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.

surveyhlm.lsf

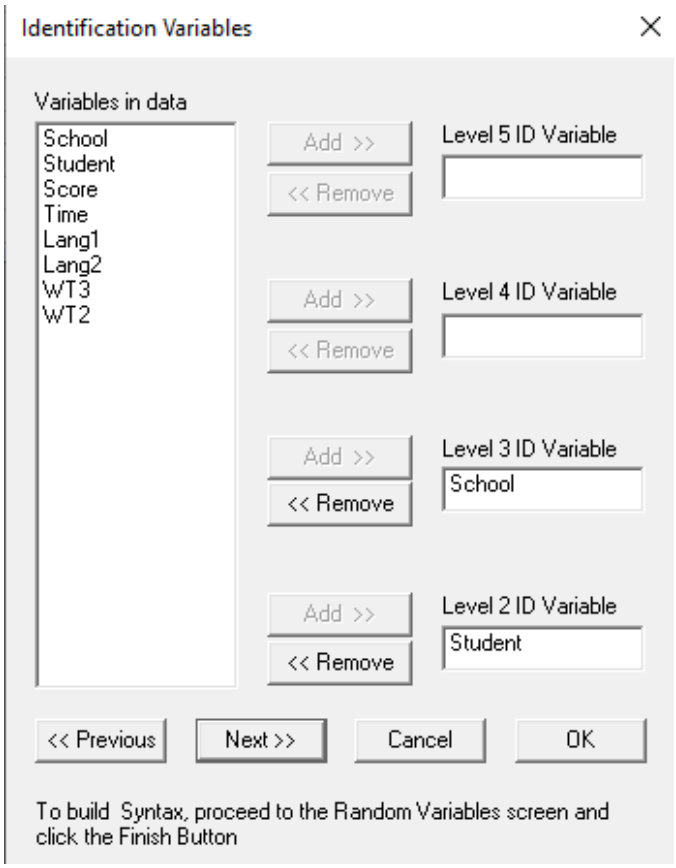
	School	Student	Score	Time	Lang1	Lang2	WT3	WT2
1	1.00	1.00	-1.84	0.00	0.00	0.00	1.59	1.75
2	1.00	1.00	-0.89	1.00	0.00	0.00	1.59	1.75
3	1.00	1.00	-1.21	2.00	0.00	0.00	1.59	1.75
4	1.00	1.00	-3.24	3.00	0.00	0.00	1.59	1.75
5	1.00	1.00	-1.16	4.00	0.00	0.00	1.59	1.75
6	1.00	1.00	-1.30	5.00	0.00	0.00	1.59	1.75
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.

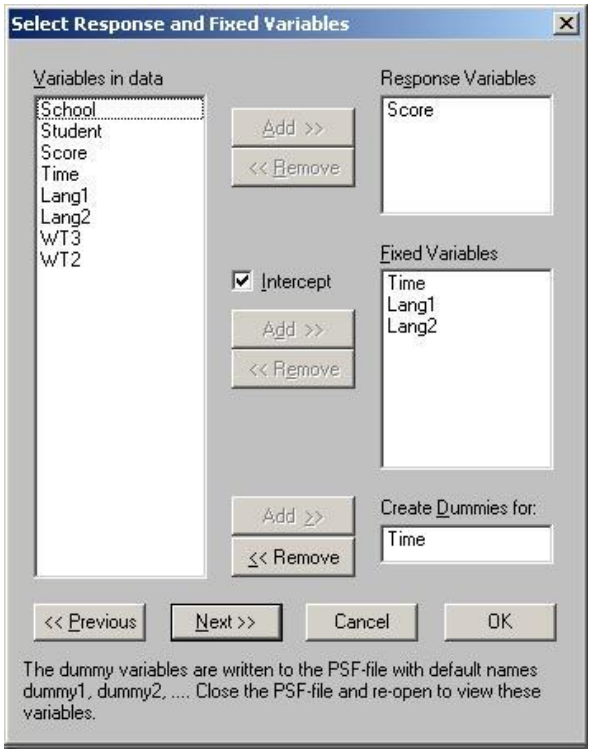
Click the **Open** option from the **File** menu to select and open the data file. Select the **Lisrel Data (*.lsf)** option on the **Files of type** drop-down list box. Select the file **surveyhlm**. Click on the **Open** button to open **surveyhlm.lsf** in a LSF window. Click on the **Linear Model**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

