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Correlation

Correlation is primarily concerned with investigating whether a relationship exists and with determining its magnitude and direction. When two variables vary together, such as loneliness and depression, they are said to be correlated.

This chapter presents two correlation coefficients: the *Pearson product moment correlation coefficient* (r), employed with **interval- or ratio-scaled** variables, and the *Spearman rank order correlation coefficient* (r_{rho}), employed with **ordered or ranked data**.

It is important to note that, irrespective of which correlational technique the researcher uses, they have the following characteristics in common:

1. Two sets of measurements are obtained on the same individuals or on pairs of individuals who are matched on some basis.
2. The values of the correlation coefficients vary between **+1.00** and **-1.00**. Both of these extremes represent perfect relationships between the variables, and **0.00** represents the absence of a relationship.

3. A *positive relationship* means that individuals obtaining high scores on one variable tend to obtain high scores on a second variable. The converse is also true, that is, individuals scoring low on one variable tend to score low on a second variable.

4. A *negative relationship* means that individuals scoring low on one variable tend to score high on a second variable. Conversely, individuals scoring high on one variable tend to score low on a second variable.

Requirements

- For each subject in the study, there must be *related pairs of scores*. That is, if a subject has a score on variable X , then the same subject must also receive a score on variable Y .
- The variables should be measured at least at the *ordinal level*

A s s u m p t i o n s

- **Linearity**—The relationship between the two variables must be *linear*, that is, the relationship can be most accurately represented by a straight line.
- **Homoscedasticity**—The variability of scores along the Y variable should remain constant at all values of the X variable

Example 1: Pearson Product Moment Correlation Coefficient

Assume that a researcher wishes to ascertain whether there is a relationship between grade point average (GPA) and the scores on a reading-comprehension (READ) test of 15 first-year students. The researcher recorded the pair of scores below, together with their rankings.

| Student | Read | Read_Rank | GPA | GPA_Rank |
|---------|------|-----------|-----|----------|
| s1 | 38 | 13 | 2.1 | 13 |
| s2 | 54 | 3 | 2.9 | 6 |
| s3 | 43 | 10 | 3.0 | 5 |
| s4 | 45 | 8 | 2.3 | 12 |
| s5 | 50 | 4 | 2.6 | 7.5 |
| s6 | 61 | 1 | 3.7 | 1 |
| s7 | 57 | 2 | 3.2 | 4 |
| s8 | 25 | 15 | 1.3 | 15 |
| s9 | 36 | 14 | 1.8 | 14 |
| s10 | 39 | 11.5 | 2.5 | 9.5 |
| s11 | 48 | 5.5 | 3.4 | 2 |
| s12 | 46 | 7 | 2.6 | 7.5 |
| s13 | 44 | 9 | 2.4 | 11 |
| s14 | 39 | 11.5 | 2.5 | 9.5 |
| s15 | 48 | 5.5 | 3.3 | 3 |

Data Entry Format

| Variables | Column(s) | Code |
|-----------|-----------|---------------------|
| READ | 1 | Reading score |
| READ_RANK | 2 | Ranking |
| GPA | 3 | Grade point average |
| GPA_RANK | 4 | Ranking |

