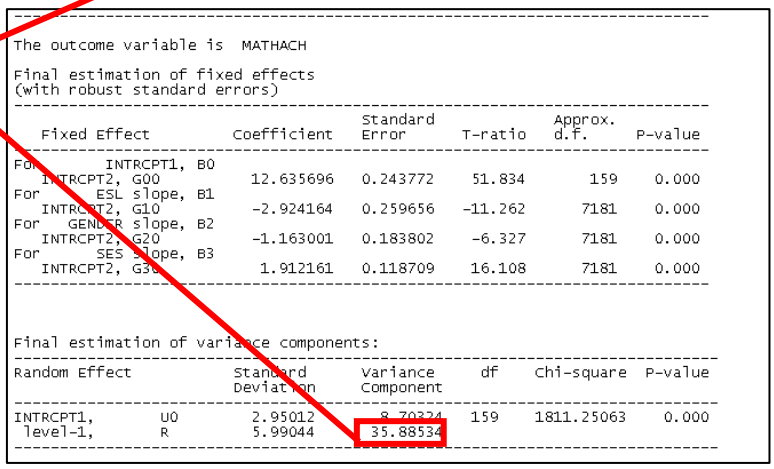


	A	B	C	D	E	F	G	H	I	J
1	Dependant Variable:	Math Achievement								
3	Null									
4	INTERCEPT	8.61431	(From 'Final estimation of variance components')							
5	Level-1	39.14831								
6	Total Variance	47.76262	(Add INTERCEPT and Level-1 variance)							
8	Level 1 - Ver. 1									
10	Variable	Coeff	t-ratio	p						
11	SES	1.912161	16.108	0.000						
12	GENDER	-1.163	-6.327	0.000						
13	ESL	-2.92416	-11.262	0.000						
14						Difference	3.26297	(Level 1 variance component subtract Variable variance component)		
15						% Variance	7%	(Difference divided by Total Variance)		

Variance Component: 35.8853

Run the model in HLM and record the variance component for level-1 (R) on your tracking sheet. The total variance accounted for by your model will be automatically calculated.

There is additional space in the worksheet to explore a variety of level-1 variable combinations.



```
The outcome variable is   MATHACH

Final estimation of fixed effects
(with robust standard errors)
----------------------------------------------------------------------------
   Fixed Effect          Coefficient   Standard Error   T-ratio   Approx. d.f.   P-value
----------------------------------------------------------------------------
For      INTRCPT1, B0
   INTRCPT2, G00          12.635696     0.243772       51.834       159       0.000
For      ESL slope, B1
   INTRCPT2, G10          -2.924164     0.259656      -11.262      7181       0.000
For   GENDER slope, B2
   INTRCPT2, G20          -1.163001     0.183802       -6.327      7181       0.000
For      SES slope, B3
   INTRCPT2, G30           1.912161     0.118709       16.108      7181       0.000
----------------------------------------------------------------------------


Final estimation of variance components:
----------------------------------------------------------------------------
Random Effect            Standard Deviation   Variance Component   df    Chi-square   P-value
----------------------------------------------------------------------------
INTRCPT1,       U0          2.95012              8.70324           159   1811.25063     0.000
level-1,        R           5.99044             35.88534
----------------------------------------------------------------------------
```

Once you have finalized your model (decided on which variables you will leave in), complete the "Level 1 FINAL" table at the bottom of the worksheet labeled. The information you enter into the "Level 1 FINAL" table will automatically update the summary information in the Level 2 Final Model worksheet.

Level 2 Ind. Variables

The layout and approach to the Level 2 Ind. Variables worksheet is the same as the Level 1 Ind. Variables worksheet. Note that the Dependent variable and Null model information has already been entered from the Level 1 Ind. Variable worksheet.

