

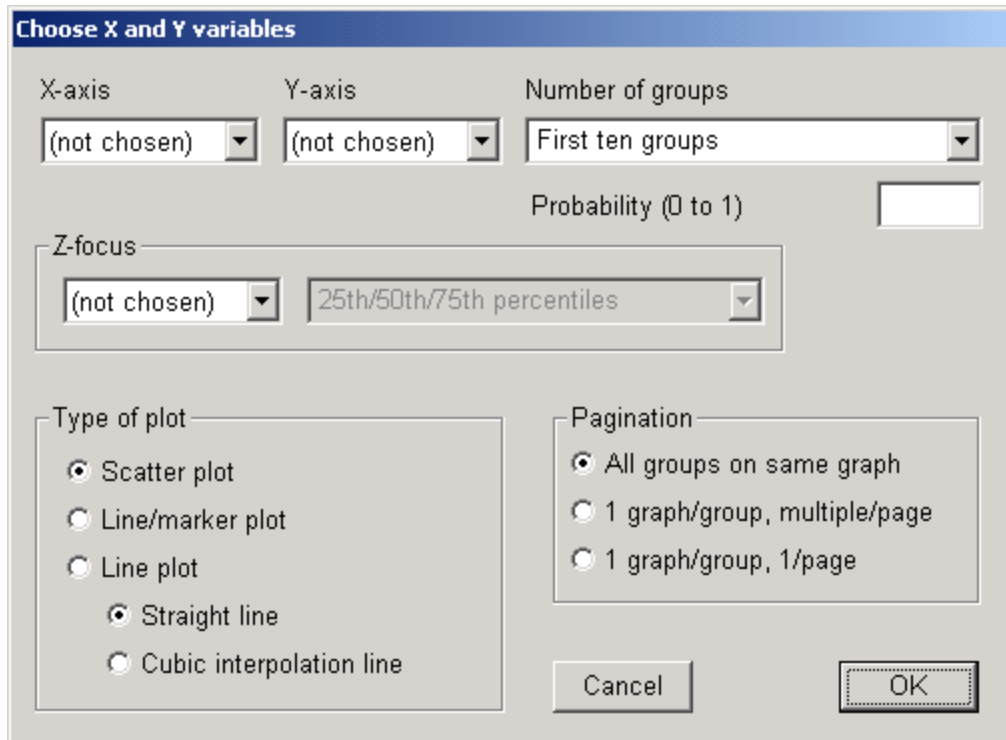


## Scatter plots

In the previous section, we illustrated how to graphically summarize and compare univariate distributions of level-1 variables, with and without a level-2 classification variable. Now we demonstrate how to use data-based scatter plots to explore bivariate relationships between level-1 variables for individual or a group of level-2 units, with and without controlling level-2 variables. We will continue to use the HS&B data set and we are going to examine the relationships between MATHACH and SES for a group or individual schools, with and without controlling for the sector of the school.

