Fitting the random intercept model in SPSS

The data (In Variable View)

	Name	Type	Wid	Dec	Label	Values
1	cluster	Numeric	1	0	Socioeconomic profile of the school	{1, low}...
2	teacher	Numeric	1	0	Teacher	None
3	sid#	Numeric	1	4	Student ID	None
4	year	String	7	0	Year	None
5	sex	Numeric	1	4	Sex	{1.0000, male}.
6	att_scho	Numeric	1	4	Attitude toward School	None
7	att_scnt	Numeric	1	4	Attitude toward Scientists	None
8	sciences	Numeric	1	4	Science Selfconcept	None
9	att_scie	Numeric	1	4	Attitude toward Science	None

The research Question:

Are the students' attitudes toward school different between boys and girls?

The Model:

Since we sampled teachers, and then surveyed their students, students within the same class will have correlated attitudes. A random intercept model can be used to address this dependency.

$$att\_scho_{i,j} = \beta_0 + \beta_1 * sex_{i,j} + b_j + \varepsilon_{i,j}$$

$$b_j \overset{iid}{\sim} Normal(0, \sigma_2^2)$$

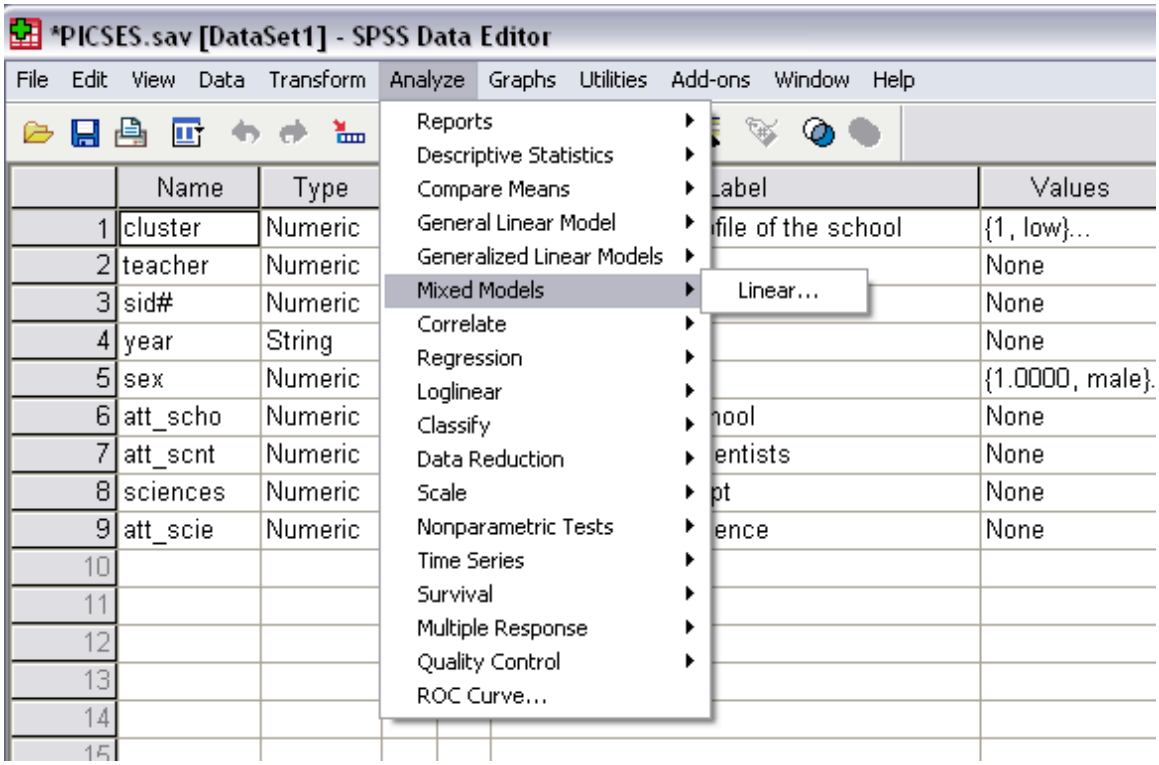
$$\varepsilon_{ij} \overset{iid}{\sim} Normal(0, \sigma_1^2)$$

i indexes teachers. *j* indexes teachers.

This model separates out the variation due to teacher differences, and the variation due to individual student differences.