READ_RANK

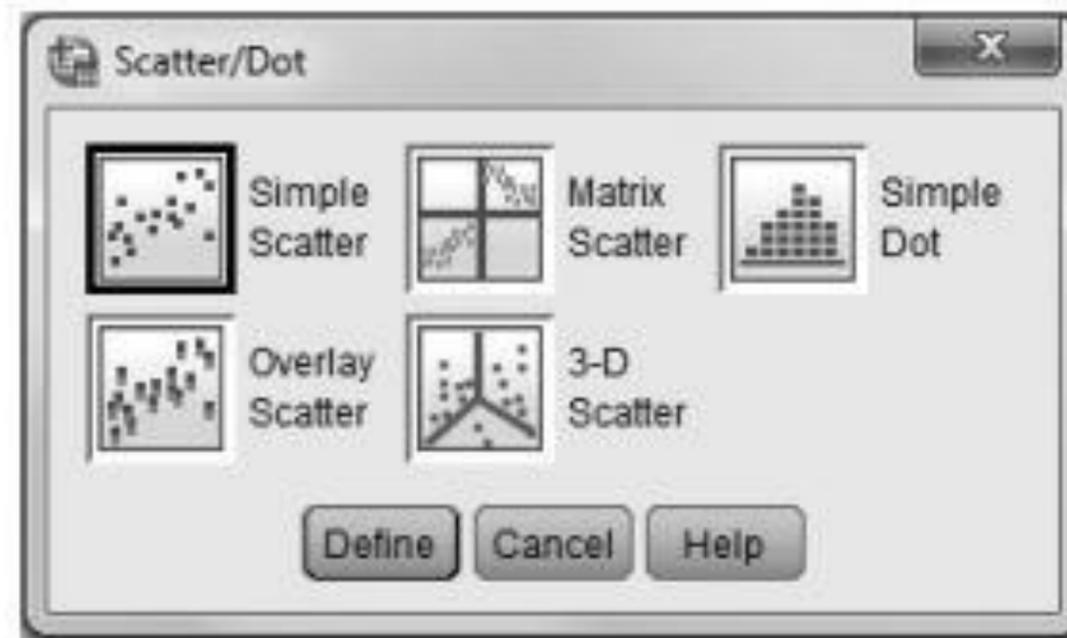
1

Ranking

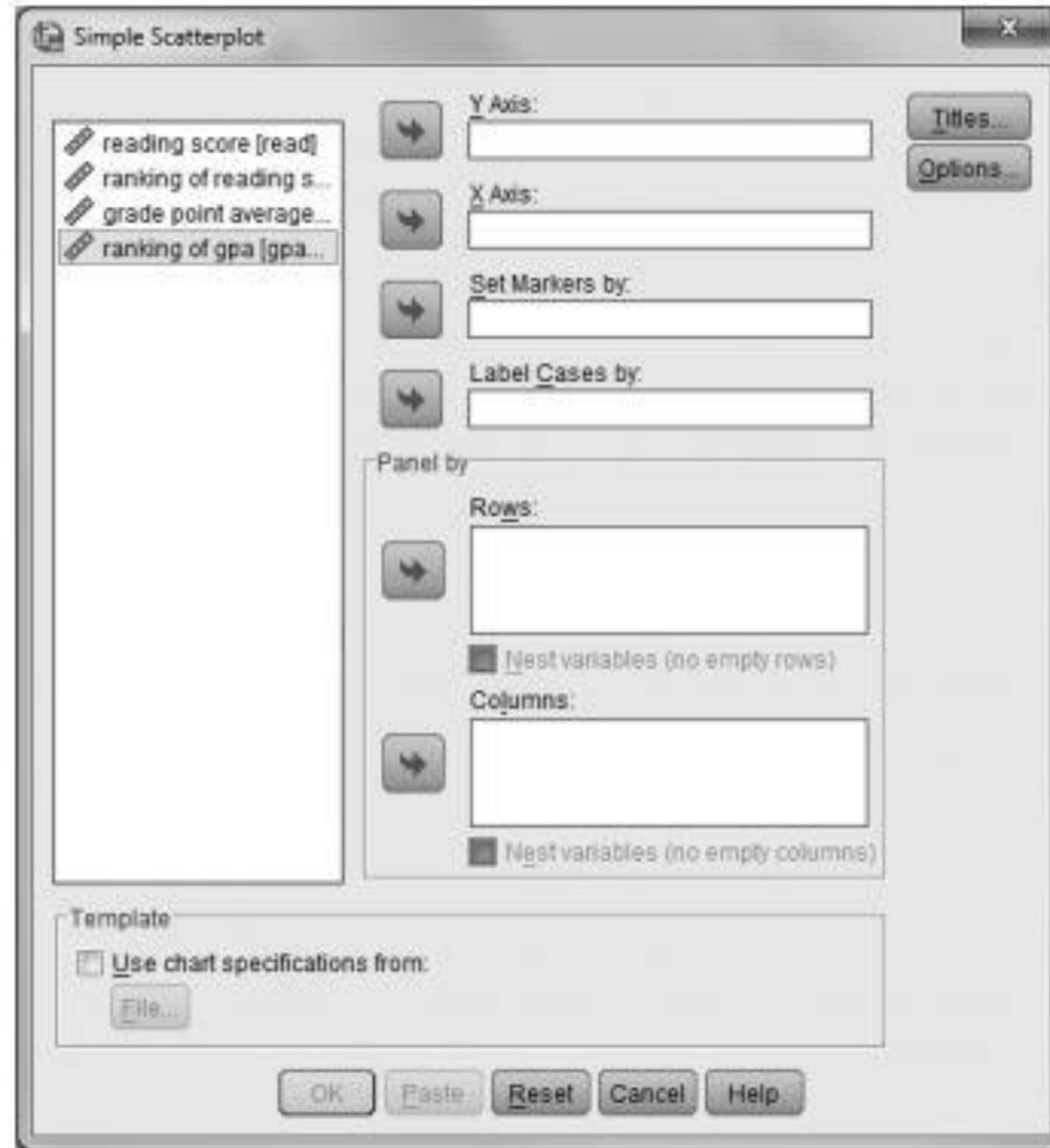
Testing Assumptions

Linearity and **Homoscedasticity** Scatterplots will be used to test the assumptions of linearity and homoscedasticity.

1. From the menu bar, click **Graphs**, then **Legacy Dialogs**, and then **Scatter/Dot...** The following **Scatter/Dot** window will open. Click (highlight) the  **Simple Scatter** icon.



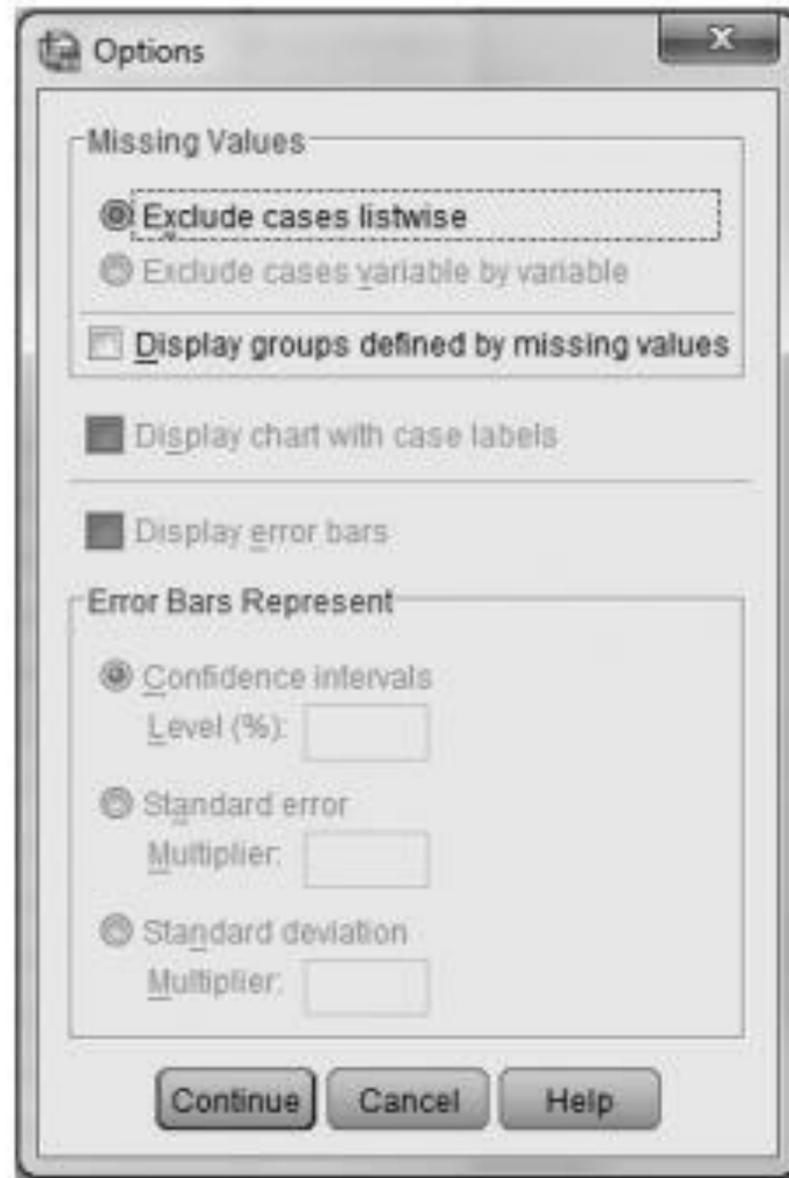
2. Click **Define** to open the **Simple Scatterplot** window below.



