



UJI BEDA

(t Test for Independent & Paired Groups)

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RULES



1. PJ mata kuliah wajib mempersiapkan perlengkapan sebelum proses pembelajaran
2. Membawa Laptop (optional)
3. Terpasang Software SPSS
4. Terkoneksi Internet
5. Mengumpulkan *hasil praktik* selesai perkuliahan di SIP

The independent t test is used for testing the difference between the means of two independent groups. It is particularly useful when the research question requires the comparison of variables (measured at least at the *ordinal* level) obtained from two independent samples.

“Do males and females differ in performance on a standardized achievement test?”

“What is the effect of drug versus no drug on rats’ maze learning behavior?”

“Does the recidivism rate of juvenile offenders who are provided with father figures differ from those without father figures?”

Checklist of Requirements

In any one analysis, there must be:

- Only one independent (grouping) variable (IV) (e.g., subject's gender)
 - Only two levels for that IV (e.g., male, female)
 - Only one dependent variable (DV)
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Assumptions

- **Independence**—The two groups are independent of one another.
 - **Normality**—The dependent variable is normally distributed.
 - **Homogeneity of variance**—That is, the distribution of the dependent variable for one of the groups being compared has the same variance as the distribution for the other group being compared.
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Assumptions

- **Normality**—The dependent variable is normally distributed.

Uji Normalitas adalah sebuah uji yang dilakukan dengan tujuan untuk menilai sebaran data pada sebuah kelompok data atau variabel, apakah sebaran data tersebut berdistribusi normal ataukah tidak. Uji Normalitas berguna untuk menentukan data yang telah dikumpulkan berdistribusi normal atau diambil dari populasi normal.

- **Homogeneity of variance**—That is, the distribution of the dependent variable for one of the groups being compared has the same variance as the distribution for the other group being compared.
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Assumptions

- **Homogeneity of variance**—That is, the distribution of the dependent variable for one of the groups being compared has the same variance as the distribution for the other group being compared.

Uji homogenitas adalah pengujian mengenai sama tidaknya variansi-variansi dua buah distribusi atau lebih.

Example

A researcher wants to investigate whether first-year male and female students at a university differ in their memory abilities. Ten male students and 10 female students were randomly selected from the first-year enrolment roll to serve as subjects.

All 20 subjects were read 30 unrelated words and were then asked to recall as many of the words as possible. The numbers of words correctly recalled by each subject were recorded.

Males

Females

s1 16

s1 24

s2 14

s2 23

s3 18

s3 26

s4 25

s4 17

s5 17

s5 18

s6 14

s6 20

s7 19

s7 23

s8 21

s8 26

s9 16

s9 24

s10 17

s10 20

210 11

210 50

Data Entry Format

| Variables | Column | Code |
|-----------|--------|---------------------------------------|
| Gender | 1 | 1 = male, 2 = female |
| Words | 2 | Number of words correctly recalled |

collecting data

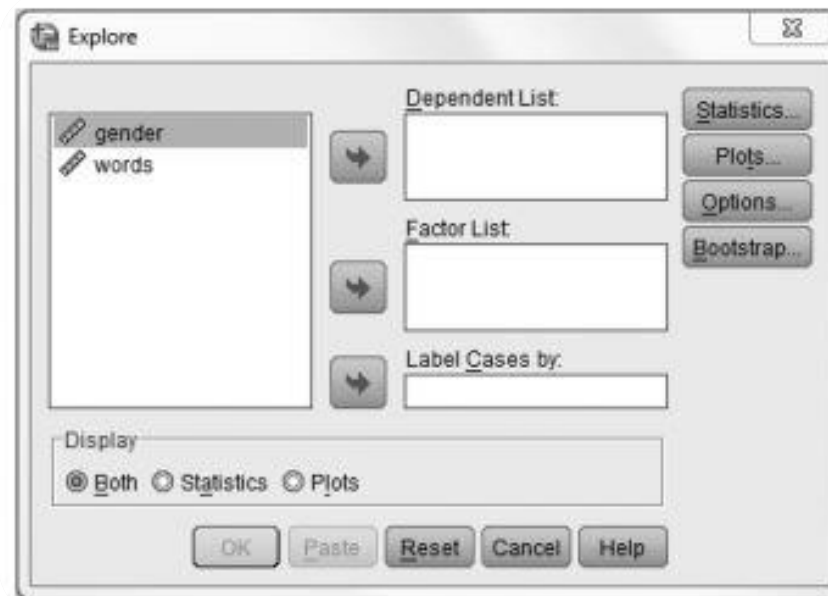
Testing Assumptions

Independence

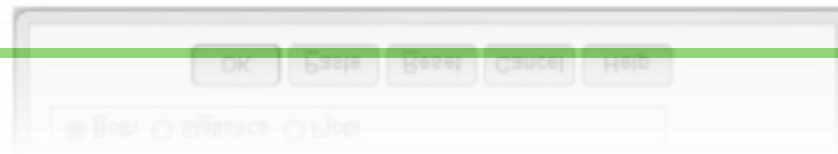
During data collection, ensure that the observations in one group are independent of the observations of the other group.