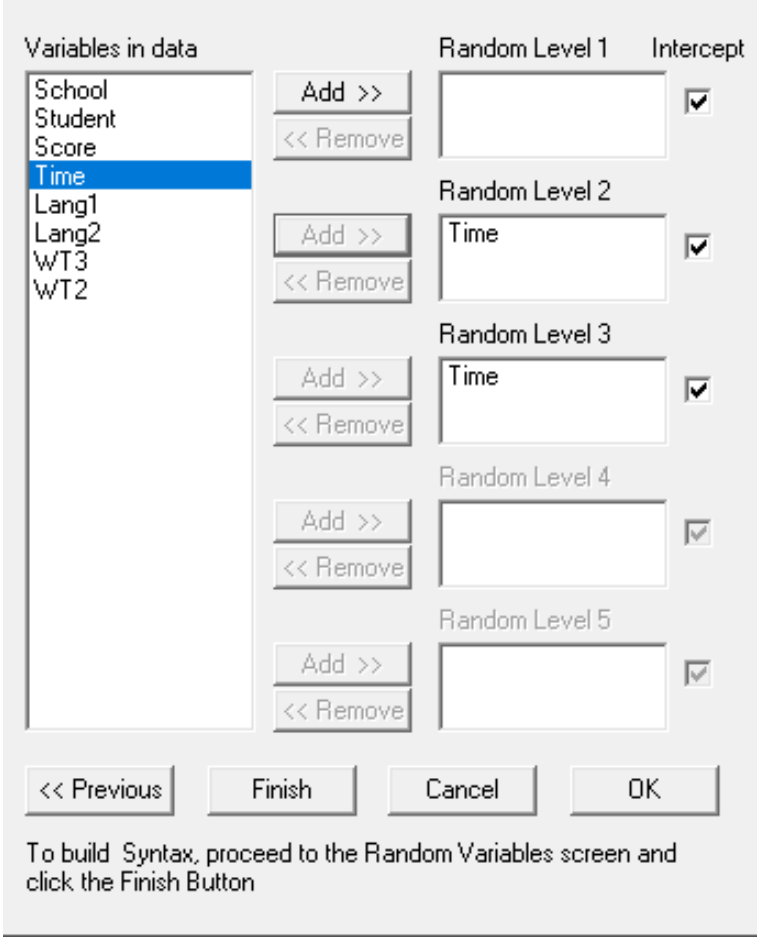
Select the variable School. Click on the **Add** button of the **Level 3 ID Variable** section. Select the variable Student. Click on the **Add** button of the **Level 2 ID Variable** section. On the **Weight Variables** dialog box, select the variable WT3. Click on the **Add** button of the **Level 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**.



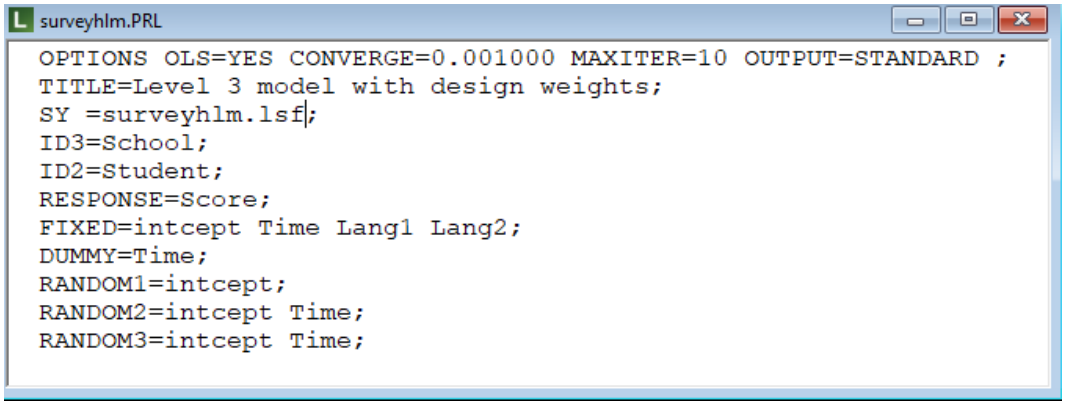
Click on the **Next** button to load the **Select Response and Fixed Variables** dialog box. Select the variable Score. Click on the **Add** button of the **Response Variables** section. Select the variables Time, Lang1 and Lang2 and add them in similar fashion to the **Fixed Variables** section. Add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