3. Transfer the **READ** variable to the **Y Axis:** field by clicking (highlight) the variable and then clicking . Transfer the **GPA** variable to the **X Axis:** field by clicking (highlight) the variable and then clicking .

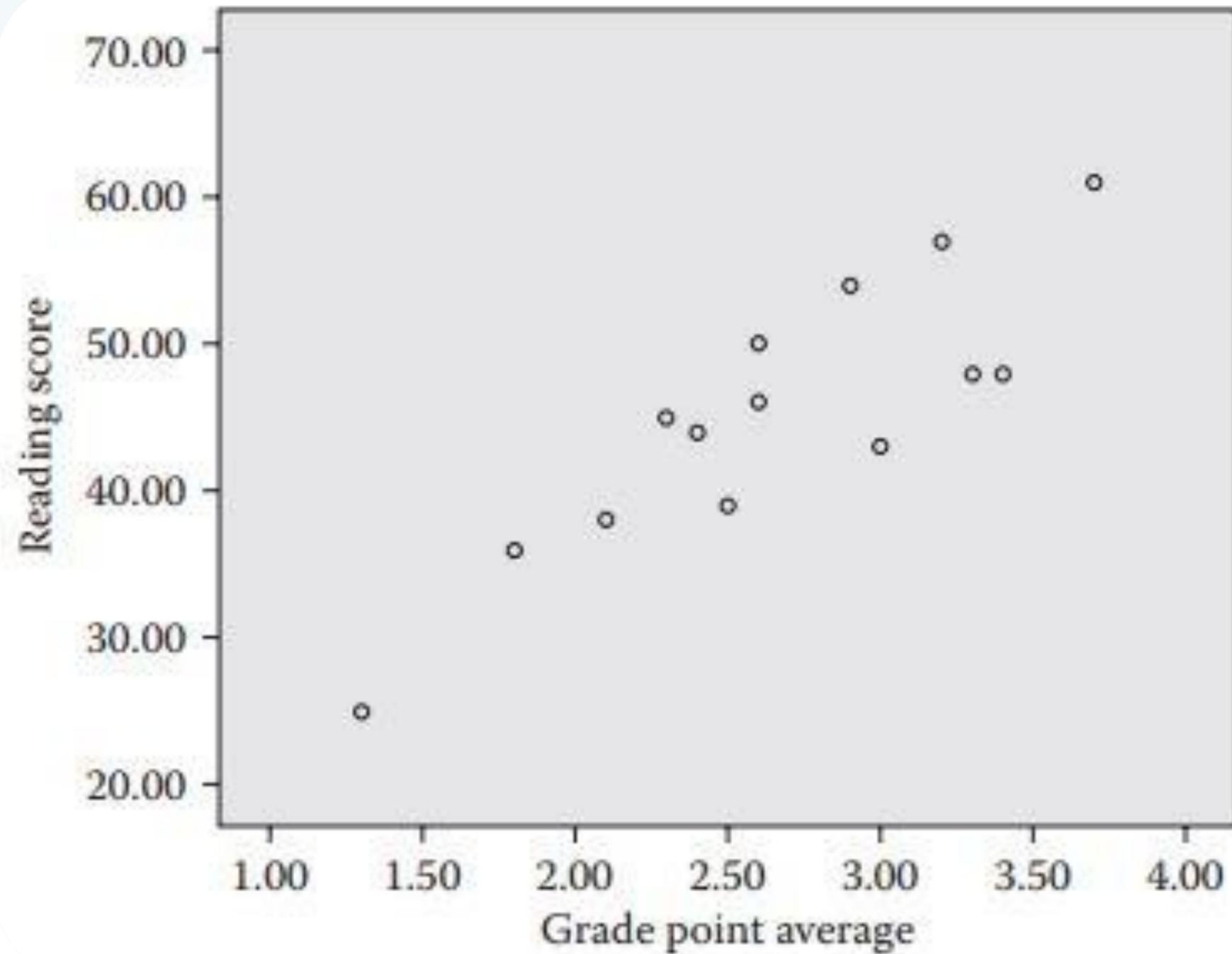


4. Click **Options...** to open the **Options** window below. Under **Missing Values**, ensure that the **Exclude cases listwise** field is checked. By default, for scatterplot, SPSS employs the **listwise** method for handling missing data. (For a discussion of the differences in the pairwise and the listwise methods of handling missing data, please see Section 10.3.6.)