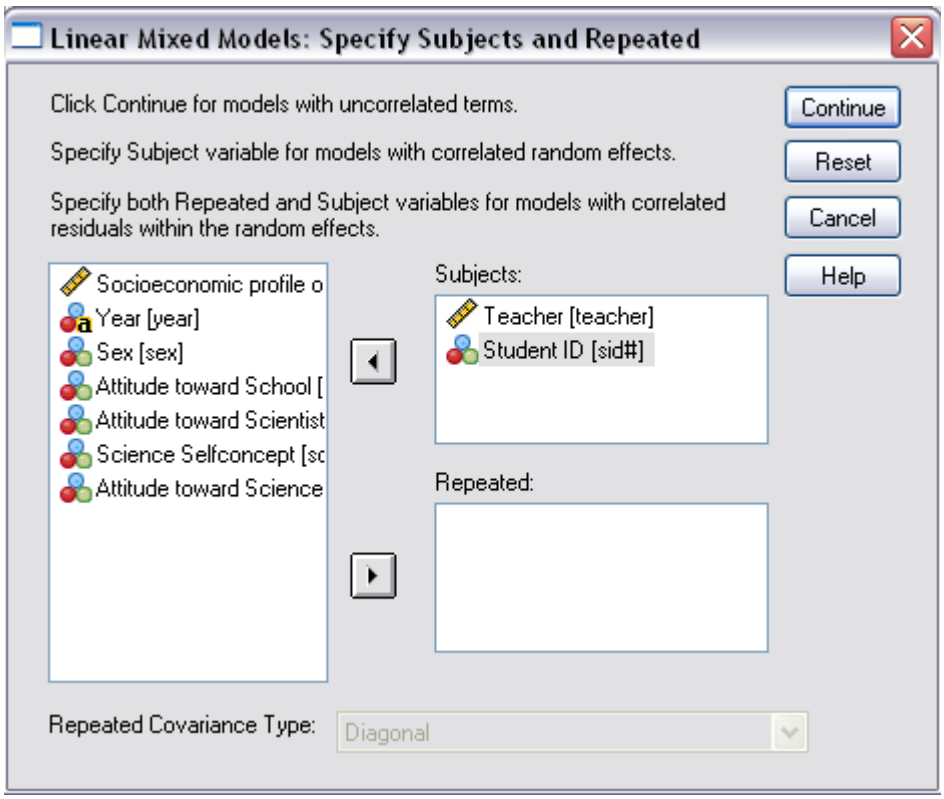
Fitting the model:

