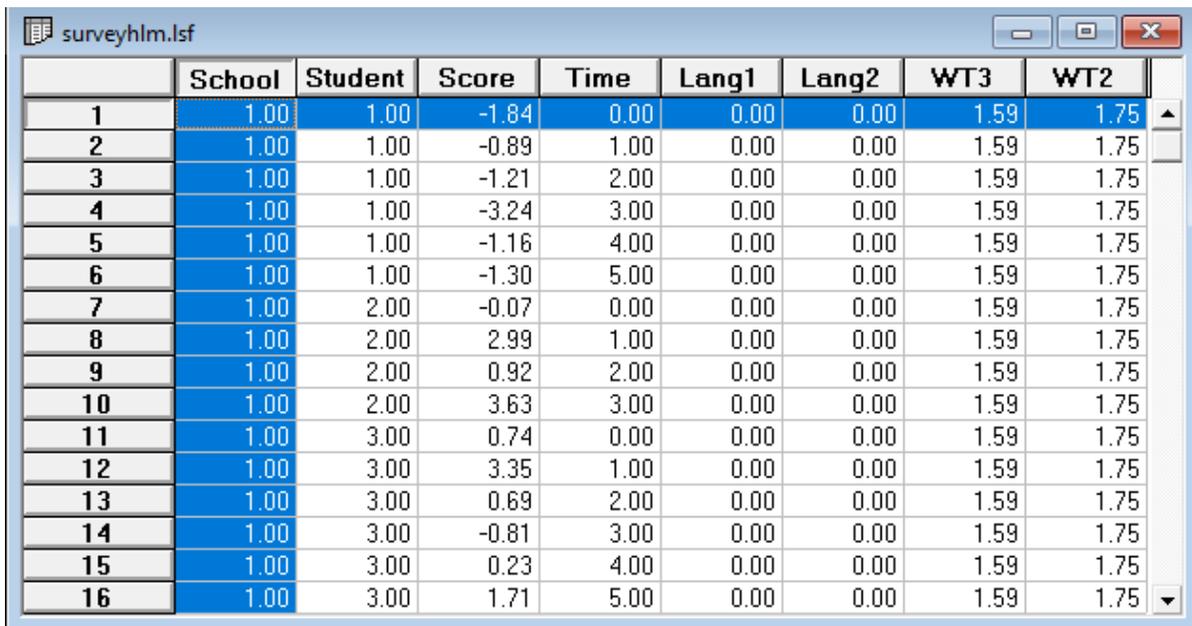


## A multilevel model with design weights

The data are stratified according to 100 schools. Within each school ten students are selected as primary sampling units (PSUs). Students were selected on the basis of their initial achievement in an aptitude test (Score1) and measurements were repeated at six intervals for five students from each school and over four time intervals for the remaining five students. The data are listed in the file **SURVEYHLM.LSF** in the **Multilevel Examples** folder. The first portion of this file is shown below.



