

## Computer Lab part 1.

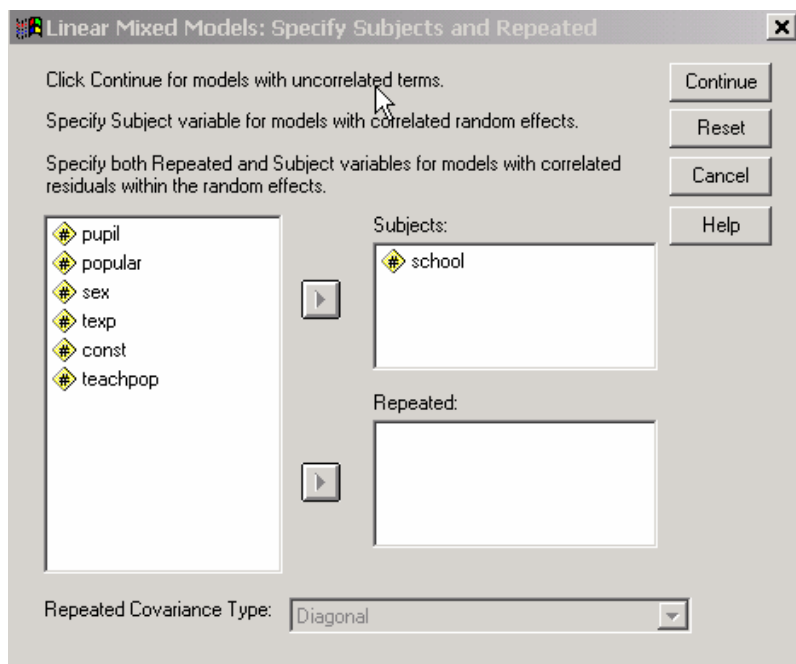
### Part 1: Guidelines for fitting a multilevel model in SPSS Mixed

Note: table and page number refer to

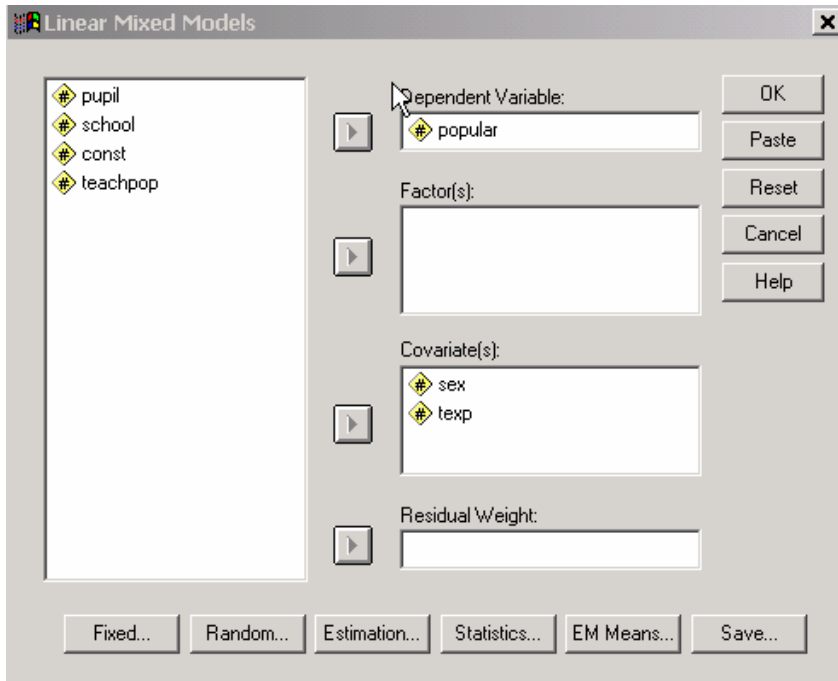
Hox, J.J. (2002). *Multilevel Analysis, Techniques and Applications*. Mahwah: Erlbaum.