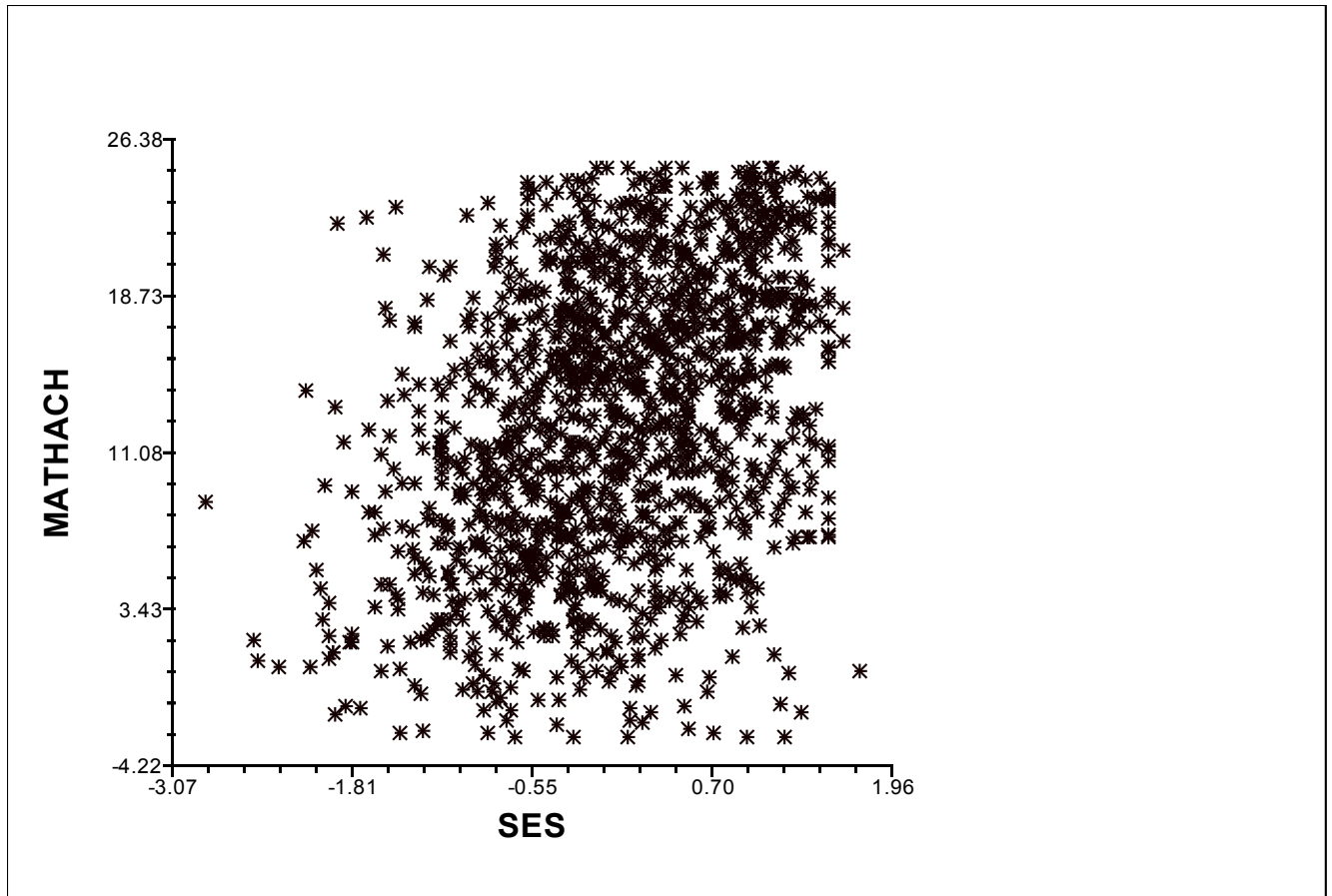
### To prepare a scatter plot

1. From the HLM window, open the **File** menu.
2. Choose **Create a new model using an existing MDM file** to open an **Open MDM File** dialog box. Open HSB.MDM.
3. Open the **File** menu, choose **Graph Data .... line plots, scatter plots** to open a **Choose X and Y variables** dialog box (see Figure 8).
4. Select SES from the **X-axis** drop-down list box.
5. Select MATHACH from the **Y-axis** drop-down list box.
6. Select number of groups. In this example, select **Random sample of spec'd prob** and enter .2 into the textbox to select 20 percent of the schools.