5. Click **Continue** to return to the **Simple Scatterplot** window.



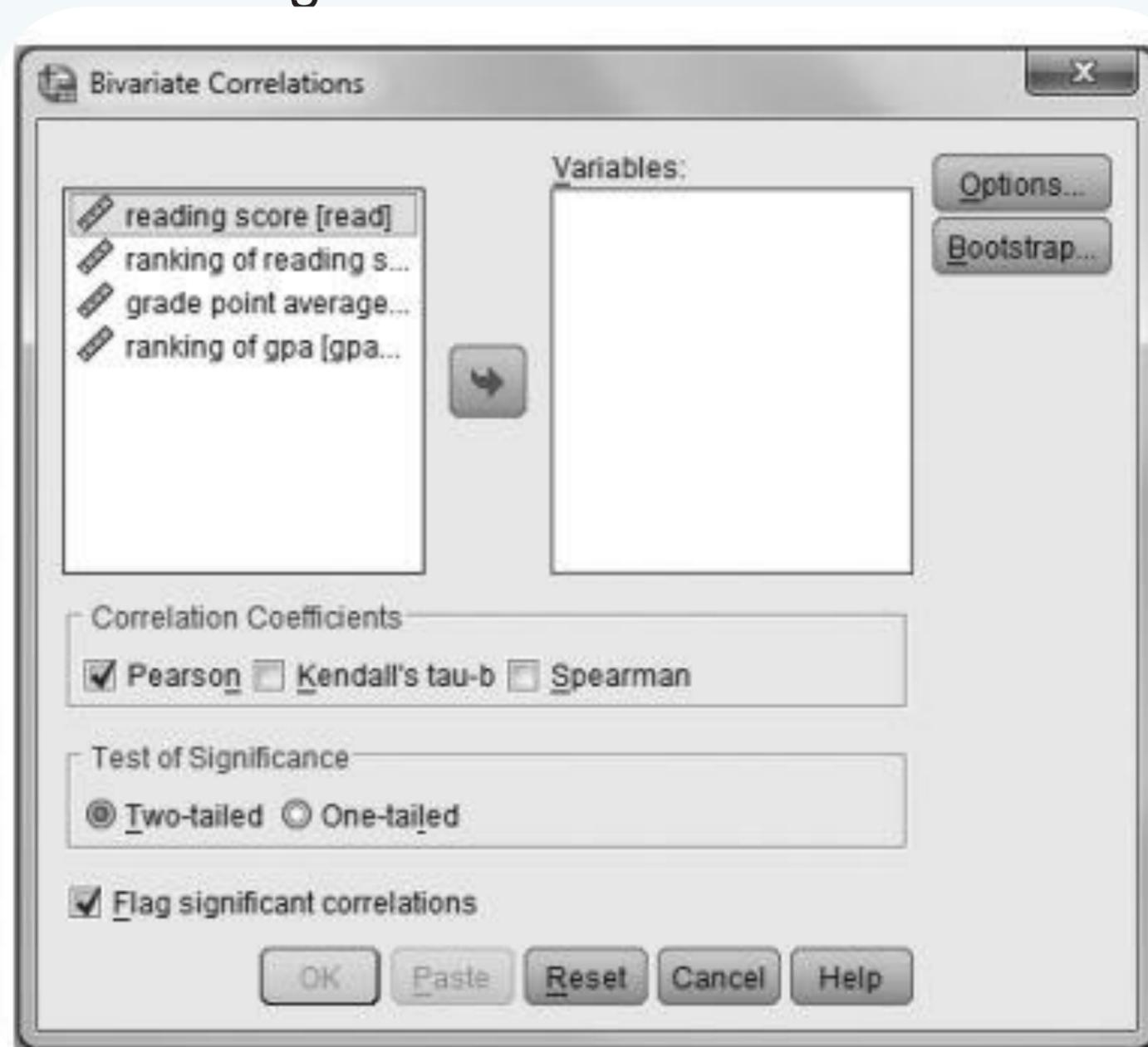


Interpretation

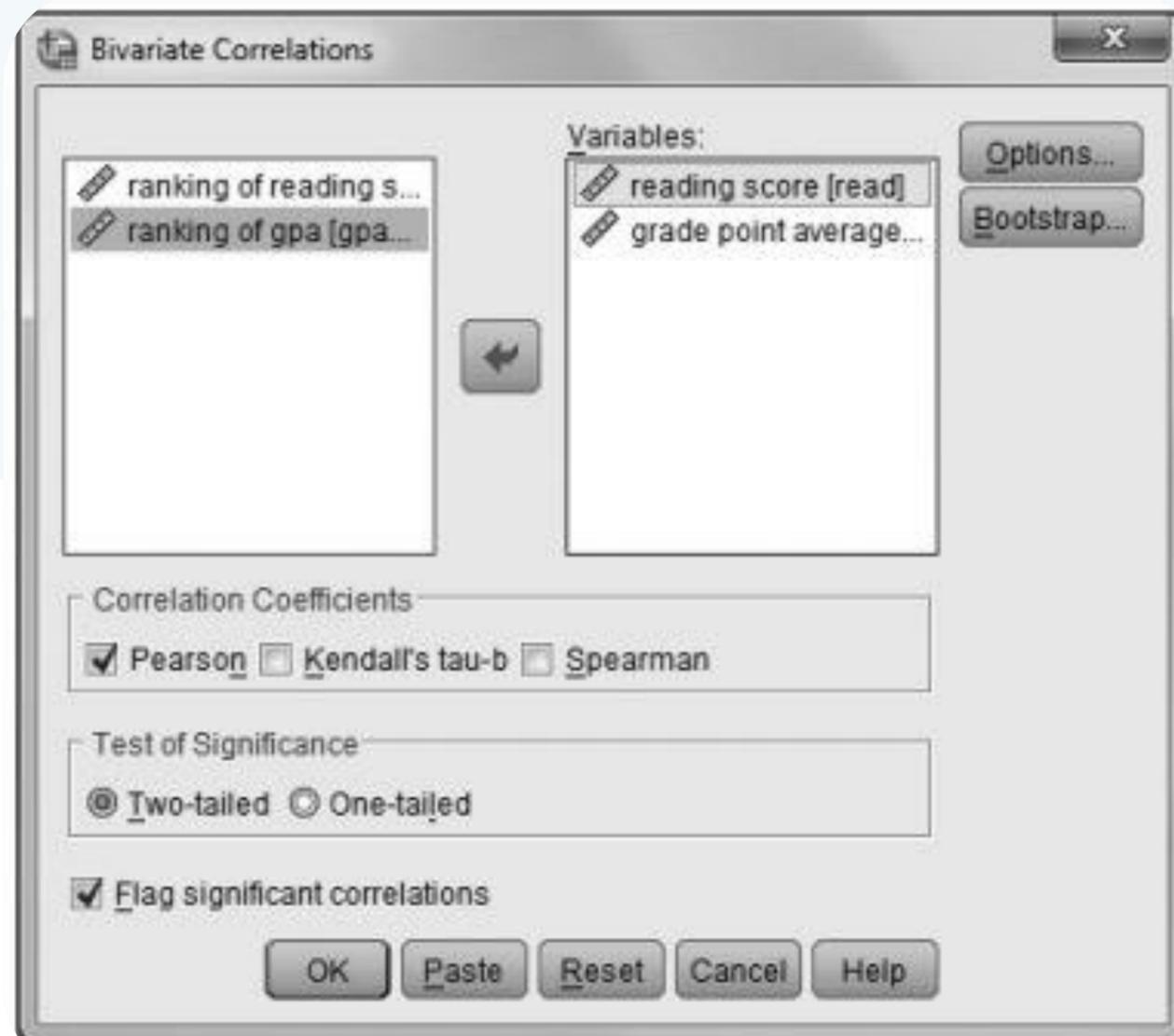
As can be seen from Figure, there is a linear relationship between the variables of reading score and grade point average, such that as reading score increases, so does grade point average. The figure also shows that the homoscedasticity assumption is met, because the variability of the READ score remains relatively constant from one GPA score to the next. Heteroscedasticity is usually shown by a cluster of points that is wider as the values for the Y variable (READ) get larger.