The following steps will estimate model M1 in Table 2.1. The data can be found in the file POPULAR.SAV. All data sets and the answers to the exercises can be downloaded from [www.fss.uu.nl/ms/jh](http://www.fss.uu.nl/ms/jh). The file names should be given the extension .SAV. After saving, the files can be opened using SPSS.

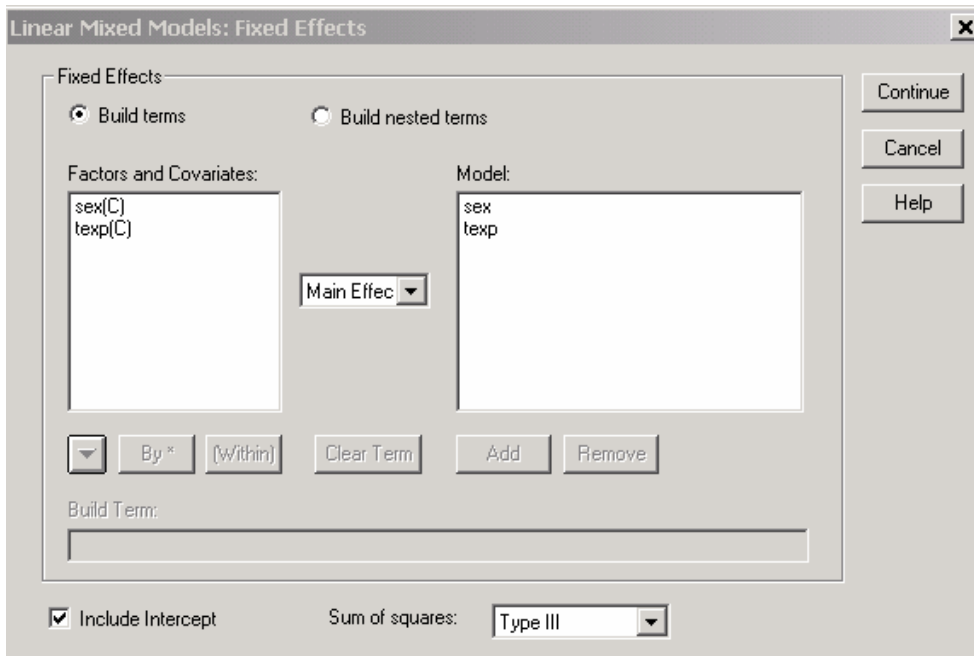
In SPSS: start with Analyze – Mixed Models – Linear...