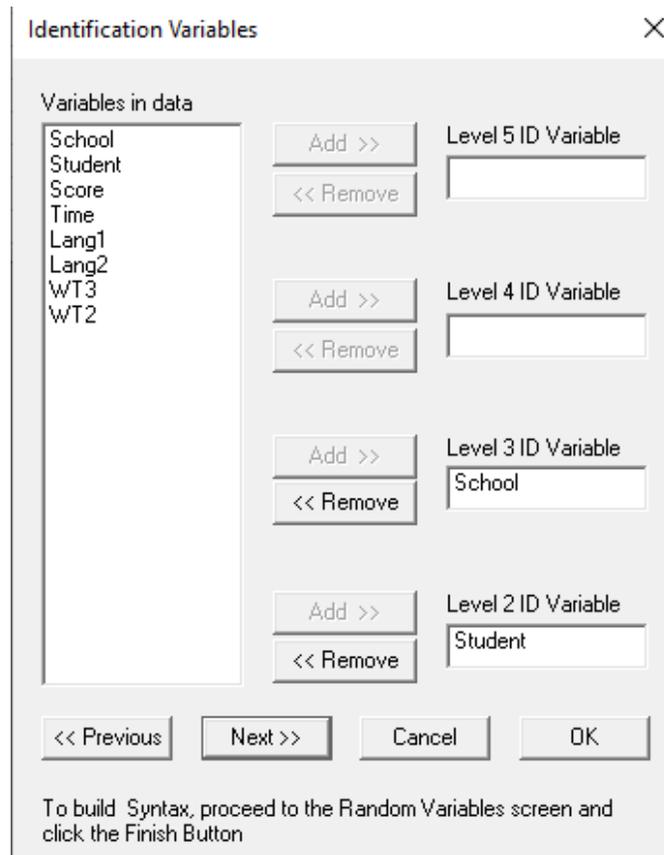
	School	Student	Score	Time	Lang1	Lang2	WT3	WT2
1	1.00	1.00	-1.84	0.00	0.00	0.00	1.59	1.75
2	1.00	1.00	-0.89	1.00	0.00	0.00	1.59	1.75
3	1.00	1.00	-1.21	2.00	0.00	0.00	1.59	1.75
4	1.00	1.00	-3.24	3.00	0.00	0.00	1.59	1.75
5	1.00	1.00	-1.16	4.00	0.00	0.00	1.59	1.75
6	1.00	1.00	-1.30	5.00	0.00	0.00	1.59	1.75
7	1.00	2.00	-0.07	0.00	0.00	0.00	1.59	1.75
8	1.00	2.00	2.99	1.00	0.00	0.00	1.59	1.75
9	1.00	2.00	0.92	2.00	0.00	0.00	1.59	1.75
10	1.00	2.00	3.63	3.00	0.00	0.00	1.59	1.75
11	1.00	3.00	0.74	0.00	0.00	0.00	1.59	1.75
12	1.00	3.00	3.35	1.00	0.00	0.00	1.59	1.75
13	1.00	3.00	0.69	2.00	0.00	0.00	1.59	1.75
14	1.00	3.00	-0.81	3.00	0.00	0.00	1.59	1.75
15	1.00	3.00	0.23	4.00	0.00	0.00	1.59	1.75
16	1.00	3.00	1.71	5.00	0.00	0.00	1.59	1.75

The -9.000 entries denote missing values.

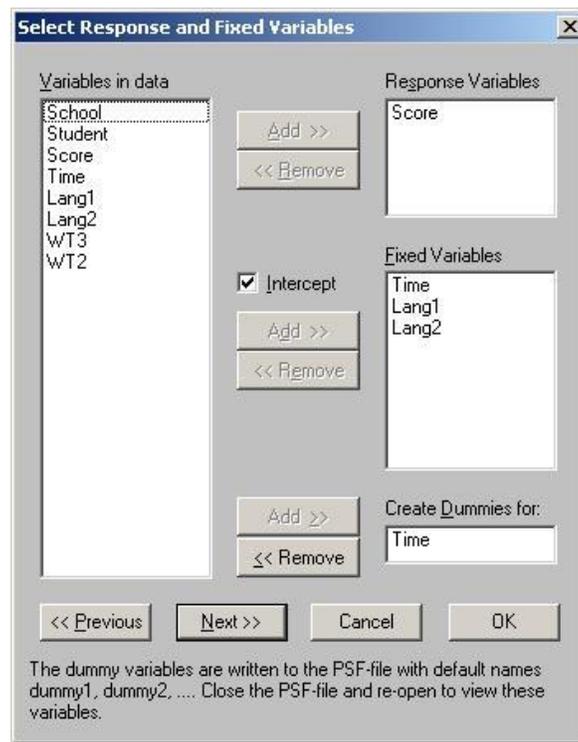
Click the **Open** option from the **File** menu to select and open the data file. Select the **Lisrel Data (\*.lsf)** option on the **Files of type** drop-down list box. Select the file **surveyhlm**. Click on the **Open** button to open **surveyhlm.lsf** in a LSF window. Click on the **Linear Model** option on the **Multilevel** menu.

Select the **Title and Options** option on the **Linear Model** menu to load the **Title and Options** dialog box. Enter the string **Level 3 Model with Design Weights** in the **Title:** string field. Click on the **Next** button to load the **Identification variables** dialog box.

Select the variable **School**. Click on the **Add** button of the **Level 3 ID Variable** section. Select the variable **Student**. Click on the **Add** button of the **Level 2 ID Variable** section. On the **Weight Variables** dialog box, select the variable **WT3**. Click on the **Add** button of the **Level 3 Weight:** section and add the variable **WT3**. Add the level-2 weight in the same way. Click on the **Add** button of the **Level 2 Weight**.



Click on the **Next** button to load the **Select Response and Fixed Variables** dialog box. Select the variable Score. Click on the **Add** button of the **Response Variables** section. Select the variables Time, Lang1 and Lang2 and add them in similar fashion to the **Fixed Variables** section. Add the variable Time to the **Create Dummies for:** section to produce the following **Select Response and Fixed Variables** dialog box.