Windows Method: Pearson Product Moment Correlation

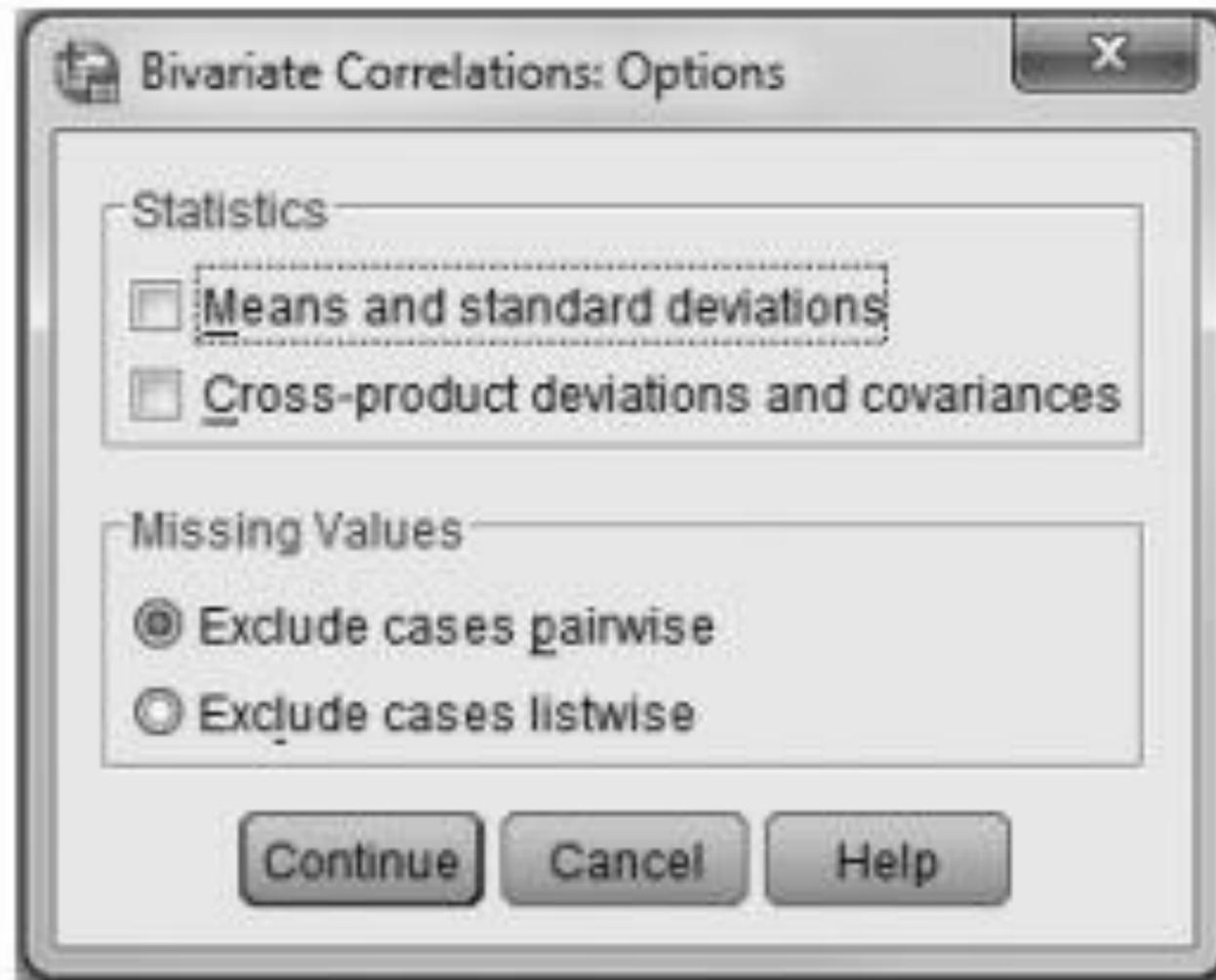
From the menu bar, click **Analyze**, then **Correlate**, and then **Bivariate....**The following **Bivariate Correlations** window will open.