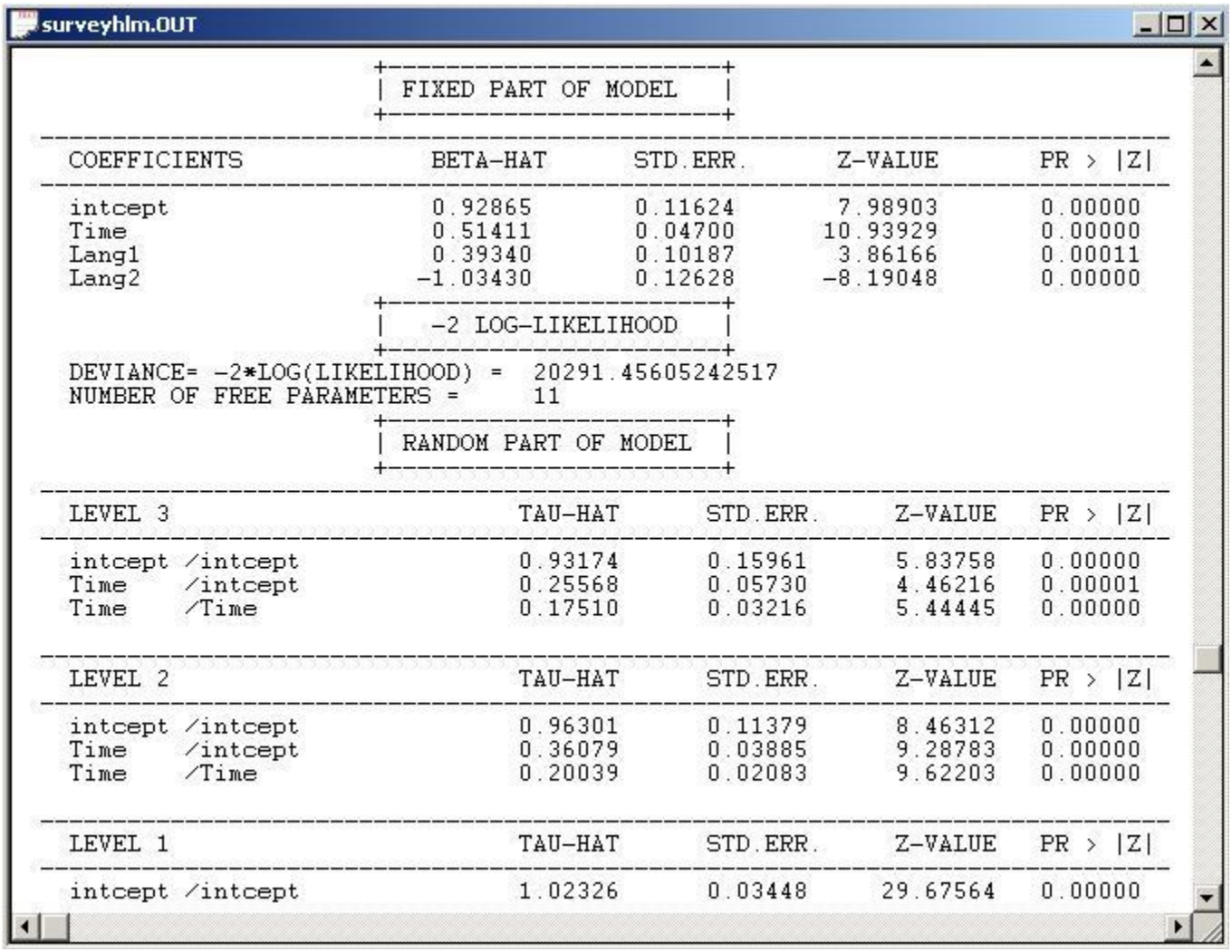
On the next dialog box (**Random Variables**) add the variable Time to both the **Random Level 2** and the **Random Level 3** sections to produce the following **Random Variables** dialog box.