1. Select Analyze>Mixed Models>linear.

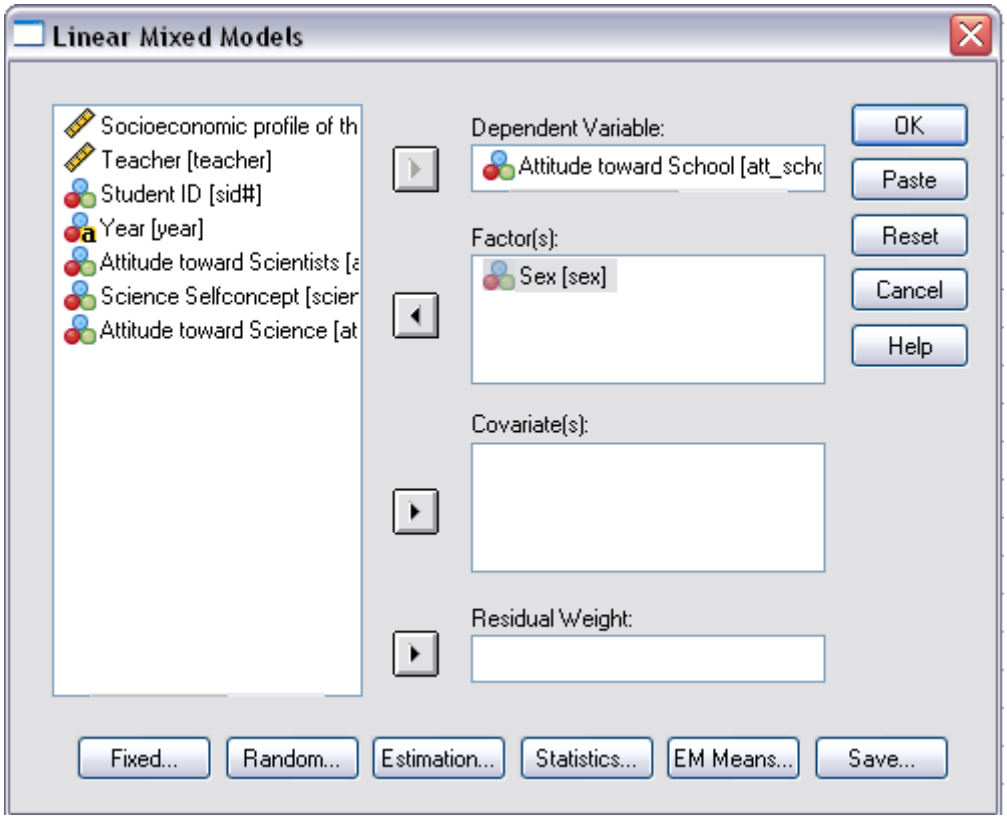


If you do not have this option, you do not have the Advance Regression Models add-on pack installed.

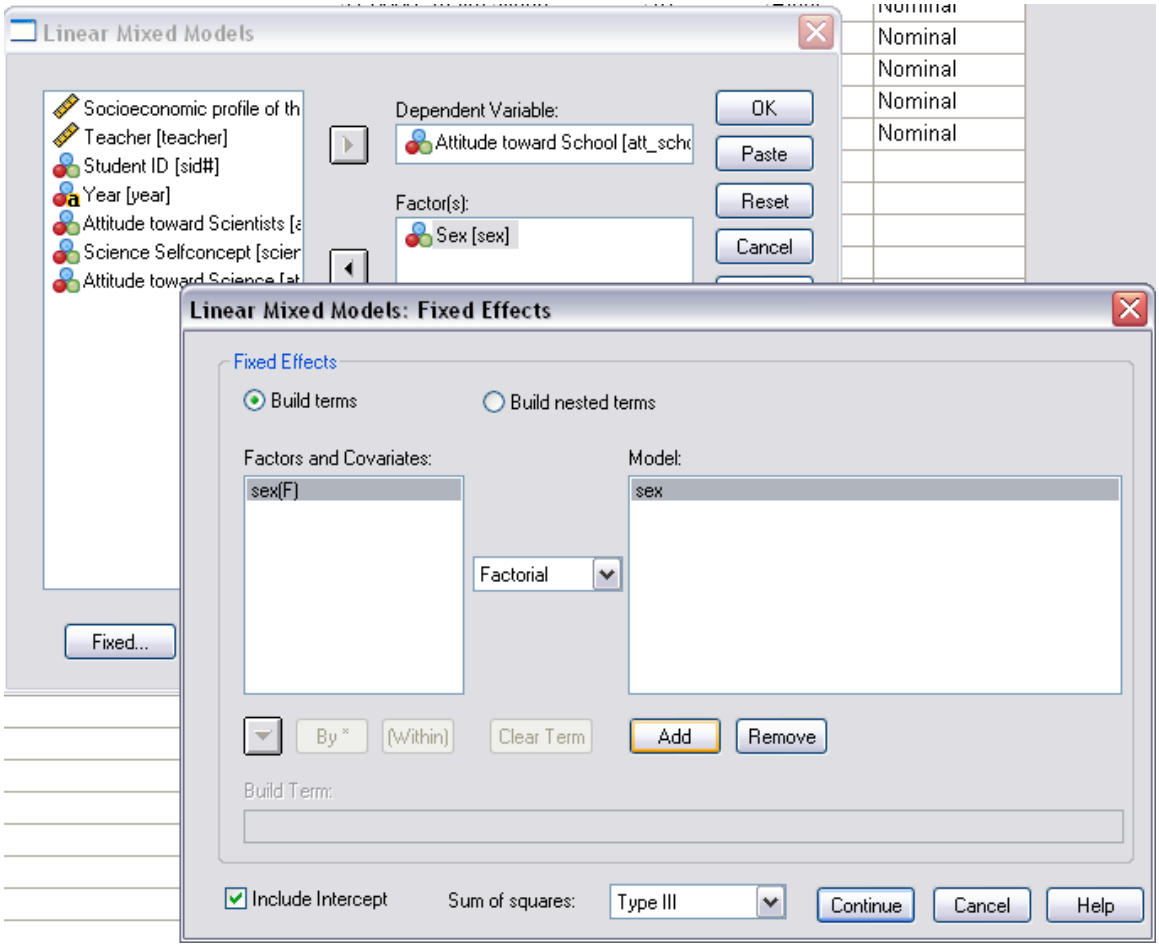
2. Move both your students and teachers into the Subjects box. Leave the Repeated box blank. Press continue.