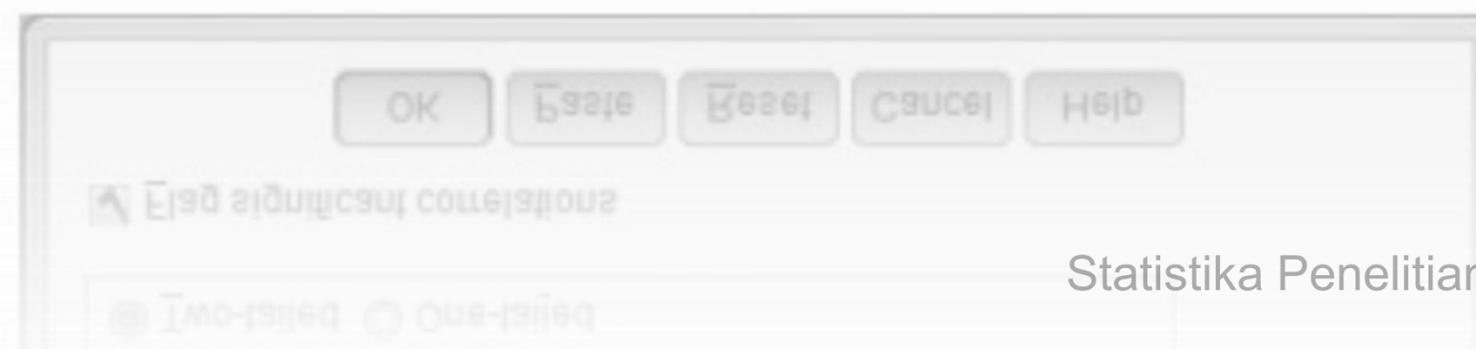
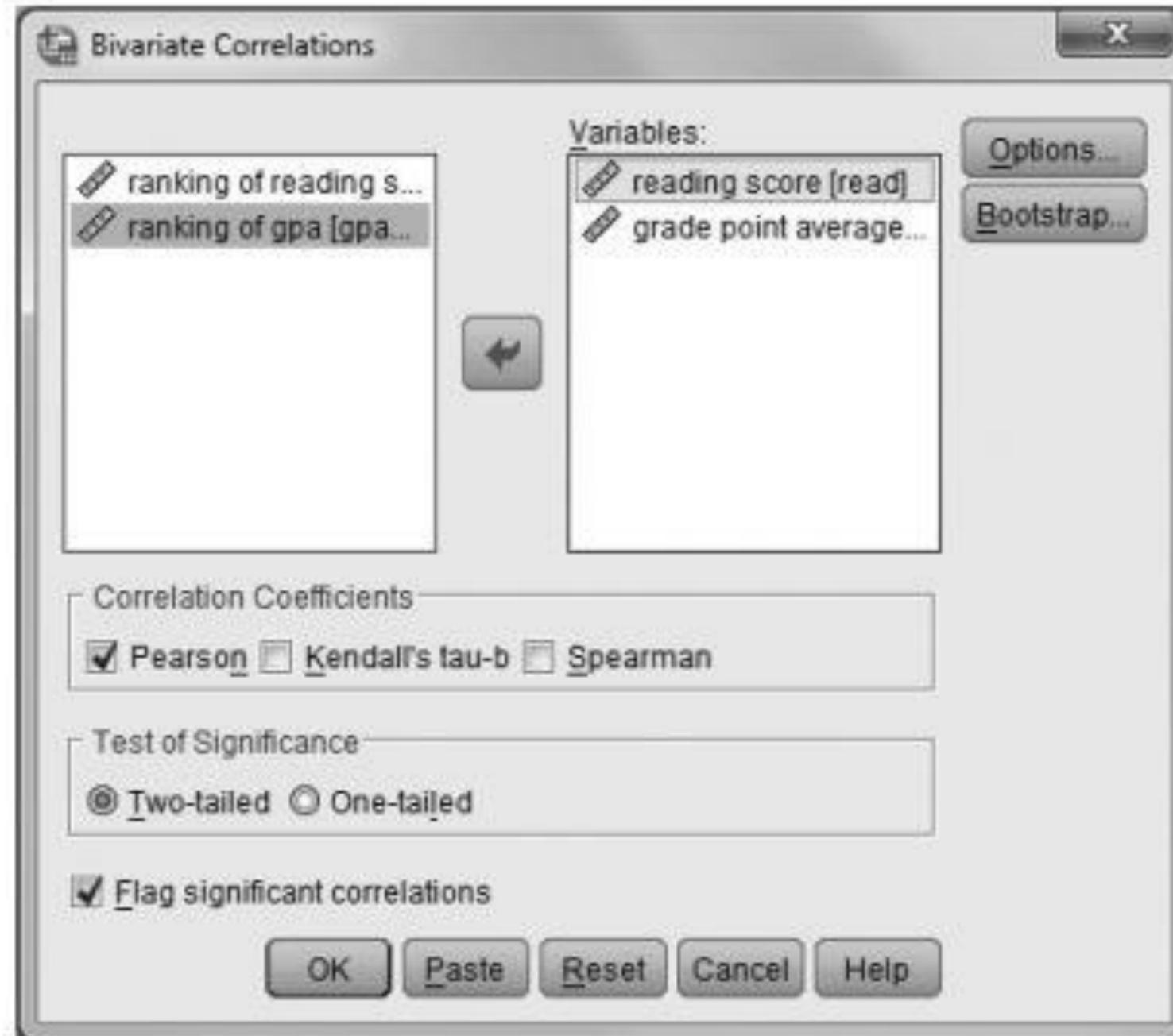
Transfer the **READ** and **GPA** variables to the **Variables:** field by clicking (highlight) them and then clicking **→**. By default, SPSS will employ the **Pearson correlation analysis**, and a **two-tailed test of significance** (both fields are checked)



Click to open the **Bivariate Correlation: Options** window



Click **Continue** to return to the **Bivariate Correlations** window.



SPSS Output

Pearson Product Moment Correlation

Correlations

| | | Reading Score | Grade Point Average |
|---------------------|---------------------|---------------|---------------------|
| reading score | Pearson Correlation | 1 | .867** |
| | Sig. (2-tailed) | | .000 |
| | N | 15 | 15 |
| grade point average | Pearson Correlation | .867** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 15 | 15 |

** Correlation is significant at the 0.01 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Results and Interpretation

The correlation between reading scores and grade point average is positive and statistically significant ($r = 0.867$, $p < .001$). This means that as the students' reading scores increase, so do their grade point averages. Please note that this interpretation in no way implies *causality*—that increases in reading scores caused increases in GPA scores. The significant relationship merely indicates that the two variables *covary*

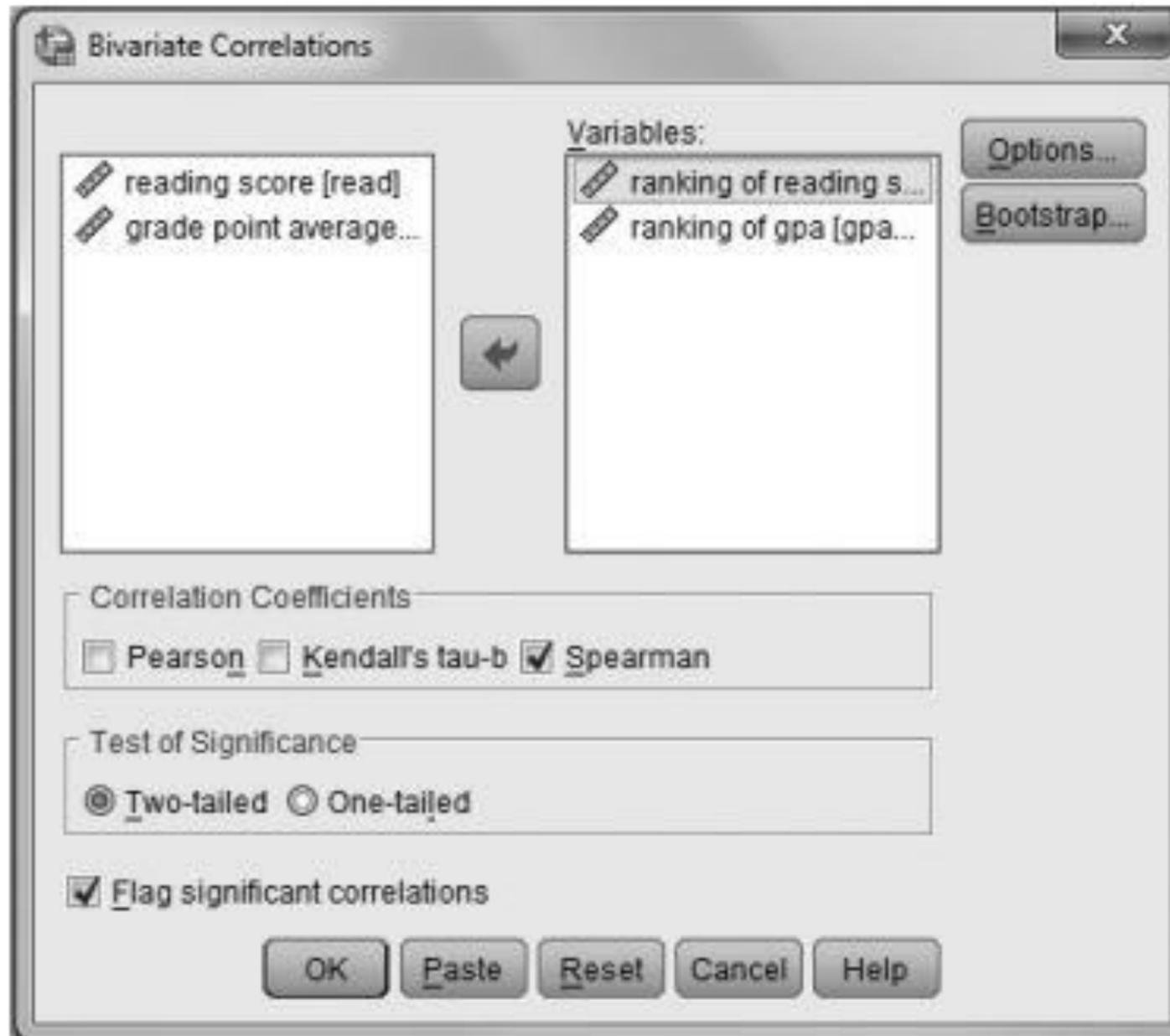
Example 2: Spearman Rank Order Correlation Coefficient