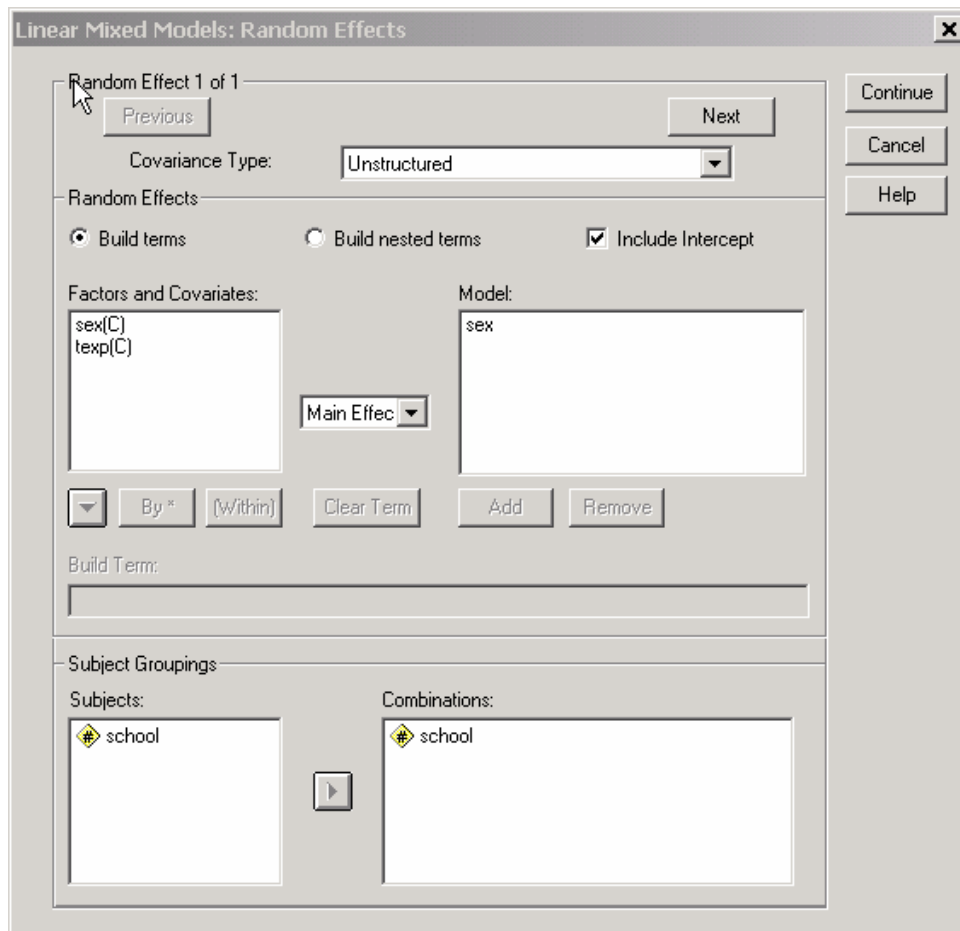
Step 1: Assign nested variable and continue.



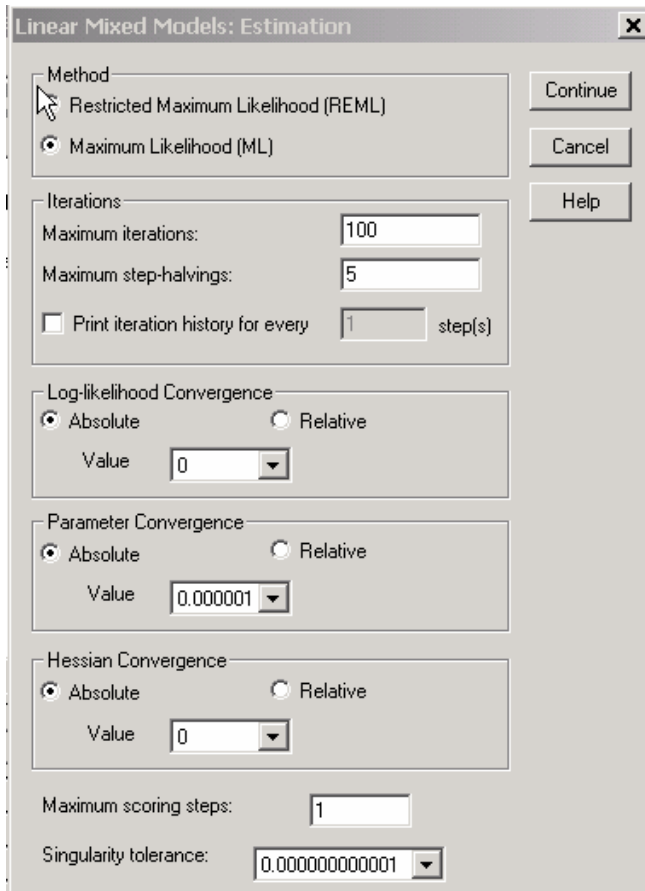
Step 2: Assign outcome variable and predictors. Note that predictors may be categorical (assign them as factors) or continuous (assign them as covariates).