On the next dialog box (**Random Variables**) add the variable Time to both the **Random Level 2** and the **Random Level 3** sections to produce the following **Random Variables** dialog box.

Variables in data		Random Level 1	Intercept
School	Add >>		<input checked="" type="checkbox"/>
Student	<< Remove		
Score			
<b>Time</b>			
Lang1	Add >>	Time	<input checked="" type="checkbox"/>
Lang2	<< Remove		
WT3			
WT2			
	Add >>	Time	<input checked="" type="checkbox"/>
	<< Remove		
	Add >>		<input checked="" type="checkbox"/>
	<< Remove		
	Add >>		<input checked="" type="checkbox"/>
	<< Remove		

To build Syntax, proceed to the Random Variables screen and click the Finish Button

Click on the **Finish** button to produce the following text editor window for **SURVEYHLM.PRL**.

```

L surveyhlm.PRL
OPTIONS OLS=YES CONVERGE=0.001000 MAXITER=10 OUTPUT=STANDARD ;
TITLE=Level 3 model with design weights;
SY =surveyhlm.lsf;
ID3=School;
ID2=Student;
RESPONSE=Score;
FIXED=intcept Time Lang1 Lang2;
DUMMY=Time;
RANDOM1=intcept;
RANDOM2=intcept Time;
RANDOM3=intcept Time;

```

Click on the **Run PRELIS** toolbar icon to produce the following text editor window for **SURVEYHLM.OUT**.

FIXED PART OF MODEL				
COEFFICIENTS	BETA-HAT	STD. ERR.	Z-VALUE	PR >  Z
intcept	0.92865	0.11624	7.98903	0.00000
Time	0.51411	0.04700	10.93929	0.00000
Lang1	0.39340	0.10187	3.86166	0.00011
Lang2	-1.03430	0.12628	-8.19048	0.00000
-2 LOG-LIKELIHOOD				
DEVIANCE= -2*LOG(LIKELIHOOD) = 20291.45605242517				
NUMBER OF FREE PARAMETERS = 11				
RANDOM PART OF MODEL				
LEVEL 3	TAU-HAT	STD. ERR.	Z-VALUE	PR >  Z
intcept /intcept	0.93174	0.15961	5.83758	0.00000
Time /intcept	0.25568	0.05730	4.46216	0.00001
Time /Time	0.17510	0.03216	5.44445	0.00000
LEVEL 2	TAU-HAT	STD. ERR.	Z-VALUE	PR >  Z
intcept /intcept	0.96301	0.11379	8.46312	0.00000
Time /intcept	0.36079	0.03885	9.28783	0.00000
Time /Time	0.20039	0.02083	9.62203	0.00000
LEVEL 1	TAU-HAT	STD. ERR.	Z-VALUE	PR >  Z
intcept /intcept	1.02326	0.03448	29.67564	0.00000

### Saturated Model

We now show how to fit a saturated model to these data and compare this model to that previously fitted using the deviance statistic obtained from the output of the previous model.

Using the syntax previously obtained, select the **Title and Options** option using the **Linear Model** option on the **Multilevel** menu. Enter 11 in the **Nfree:** string field. Enter 20291.456 in the **Deviance:** string field to produce the following **Title and Options** dialog box.

**Title and Options**

Title (Maximum 70 characters):

Maximum Number of Iterations:

Convergence Criterion:

Missing Data Value:  Nfree:

Missing Dep Value:  Deviance:

Use OLS for starting values     Calculate effect sizes

Additional Output

Asymptotic Covariances     Residuals

Empirical Bayes Estimates     No Data Summary

Between and Within Covariance Matrices

To build Syntax, proceed to the Random Variables screen and click the Finish Button

Click on the **Next** button to proceed to the **Response and Fixed Variables** dialog box. Select the variables Time, Lang1 and Lang2 from the **Response Variables** and **Create Dummies for:** sections and select the variables dummy1 to dummy6. Click on the **Add** button of the **Fixed Variables** section.

Uncheck the **Intercept** check box to produce the following **Select Response and Fixed Variables** dialog box.