	A	B	C	D	E	F	G	H	I
1	Dependant Variable:	Math Achievement							
2									
3	Null								
4	INTERCEPT	8.61431	(From 'Final estimation of variance components')						
5	Level-1	39.14831							
6	Total Variance	47.76262	(Add INTERCEPT and Level-1 variance)						
7									
8	Level 2								
9	Variable	Variance Componen	Coeff	t-ratio	p		NOTES		
10	School Type	6.76838			0.000				
11	Difference	1.84593	(Level 2 variance component subtract Variable variance component)						
12	% Variance	4%	(Difference divided by Total Variance)						
13	3.86480054904861% of Math Achievement at level-2 is attributable to School Type								

The approach to this worksheet is the same as the Level 1 Ind. Variables worksheet. Enter the HLM output information for each level 2 variable (using the example on page 13 of workbook 1):

Enter the variance component of the INTRCPT1 (U0)

	Level 2						
9	Variable	Variance Componen	Coeff	t-ratio	p		NOTES
10	School Type	6.76838			0.000		
11	Difference	1.84593	(Level 2 variance component subtract Variable variance component)				
12	% Variance	4%	(Difference divided by Total Variance)				
13	3.86480054904861% of Math Achievement at level-2 is attributable to School Type						

Enter the P-value

Final estimation of variance components:

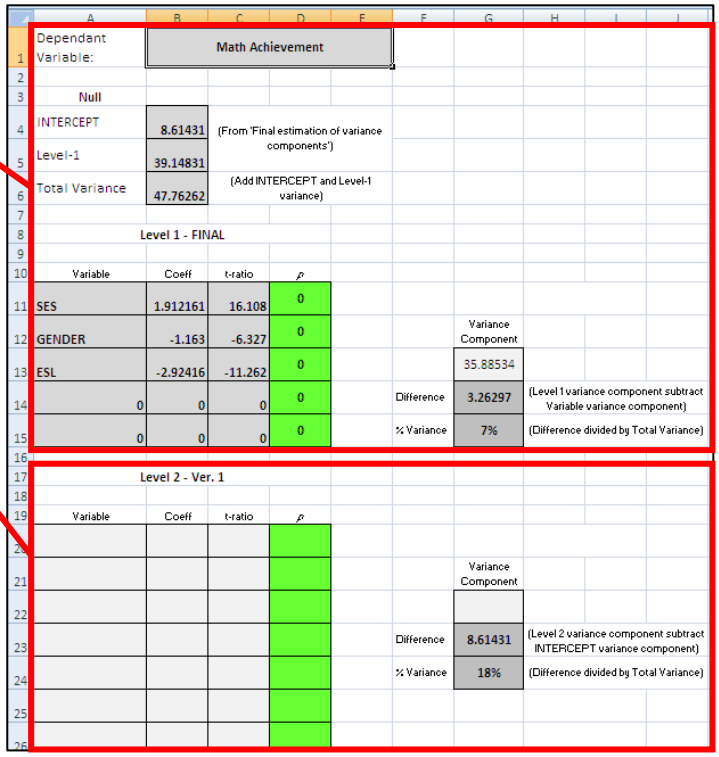
Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, level-1,	U0	2.60161	6.76838	158	1414.68674	0.000
	R	5.99065	35.88794			

As with the level-1 worksheet, the coefficient and t-ratio information can be found in the "Final estimation of fixed effects (with robust standard errors)" table.

Level-2 Final Model Worksheet

The Level-2 Final Model Worksheet is designed to explore the variance component for combinations of level-2 predictors.

Note that the Null model and Level 1 FINAL model information you entered previously has been automatically updated in this worksheet.