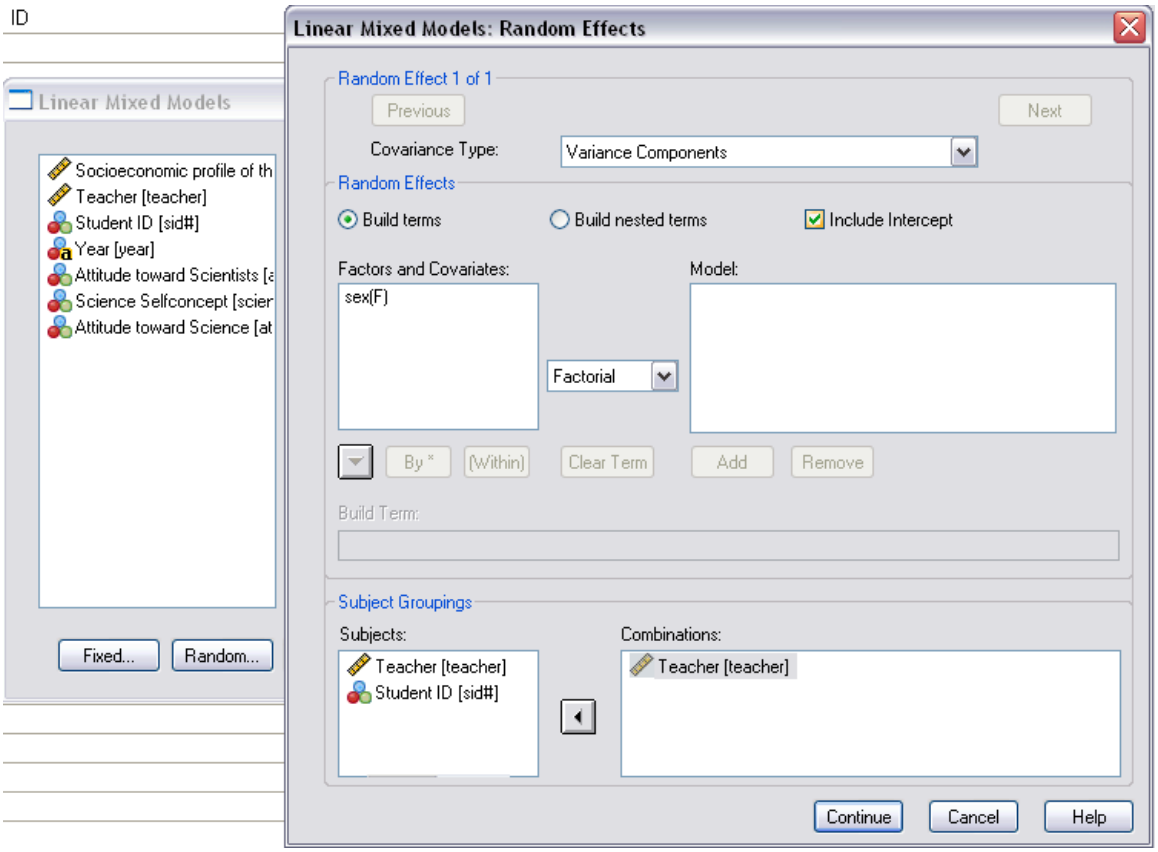
3. Move att_scho into the dependant variable box. Move sex into the factor box. Anything in the factor box is automatically dummy coded. In general put categorical variables into the factor box, and continuous ones into the Covariate box.