**Figure 8 Choose X and Y variables dialog box**

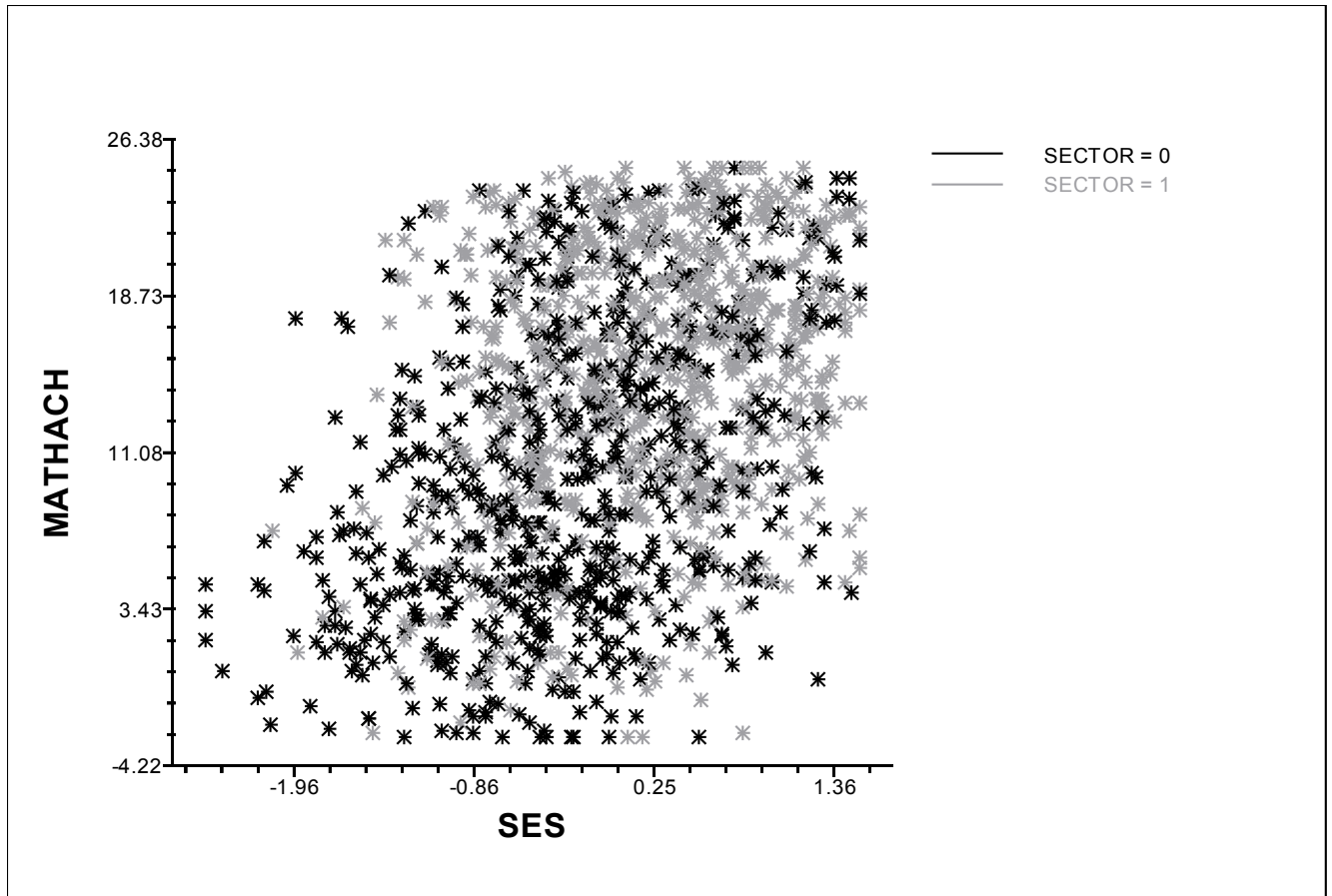
7. Select type of plot. Users can select one of the two major types of plots: (a) scatter plot; and (b) line plot with and without markers or asterisks showing where the data points are. Click the selection button for **Scatter plot** (default) for this example.
8. Select type of pagination. There are three options: (a) all groups on the same graph (default); (b) one graph per groups and to display a maximum of eight graphs on one page, and (c) 1 graph per group and to be displayed on multiple pages. In this example, we will display the bivariate relationship between SES and MATHACH for all the selected schools on a single graph. We choose the option **All groups on same graph** accordingly.
9. Click **OK** to make the scatter plot. This gives us the following graph (see Figure 9), indicating a moderate positive association between SES and MATHACH, and suggesting that both variables have "ceilings" (upper limits).



