Partial Correlation

A partial correlation provides an index of whether two variables are linearly related (say score on the verbal section of the SAT and college grade point average) if the effects of a third (or more) control variable (say high school grade point average) are removed from their relationship. A partial correlation is a type of Pearson correlation coefficient that can range in value from -1 to +1. A significant positive partial correlation implies that as the values on one variable increase, the values on a second variable also tend to increase, **while holding constant the values of the control variable(s).**

Partial correlations are conducted in order to understand why two variables are correlated. In order to interpret a partial correlation between two variables, we will first need to know the size of the zero-order (bi-variate) correlation between the two variables.

Partial correlations assist in understanding regression. The simplest partial correlation involves only three variables, a predictor variable, a predicted variable, and a control variable. Suppose as in the previous problem (under regression) an admissions officer is interested in the relationship between a student's score on the verbal section of the SAT (the predictor variable) and the student's final grade point average while in college (the predicted variable). However, suppose high school GPA is correlated with both college GPA and verbal SAT score. Would there still be a meaningful correlation between verbal SAT score and college GPA if we controlled for performance while in high school? Will the removal of high school GPA lessen the relationship between verbal SAT and college GPA?

Suppose the admissions officer in the previous problem, under simple regression, believed that the reason verbal SAT scores and College GPA are related is that they share a common denominator - namely how the student applied themselves while in high school. If correct, there should be a correlation between verbal SAT and college GPA but the correlation between these two variables partialling out the effects of high school performance should approach zero. The admissions officer obtained the following information:

Student	Verbal SAT	College GPA	High School GPA
Jane	760	3.95	98
Bob	720	3.68	95
Rich	710	3.66	94
Laura	700	3.20	92
Karen	650	3.10	90
Randy	580	2.90	88
Jim	570	2.70	85
Paul	520	2.70	82
Glen	520	2.50	80
Bill	500	2.30	78
Mary	490	2.00	70

1. Logon to system
2. **Click Start > Programs > SPSS for Windows > SPSS 10.1 for Windows**. At this point a window will appear asking you what you would like to do. Click on the circle next to Type in Data (2nd option in list) and then click **OK** at the bottom of the window.
3. A Data Editor will appear. Look in the lower left corner of the screen. You should see a **Data View** tab and to the right of it a **Variable View** tab. The **Variable View** tab will be used first for the Data **Definition** Phase of creating a data file. The Data **View** tab will be used to actually enter the raw numbers listed above. (See pages 1-3 for a more detailed explanation of creating data files.)

DATA DEFINITION PHASE

4.   Click on the **Variable View** tab in the lower left corner. A new screen will appear with the following words at the top of each column.

          Name Type Width Decimals **Label Values** Missing Columns Align Measure

5.   Click on the white cell in **Row 1** under the word **Name** and type in the word **verbsat** (for Verbal SAT score).
6.   Click on the white cell in **Row 1** under the word **Label** and type in **Verbal SAT**. (Doing this will provide you with a more expansive label in the results output).
7.   Click on the white cell in **Row 2** under the word **Name** and type in the word **colgpa** (for College GPA).
8.   Click on the white cell in **Row 2** under the word **Label** and type in **College GPA**. (Doing this will provide you with a more expansive label in the results output).
9.   Click on the white cell in **Row 3** under the word **Name** and type in **hsgpa** (for high school GPA).
10.   Click on the white cell in **Row 3** under the word **Label** and type in **high school gpa** (Doing this will provide you with a more expansive label in the results output).