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



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



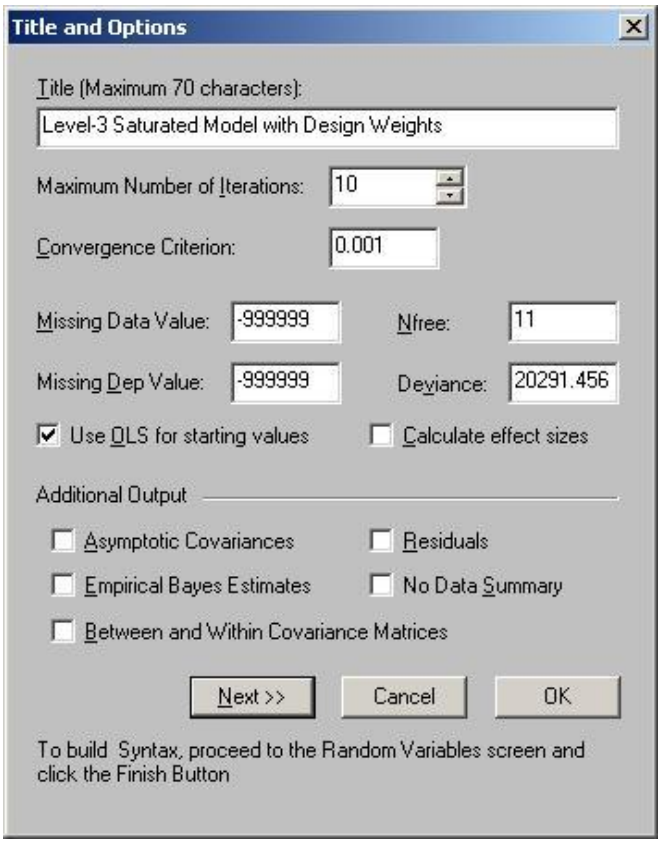
surveyhlm.OUT

```
                        +-----------------------+
                        | 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

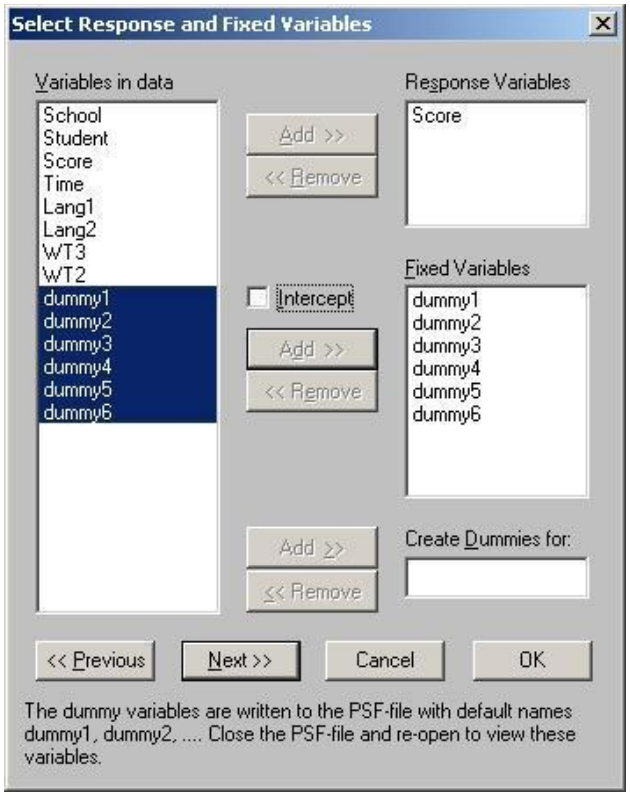
We now show how to fit a saturated model to these data and compare this model to that previously fitted using the deviance statistic obtained from the output of the previous model.

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.

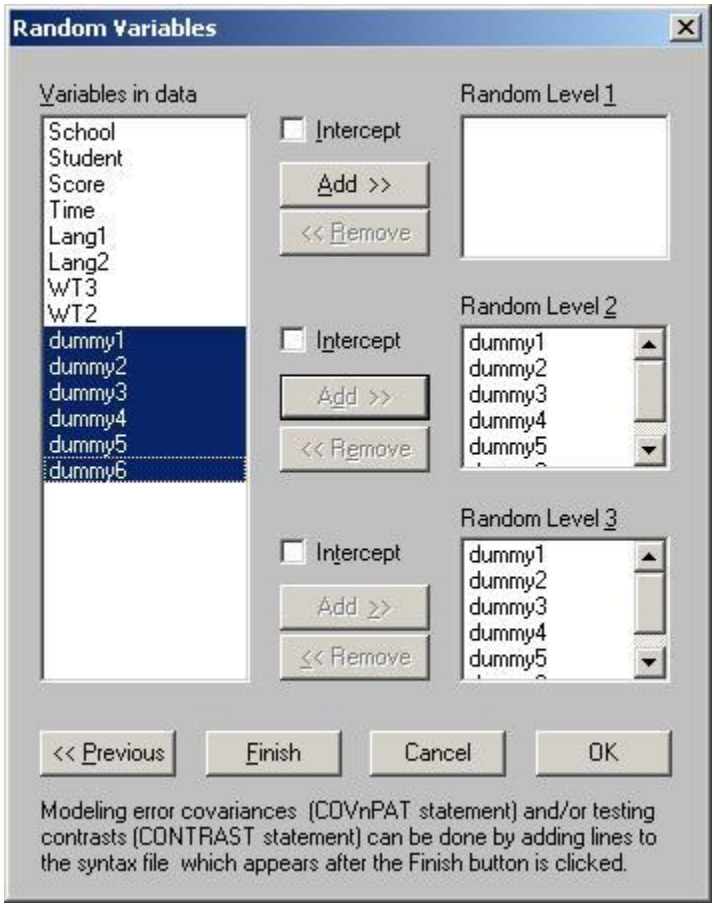