**Select Response and Fixed Variables**

Variables in data

- School
- Student
- Score
- Time
- Lang1
- Lang2
- WT3
- WT2
- dummy1
- dummy2
- dummy3
- dummy4
- dummy5
- dummy6

Response Variables

Score

Fixed Variables

Intercept

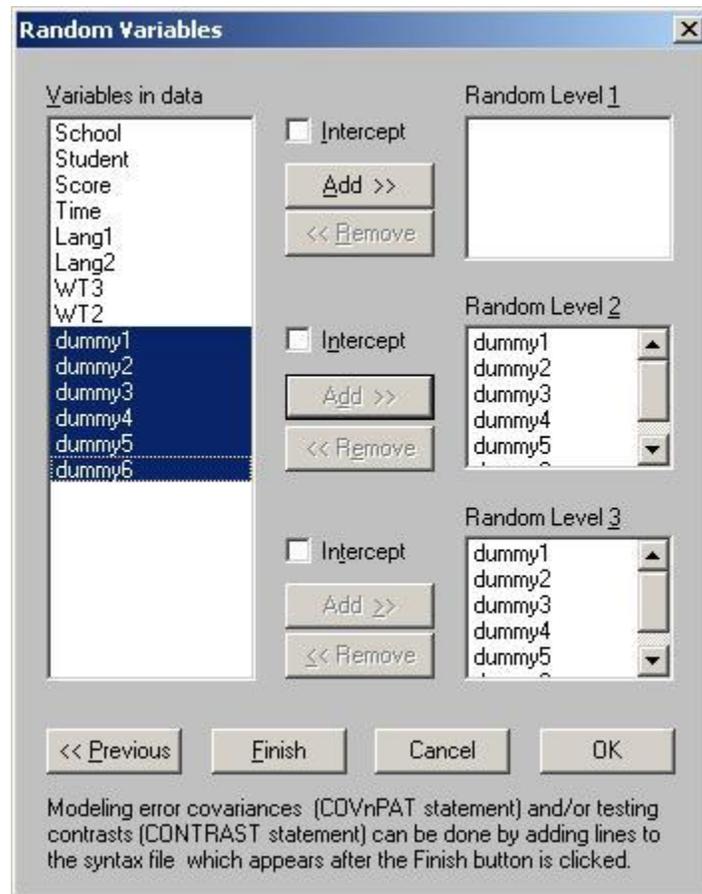
Create Dummies for:

The dummy variables are written to the PSF-file with default names dummy1, dummy2, .... Close the PSF-file and re-open to view these variables.

Click on the **Next** button to load the **Random Variables** dialog box. Select the variables dummy1 to dummy6. and add these to both the **Random Level 2** and **Random Level 3** sections to produce the following **Random Variables** dialog box.



Click on the **Finish** button to produce the following text editor window for **SURVEYHLM.PRL**.

```
surveyhlm.PRL
OPTIONS OLS=YES NFREE=11 DEVIANCE=20291.456 CONVERGE=0.001000
TITLE=Level 3 saturated model with design weights;
SY=surveyhlm.lsf;
ID3=School;
ID2=Student;
WEIGHT3=WT3;
WEIGHT2=WT2;
RESPONSE=Score;
FIXED=dummy1 dummy2 dummy3 dummy4 dummy5 dummy6;
RANDOM2=intcept dummy1 dummy2 dummy3 dummy4 dummy5 dummy6;
RANDOM3=intcept dummy1 dummy2 dummy3 dummy4 dummy5 dummy6;
```

Click on the **Run PRELIS** toolbar icon to produce the following text editor window for **SURVEYHLM.OUT**.

FIXED PART OF MODEL					
COEFFICIENTS		BETA-HAT	STD. ERR.	Z-VALUE	PR >  Z
dummy1		0.86268	0.10531	8.19161	0.00000
dummy2		1.47507	0.14581	10.11623	0.00000
dummy3		1.92424	0.17203	11.18518	0.00000
dummy4		2.43611	0.22121	11.01268	0.00000
dummy5		2.98650	0.26038	11.46986	0.00000
dummy6		3.40673	0.30944	11.00947	0.00000
-2 LOG-LIKELIHOOD					
DEVIANCE= -2*LOG(LIKELIHOOD) = 20289.12092170451					
NUMBER OF FREE PARAMETERS = 48					
RANDOM PART OF MODEL					
LEVEL 3		TAU-HAT	STD. ERR.	Z-VALUE	PR >  Z
dummy1	/dummy1	0.91628	0.14765	6.20565	0.00000
dummy2	/dummy1	1.14733	0.19932	5.75637	0.00000
dummy2	/dummy2	1.74251	0.35640	4.88925	0.00000
dummy3	/dummy1	1.37995	0.22725	6.07237	0.00000
dummy3	/dummy2	2.03690	0.39189	5.19761	0.00000
dummy3	/dummy3	2.54612	0.44791	5.68443	0.00000