For this example, the same data set (**CORR.SAV**) will be used. However, the rank order of the two variables (READ_RANK, GPA_RANK) will be used instead of their actual values as recorded.

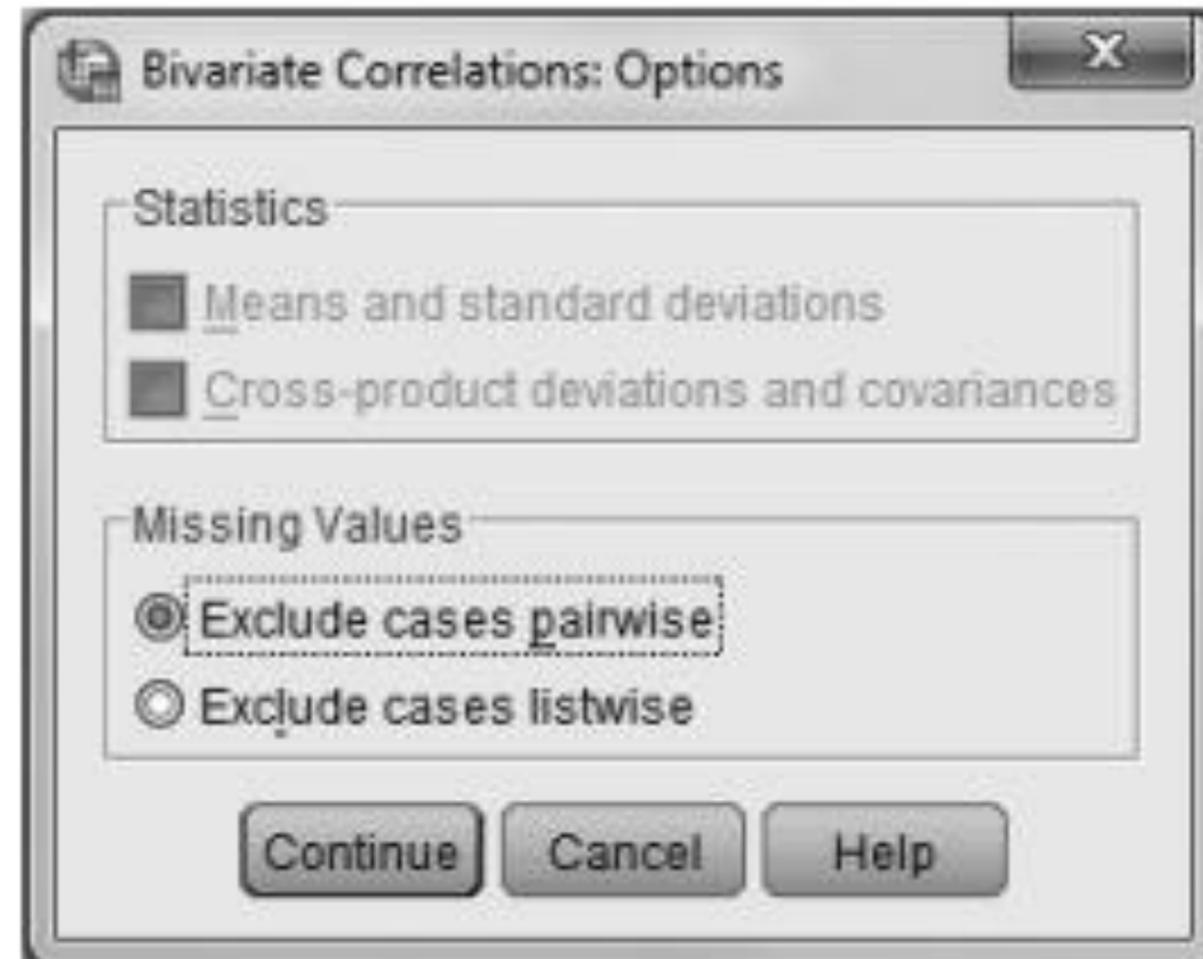
From the menu bar, click **Analyze**, then **Correlate**, and then **Bivariate...**
The following **Bivariate Correlations** window will open.