Click on the **Next** button to proceed to the **Response and Fixed Variables** dialog box. Select the variables Time, Lang1 and Lang2 from the **Response Variables** and **Create Dummies for:** sections and select the variables dummy1 to dummy6. Click on the **Add** button of the **Fixed Variables**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

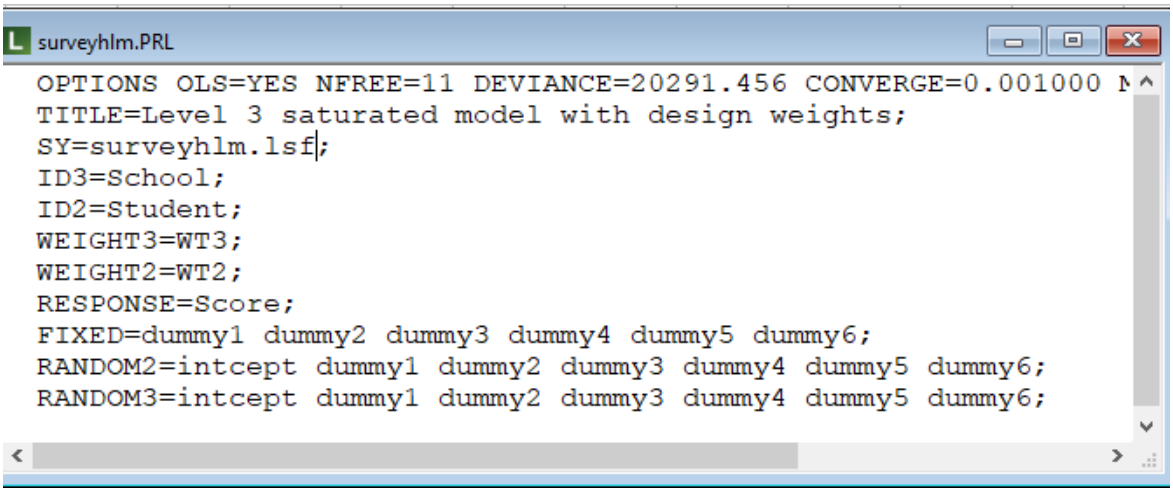
Uncheck the **Intercept** check box to produce the following **Select Response and Fixed Variables** dialog box.



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**.



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

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
```