Normality

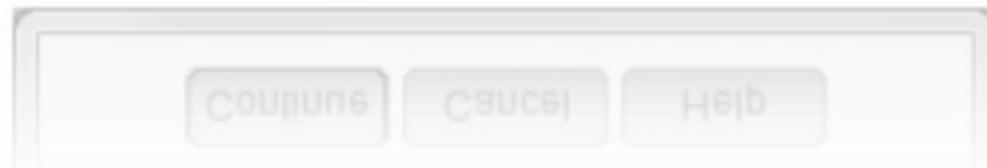
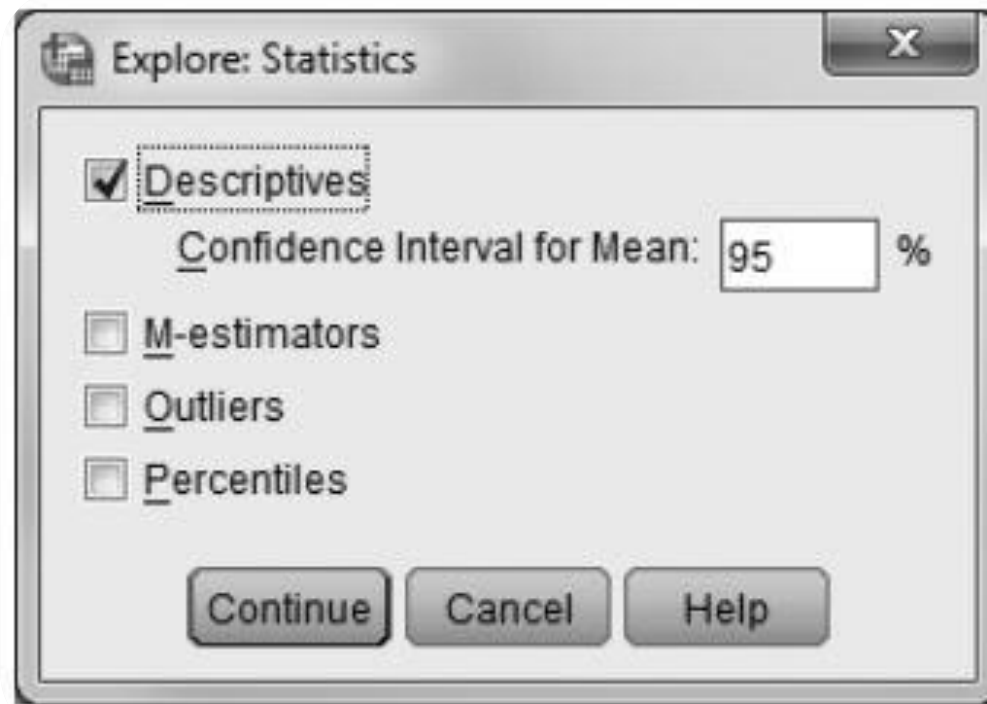
From the menu bar, click **Analyze**, then **Descriptive Statistics**, and then **Explore...** . The following **Explore** window will open.