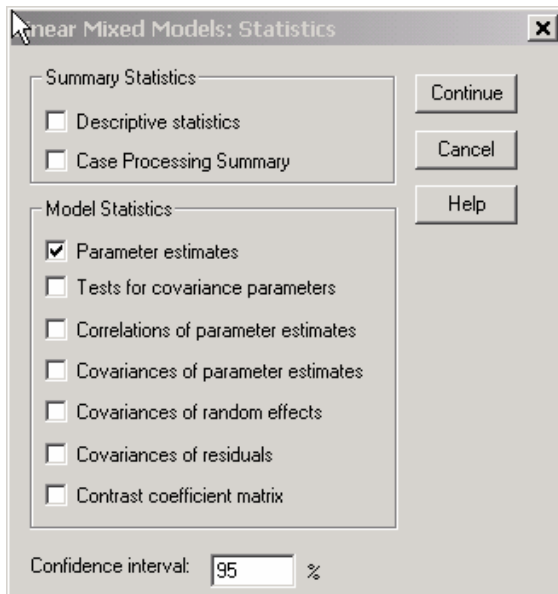
Step 3: Select fixed effects. Use the drop-down menu in the centre of the screen to indicate whether predictors should be included as factors or covariates and whether interaction terms should be included.



Step 4: Select random effects. Use the drop-down menu in the centre to indicate whether predictors should be included as factors or covariates and whether interaction terms should be included. Do not forget to include an intercept. Select the unstructured covariance type at the top if covariances between random intercepts and slopes should be estimated. Select the grouping variable at the bottom of the screen. In this case, pupils are nested within schools.



Step 5: Select an estimation method. The (unrestricted) Maximum Likelihood estimation method is used in model M1, so we select this method to reproduce the results in Table 2.1.



Step 6: Select desired statistics.

The steps above produce the following syntax:

```
MIXED
popular WITH sex texp
/CRITERIA = CIN(95) MXITER(100) MXSTEP(5) SCORING(1)
SINGULAR(0.000000000001) HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE)
PCONVERGE(0.000001, ABSOLUTE)
/FIXED = sex texp | SSTYPE(3)
/METHOD = ML
/PRINT = SOLUTION
/RANDOM INTERCEPT sex | SUBJECT(school) COVTYPE(UN) .
```

The output is as follows. Compare with the results in Table 2.1. An interpretation of the results is given in the text below Table 2.

**Information Criteria(a)**

-2 Log Likelihood	4261.175
Akaike's Information Criterion (AIC)	4275.175
Hurvich and Tsai's Criterion (AICC)	4275.232
Bozdogan's Criterion (CAIC)	4321.382
Schwarz's Bayesian Criterion (BIC)	4314.382

The information criteria are displayed in smaller-is-better forms.  
a. Dependent Variable: popularity according to sociometric score.

**Type III Tests of Fixed Effects(a)**

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	99.425	440.363	.000
SEX	1	98.872	201.592	.000
TEXP	1	99.455	114.816	.000

a. Dependent Variable: popularity according to sociometric score.

**Estimates of Fixed Effects(a)**

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	3.3399726	.1591614	99.425	20.985	.000	3.0241785	3.6557666
SEX	.8431752	.0593856	98.872	14.198	.000	.7253393	.9610110
TEXP	.1083526	.0101120	99.455	10.715	.000	.0882893	.1284159

a. Dependent Variable: popularity according to sociometric score.

**Estimates of Covariance Parameters(a)**

Parameter	Estimate	Std. Error
Residual	.3924859	.0130880
Intercept + SEX	.4024924	.0628791
[subject = SCHOOL]	.0211085	.0428073
	.2697005	.0501785

a. Dependent Variable: popularity according to sociometric score.

Note: residual is variance at person level. UN(1,1) is variance of random intercept. UN(2,1) is covariance between random intercept and slope. UN(2,2) is variance of random slope.