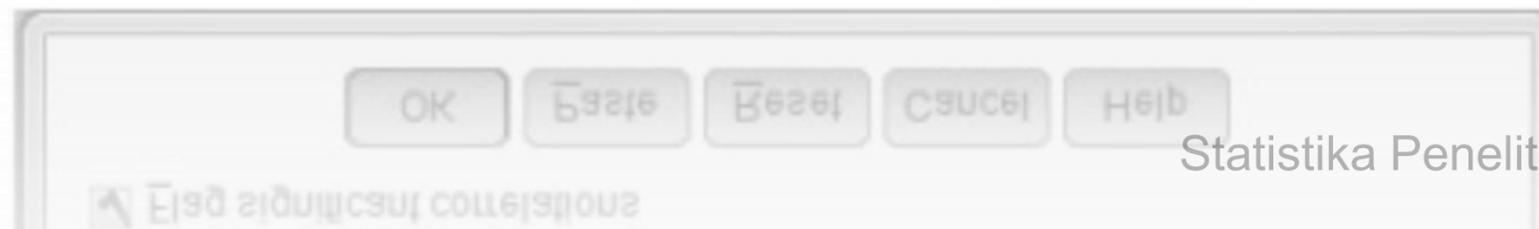
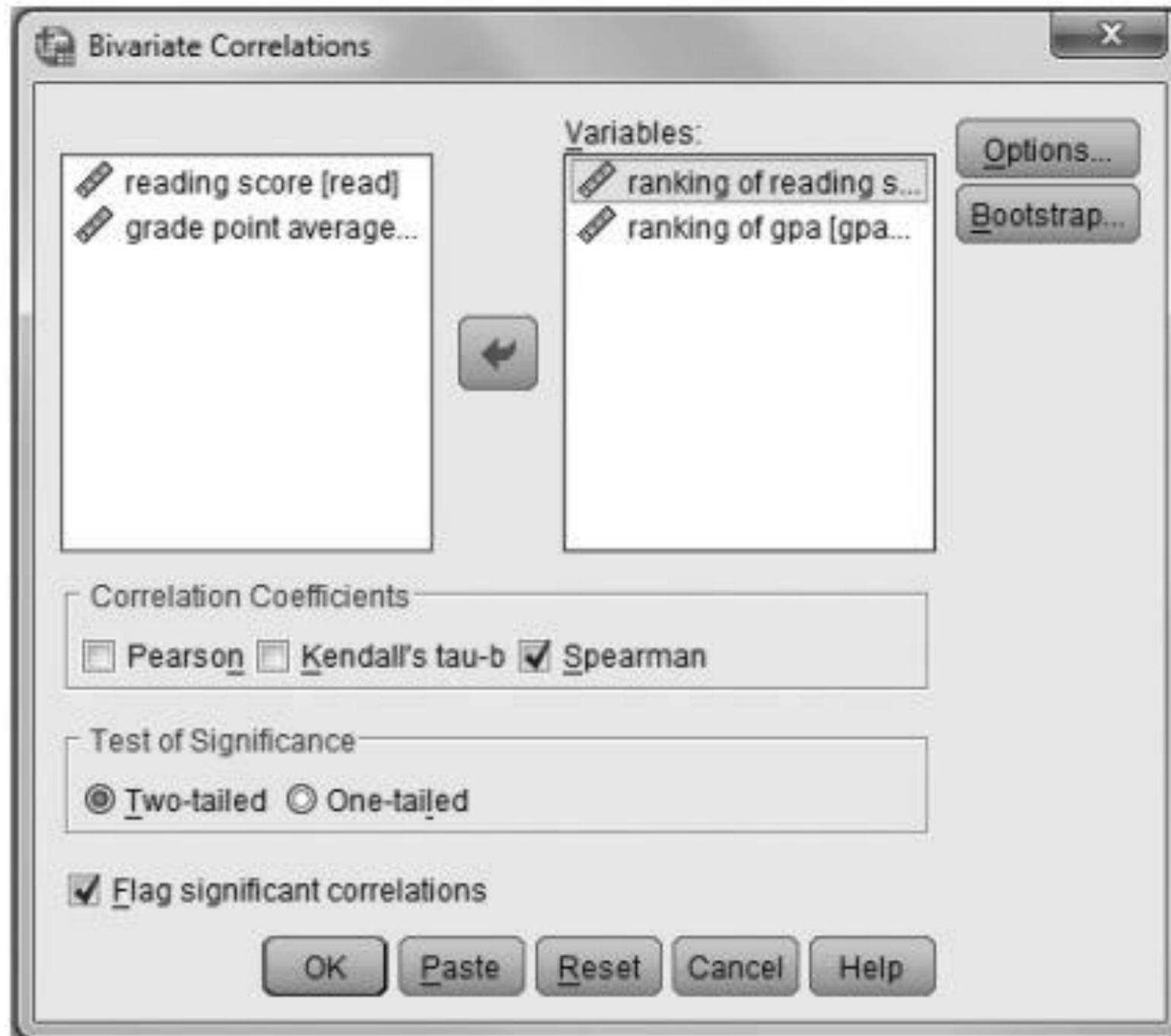
transfer the **READ_RANK** and **GPA_RANK** variables to the **Variables:** field by clicking (highlight) them and then clicking . By default, SPSS will employ the **Pearson correlation analysis** (this field is checked). Uncheck the **Pearson** field and check the **Spearman** field.



Click **Options** to open the **Bivariate Correlation: Options** window. Ensure that the **Exclude cases pairwise** field is checked.



Click **Continue** to return to the **Bivariate Correlations** window.



SPSS Output

Spearman Rank Order Correlation

| | | Correlations | | |
|----------------|---------------------------|-------------------|---------------------------|----------------|
| | | | Ranking of Reading Scores | Ranking of gpa |
| Spearman's rho | ranking of reading scores | Correlation | 1.000 | .826** |
| | | Coefficient | . | .000 |
| | | Sig. (2-tailed) N | 15 | 15 |
| | ranking of gpa | Correlation | .826** | 1.000 |
| | | Coefficient | .000 | . |
| | | Sig. (2-tailed) N | 15 | 15 |

** Correlation is significant at the 0.01 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Sig. (2-tailed) N

15

15

Results and Interpretation

The obtained Spearman rank-order coefficient ($\rho = 0.826$, $p < .001$) is highly similar in magnitude and direction to that in the Pearson correlation table (Table). Thus, similar to the Pearson coefficient, the Spearman coefficient indicates that as the students' ranked reading scores increase, so do their ranked grade point average scores.

REFLEKSI

- 1. Informasi penting hari ini**
- 2. Manfaat penting dari informasi penting hari ini**
- 3. Tindak lanjut yang dapat saudara lakukan**

The image features a white background with teal-colored geometric shapes in the corners, resembling folded paper or abstract triangles. The text is centered and consists of two lines.

THANK YOU!

ANY QUESTIONS?