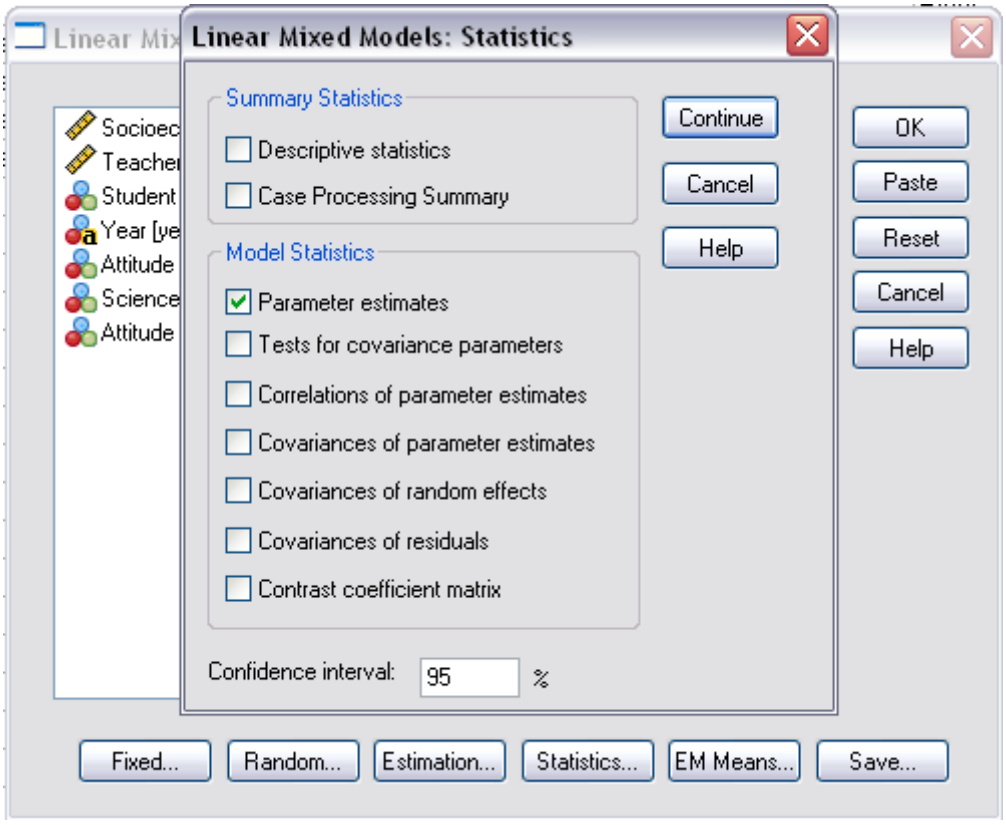
4. Click on the 'Fixed…" button. Select sex(F), then click 'add'. This forms the $\beta_0 + \beta_1 * sex_{i,j}$ part of the model. Then click continue.



5. Next we will form the random effects (b_j). Click 'Random…'. Now select 'teacher', and move it to the Combinations box. Check the 'Include Intercept' box. Click Continue.



6. Lastly, Click on ‘Statistics…’, and the check the ‘Parameter estimates’ box. Chick continue, the OK.



The Output

Output:

Type III Tests of Fixed Effects(a)

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	36.963	930.016	.000
sex	1	1057.205	50.358	.000

a Dependent Variable: Attitude toward School.

This table tests all of the variables that were put into the Fixed effects in step 4. We see that sex is significantly related to school attitudes. The F statistic for this test is: $F(1,1057.205) = 50.358$. And the p-vale is listed under sig. $p<.001$.

But, did boys or girls have better attitudes toward school? We can look at the parameter estimates to find out.

Output:

Estimates of Fixed Effects[b]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1.158292	.039578	76.096	29.266	.000	1.079466	1.237117
[sex=1.0000]	-.308764	.043510	1057.205	-7.096	.000	-.394140	-.223387
[sex=2.0000]	0[a]	0	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Dependent Variable: Attitude toward School.

Sex was coded 1=male, 2=female. We see here that boys, on average had .308764 point lower score on the attitude scale, implying that they had a more negative view of school.

Next the procedure prints out information regarding our random effect, and the residual error.

Output:

Covariance Parameters

Estimates of Covariance Parameters(a)

Parameter		Estimate	Std. Error
Residual		.504507	.022122
Intercept [subject = teacher]	Variance	.023269	.009585

a Dependent Variable: Attitude toward School.

These estimates are the approximate values of σ_1^2 and σ_2^2. No significance tests should be done on these estimates. There is no easy or standard way of determining the significance of Covariance parameters, and none of the usual software does it correctly. Though SPSS has an option to perform tests of significance on covariance parameters, these tests are incorrect. The reason why is a bit technical, but basically the estimate of the standard error breaks down when the Covariance parameter is 0, and thus can not be used in significance testing. Parametric bootstrapping can overcome this difficulty.