## Computer Lab part 2.

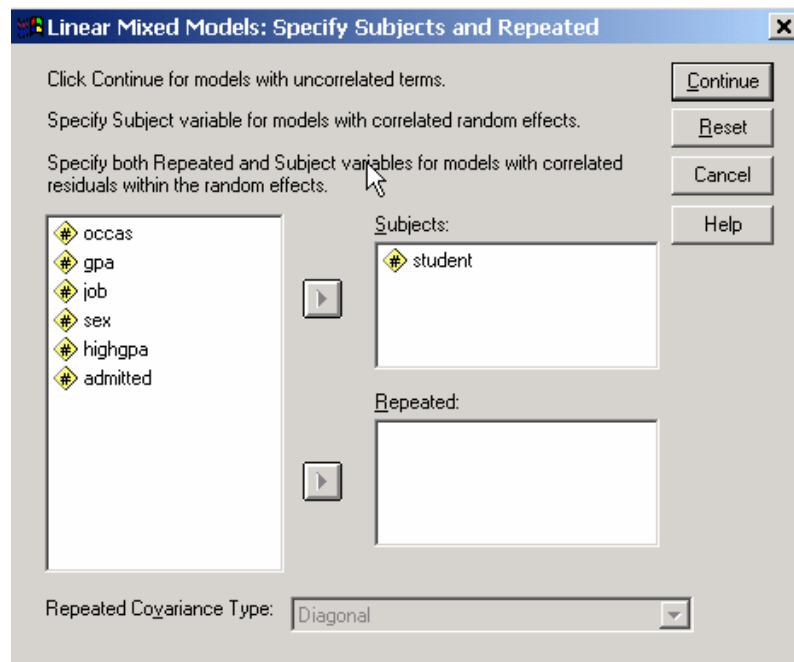
### Part 1: Guidelines for fitting a longitudinal model in SPSS Mixed

Note: table and page number refer to

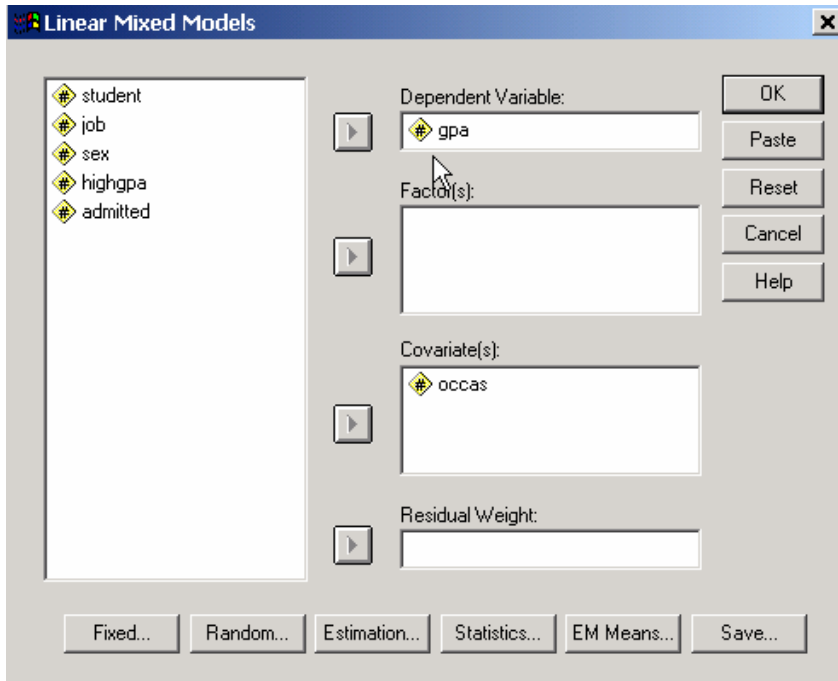
Hox, J.J. (2002). Multilevel Analysis, Techniques and Applications. Mahwah: Erlbaum.

The following steps will estimate model M2 in Table 5.3. The data can be found in the file GPAFLAT.SAV.