**Figure 9** Scatter plot for the 20% random sample of cases

**To include a level-2 classification variable**

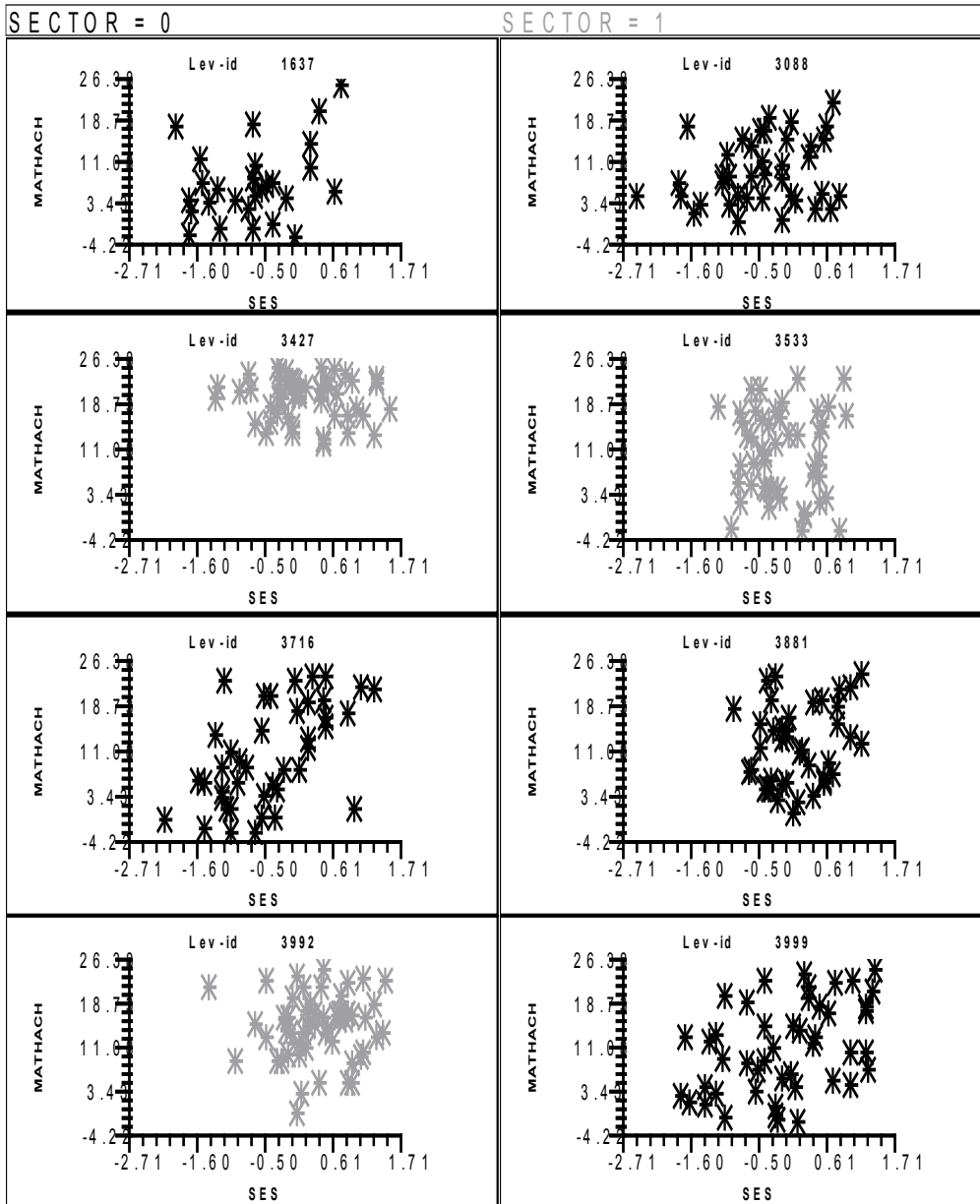
10. After specifying the variables for the x- and y-axis, select the controlling variable from the **Z-focus** drop-down list box. As in the case for the box-and-whisker plots, users can choose either a categorical and continuous controlling variable. In our example, we will choose school sector, Catholic vs. public school, as the controlling variable. To continue working on the scatter plot we have just made, click **Graph Settings** to open the **Equation Graphing** dialog box. Select SECTOR in the **Z-focus** dialog box. The following graph will be displayed (see Figure 10).