DATA ENTRY PHASE

11.   Click on the **Data View** tab in the lower left corner. The data **view** screen will now appear with Column 1 named **verbsat** (for the Verbal Sat variable) and Column 2 named **colgpa** (for the College GPA variable) and Column 3 named **hsgpa** (for the High School GPA variable)..
10.   Enter data the data for the 11 students (Jane through Mary) as follows> Click on the top left cell under the first column **verbsat** and enter:

760 tab 3.95 tab 98 enter	Then mouse to second row to enter the data for the second case.
720 tab 3.68 tab 95 enter	Then mouse to the third row to enter the data for the third case etc. for the remaining cases.
710 tab 3.66 tab 94 enter	
700 tab 3.20 tab 92 enter	
650 tab 3.10 tab 90 enter	
580 tab 2.90 tab 88 enter	The data may also be entered down one column at a time, entering all the verbsat data, then moving on to column 2 and entering the data for the college gpa, and then on to column 3 and entering the data for the high school gpa.
570 tab 2.70 tab 85 enter	
520 tab 2.70 tab 82 enter	
520 tab 2.50 tab 80 enter	
500 tab 2.30 tab 78 enter	
490 tab 2.00 tab 70 enter	

Data Analysis

1.   Click on **Analyze** at top of screen then
       a.   Click on **Correlate** then
       b.   Click on **Partial**
2.   Highlight **colgpa** by clicking on it and then
       a.   Click on **arrow >** to transfer this name to the **Variable** Box
3.   Highlight **verbsat** by clicking on it and then
       a.   Click on **arrow >** to also transfer this name to the **Variable** Box
4.   Highlight **hsgpa** by clicking on it and then
       a.   Click on **arrow >** to transfer this name to the **Controlling For** Box
5.   Click **Options** Button then

a.   Click white box adjacent to means and standard deviations (This will result in a check mark in the box) then
b.   Click white box adjacent to zero-order correlations (This will result in a check mark in the box) then
c.   Click **continue**
6.   Click **OK**
7.   Your results will appear in a Window. Scroll up using the slide bar on the right to the top of the output. The results of this analysis are presented below.

```
Variable              Mean        Standard Dev      Cases

COLGPA              2.9718             .6141          11
VERBSAT           610.9091           99.7451         11
HSGPA              86.5455            8.4542         11
```

- - - P A R T I A L   C O R R E L A T I O N   C O E F F I C I E N T S - - -

Zero Order Partials

```
                 COLGPA      VERBSAT       HSGPA

COLGPA           1.0000        .9625        .9720
                (     0)     (      9)    (      9)
                 P= .        P= .000      P= .000


VERBSAT           .9625       1.0000        .9445
                (     9)     (      0)    (      9)
                 P= .000     P= .        P= .000


HSGPA             .9720        .9445       1.0000
                (     9)     (      9)    (      0)
                 P= .000     P= .000      P= .
```

(Coefficient / (D.F.) / 2-tailed Significance)

- - - P A R T I A L   C O R R E L A T I O N   C O E F F I C I E N T S - - -

Controlling for..   HSGPA

```
                 COLGPA      VERBSAT

COLGPA           1.0000        .5751
                (     0)     (      8)
                 P= .        P= .082


VERBSAT           .5751       1.0000
                (     8)     (      0)
                 P= .082     P= .
```

(Coefficient / (D.F.) / 2-tailed Significance)

8.   For the problem above the null and alternative hypotheses are spelled out below:

H_{null}:   When controlling for high school gpa, there is no relationship between verbal SAT score and college GPA

H_{alt}:   When controlling for high school gpa, there is a relationship between verbal SAT score and college GPA.

9.   **Interpretation and APA writing template for Results Above:**

Pearson correlation coefficients were computed among the three variables of verbal SAT scores, college GPA, and high school GPA. The results of these correlational analyses indicated that all three variables were positively correlated with one another. The bi-variate correlation between verbal SAT scores and college GPA was r (9) = .9625, p < .05, and the bi-variate correlation between high school GPA and verbal SAT scores was r (9) = .9445, p < .05. Finally, the bi-variate correlation between high school GPA and college GPA was r (9) = .9720, p <.05. A partial correlation was then computed between verbal SAT scores and college GPA, holding constant or controlling for high school GPA. If high school GPA is the principle determinant of college GPA, the partial correlation between verbal SAT and college GPA should not be significant. The results suggest that verbal SAT scores are unrelated to college GPA, r (8) = .5751, p > .05, when controlling for high school GPA scores.