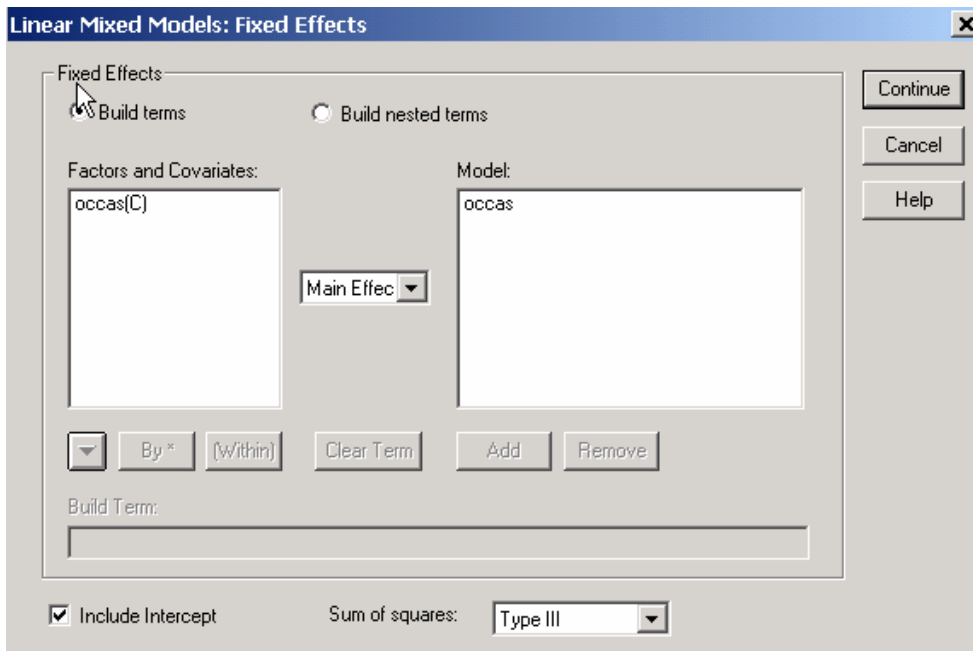
In SPSS: start with Analyze – Mixed Models – Linear...



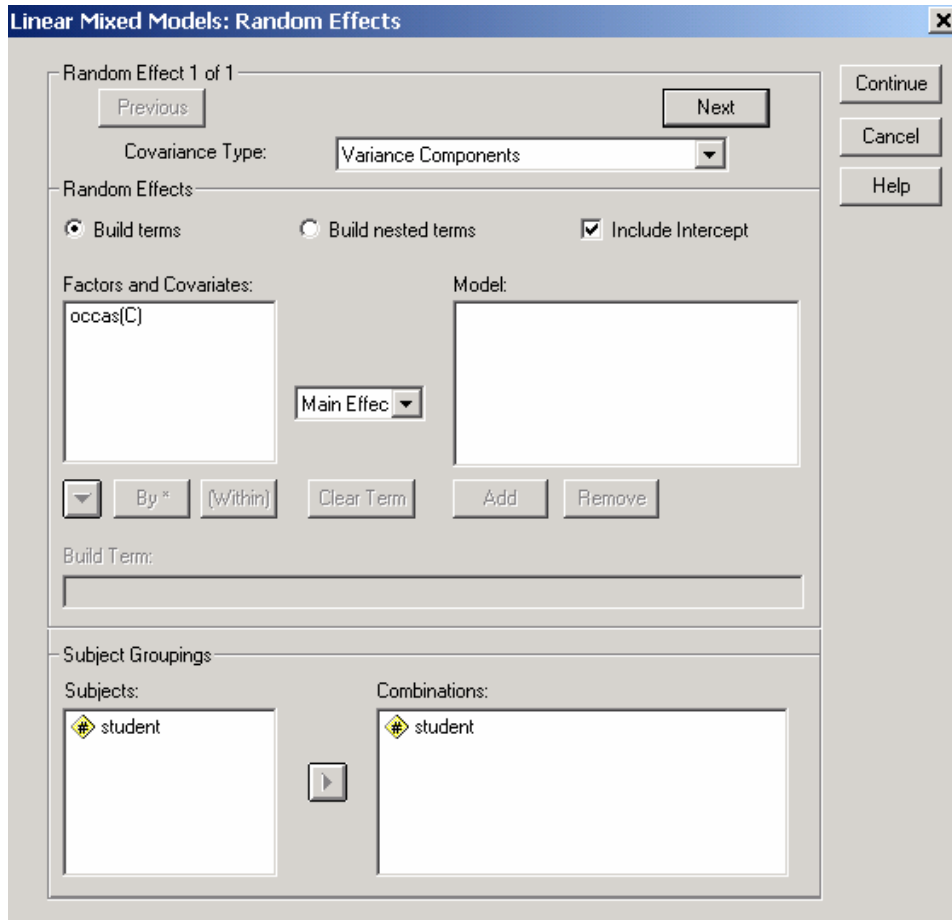
Step 1: Select subjects and continue.