**Figure 10 Scatter plot for random sample by SECTOR**

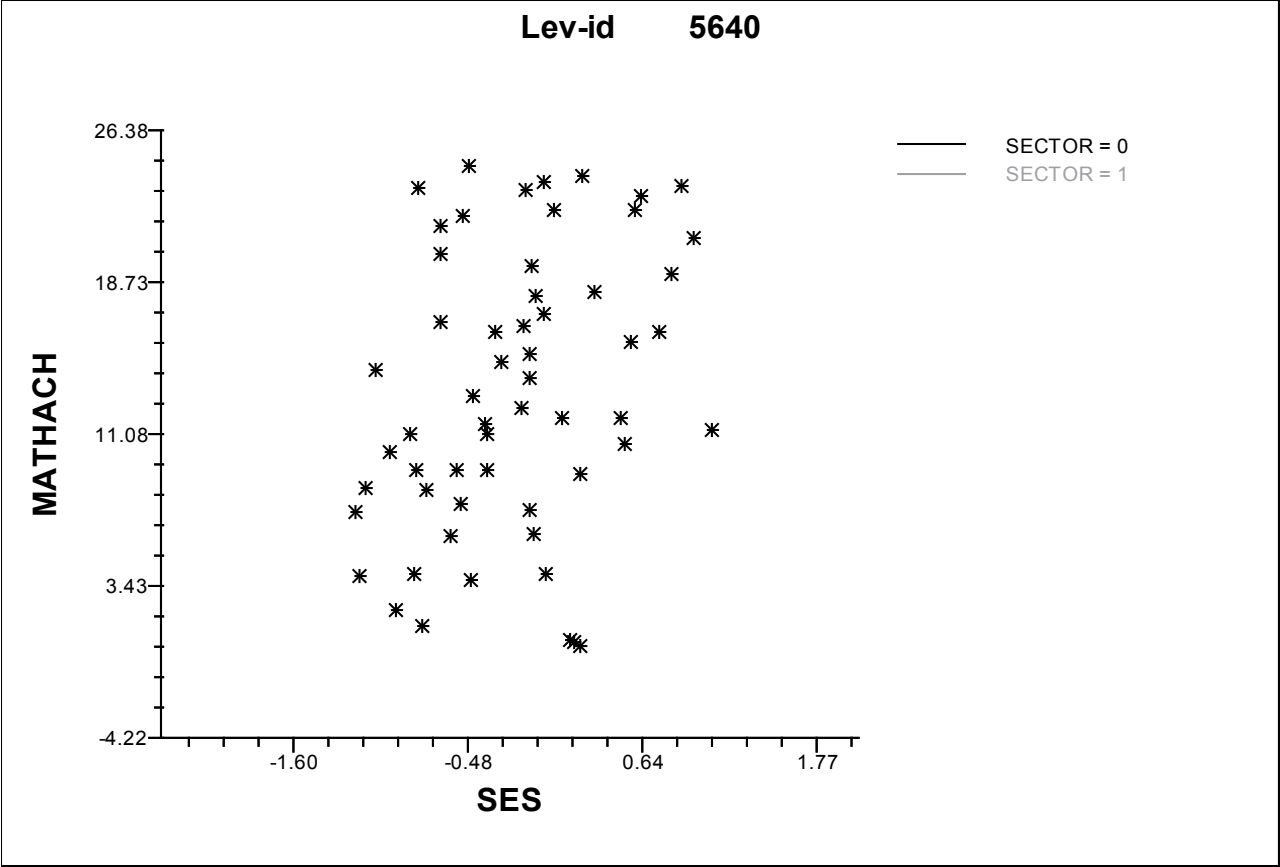
The color-coded scatter plot shows that there is not in general a radical difference in the SES-MATHACH relationship for the two types of schools.

It may be helpful to use a different pagination option to help us to discern the relationships for these two groups of school. Instead of having all the groups on the same graph, we select the **1 graph/group, multiple/page** pagination option. This gives us Figure 18.11, where we see how the two groups of schools vary in their SES and MATHACH distributions. Note, for example, that school 8946 has high levels of SES and that in school 4325, the association between SES and MATHACH appears a bit stronger than in several of the other schools. WHLM puts a maximum of 8 groups in a window. We can page back and forth using the **->** and **<-** buttons in the lower right corner of the window to display the scatter plots for other schools.



**Figure 11 Scatter plots for individual schools on one page**

As an elaboration of this, we can also choose on the **Graph Settings** dialog box to have each group's plot in a separate graph by choosing **1 graph/group, 1/page**, as shown below:



**Figure 12 Individual scatter plot for school 7697**