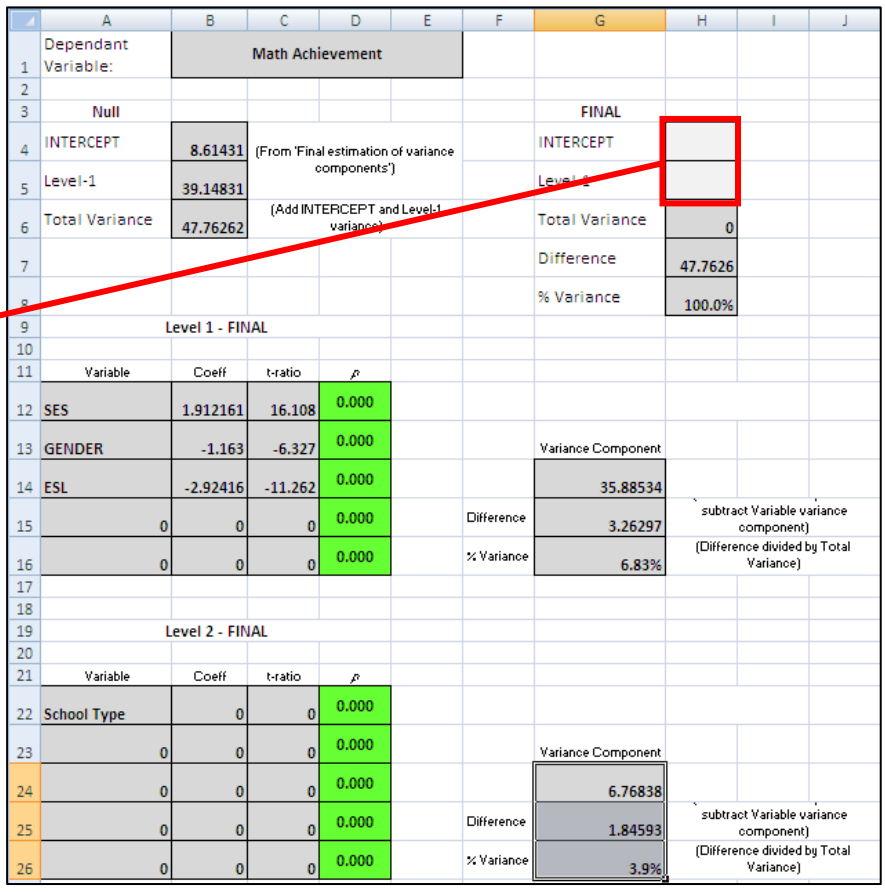
1	Dependant Variable:		Math Achievement					
2								
3	Null							
4	INTERCEPT	8.61431	(From 'Final estimation of variance components')					
5	Level-1	39.14831						
6	Total Variance	47.76262	(Add INTERCEPT and Level-1 variance)					
7								
8	Level 1 - FINAL							
9								
10	Variable	Coeff	t-ratio	p				
11	SES	1.912161	16.108	0				
12	GENDER	-1.163	-6.327	0		Variance Component		
13	ESL	-2.92416	-11.262	0		35.88534		
14	0	0	0	0	Difference	3.26297	(Level 1 variance component subtract Variable variance component)	
15	0	0	0	0	% Variance	7%	(Difference divided by Total Variance)	
16								
17	Level 2 - Ver. 1							
18								
19	Variable	Coeff	t-ratio	p				
20								
21						Variance Component		
22								
23					Difference	8.61431	(Level 2 variance component subtract INTERCEPT variance component)	
24					% Variance	18%	(Difference divided by Total Variance)	
25								
26								

As with the Level 1 Final Model worksheet, enter the Level 2 Variable information from the "Level 2 Ind. Variables" worksheet and explore the impact of cariable combinations to the variance component.

Once you have decided upon the final combination of level-2 variables, enter the information into the "Level 2 FINALMODEL" table at the bottom of the worksheet.

Final Model

The Final Model worksheet summarizes all the information you have entered in the previous worksheets. The only information left to enter is the INTERCEPT and Level-1 Variance components from the final model.



1	Dependant Variable:		Math Achievement					
2								
3	Null					FINAL		
4	INTERCEPT	8.61431	(From 'Final estimation of variance components')			INTERCEPT		
5	Level-1	39.14831				Level-1		
6	Total Variance	47.76262	(Add INTERCEPT and Level-1 variance)			Total Variance	0	
7						Difference	47.7626	
8						% Variance	100.0%	
9	Level 1 - FINAL							
10								
11	Variable	Coeff	t-ratio	p				
12	SES	1.912161	16.108	0.000				
13	GENDER	-1.163	-6.327	0.000		Variance Component		
14	ESL	-2.92416	-11.262	0.000		35.88534		
15	0	0	0	0.000	Difference	3.26297	subtract Variable variance component)	
16	0	0	0	0.000	% Variance	6.83%	(Difference divided by Total Variance)	
17								
18								
19	Level 2 - FINAL							
20								
21	Variable	Coeff	t-ratio	p				
22	School Type	0	0	0.000				
23	0	0	0	0.000		Variance Component		
24	0	0	0	0.000		6.76838		
25	0	0	0	0.000	Difference	1.84593	subtract Variable variance component)	
26	0	0	0	0.000	% Variance	3.9%	(Difference divided by Total Variance)	