Step 2: Select outcome variable and predictor.



Step 3: Select fixed effects.



Step 4: Select random effects. Do not forget to include the intercept. In this example repeated measurements are nested within students. This should be indicated at the bottom of the screen.



**Linear Mixed Models: Estimation** [X]

Method

Restricted Maximum Likelihood (REML)

Maximum Likelihood (ML)

Continue

Cancel

Help

Iterations

Maximum iterations:

Maximum step-halvings:

Print iteration history for every  step(s)

Log-likelihood Convergence

Absolute  Relative

Value:

Parameter Convergence

Absolute  Relative

Value:

Hessian Convergence

Absolute  Relative

Value:

Maximum scoring steps:

Singularity tolerance:

Step 5: Select estimation method.

**Linear Mixed Models: Statistics** [X]

Summary Statistics

Descriptive statistics

Case Processing Summary

Continue

Cancel

Help

Model Statistics

Parameter estimates

Tests for covariance parameters

Correlations of parameter estimates

Covariances of parameter estimates

Covariances of random effects

Covariances of residuals

Contrast coefficient matrix

Confidence interval:  %

Step 6: Select desired statistics.

This produces the following syntax:

```
MIXED
  gpa WITH occas
  /CRITERIA = CIN(95) MXITER(100) MXSTEP(5) SCORING(1) SINGULAR
(0.000000000001) HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE
(0.000001, ABSOLUTE)
  /FIXED = occas | SSTYPE(3)
  /METHOD = ML
  /PRINT = SOLUTION
  /RANDOM INTERCEPT | SUBJECT(student) COVTYPE(VC) .
```

The output is as follows (compare with model M2 in Table 5.3).

**Information Criteria(a)**

-2 Log Likelihood	393.649
Akaike's Information Criterion (AIC)	401.649
Hurvich and Tsai's Criterion (AICC)	401.683
Bozdogan's Criterion (CAIC)	426.009
Schwarz's Bayesian Criterion (BIC)	422.009

The information criteria are displayed in smaller-is-better forms.  
a Dependent Variable: GPA.

**Type III Tests of Fixed Effects(a)**

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	324.392	14411.313	.000
OCCAS	1	1000	681.703	.000

a Dependent Variable: GPA.

**Estimates of Fixed Effects(a)**

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2.5992143	.0216516	324.392	120.047	.000	2.5566190	2.6418096
OCCAS	.1063143	.0040719	1000	26.109	.000	.0983239	.1143047

a Dependent Variable: GPA.

**Estimates of Covariance Parameters(a)**

Parameter	Estimate	Std. Error
Residual	.0580305	.0025952
Intercept [subject Variance = STUDENT]	.0633616	.0073161

a Dependent Variable: GPA.