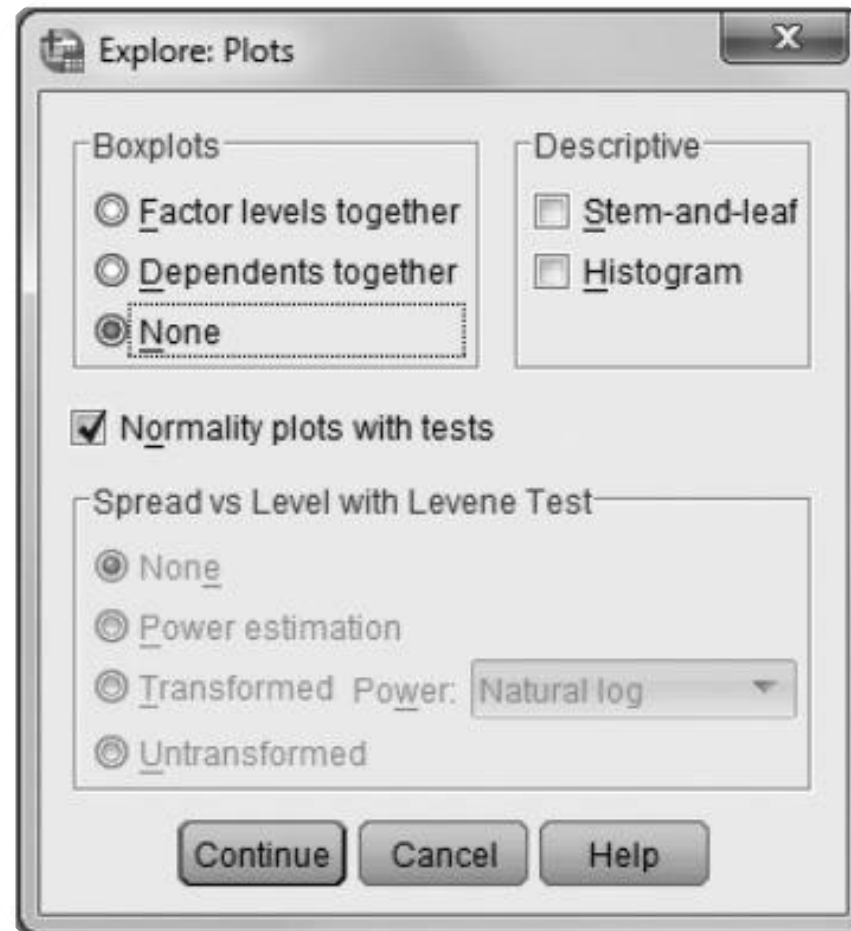
Transfer the **WORDS** variable to the **Dependent List:** field by clicking this variable (highlight) and then clicking



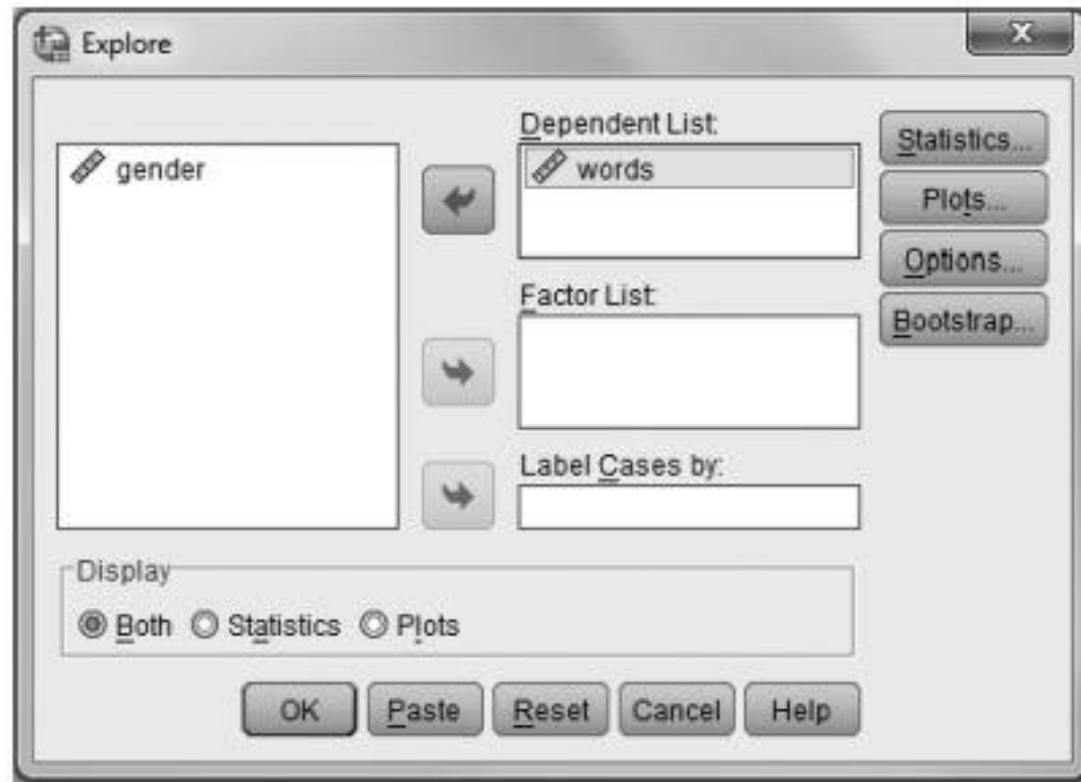
Click to open the **Explore: Statistics** window. Check the **Descriptives** field and click to return to the **Explore** window



In the **Explore** window click to open the **Explore: Plots**



window. Check the **Normality plots with tests** field. Click to return to the **Explore** window



SPSS Output

Explore Analysis (Selected) Output

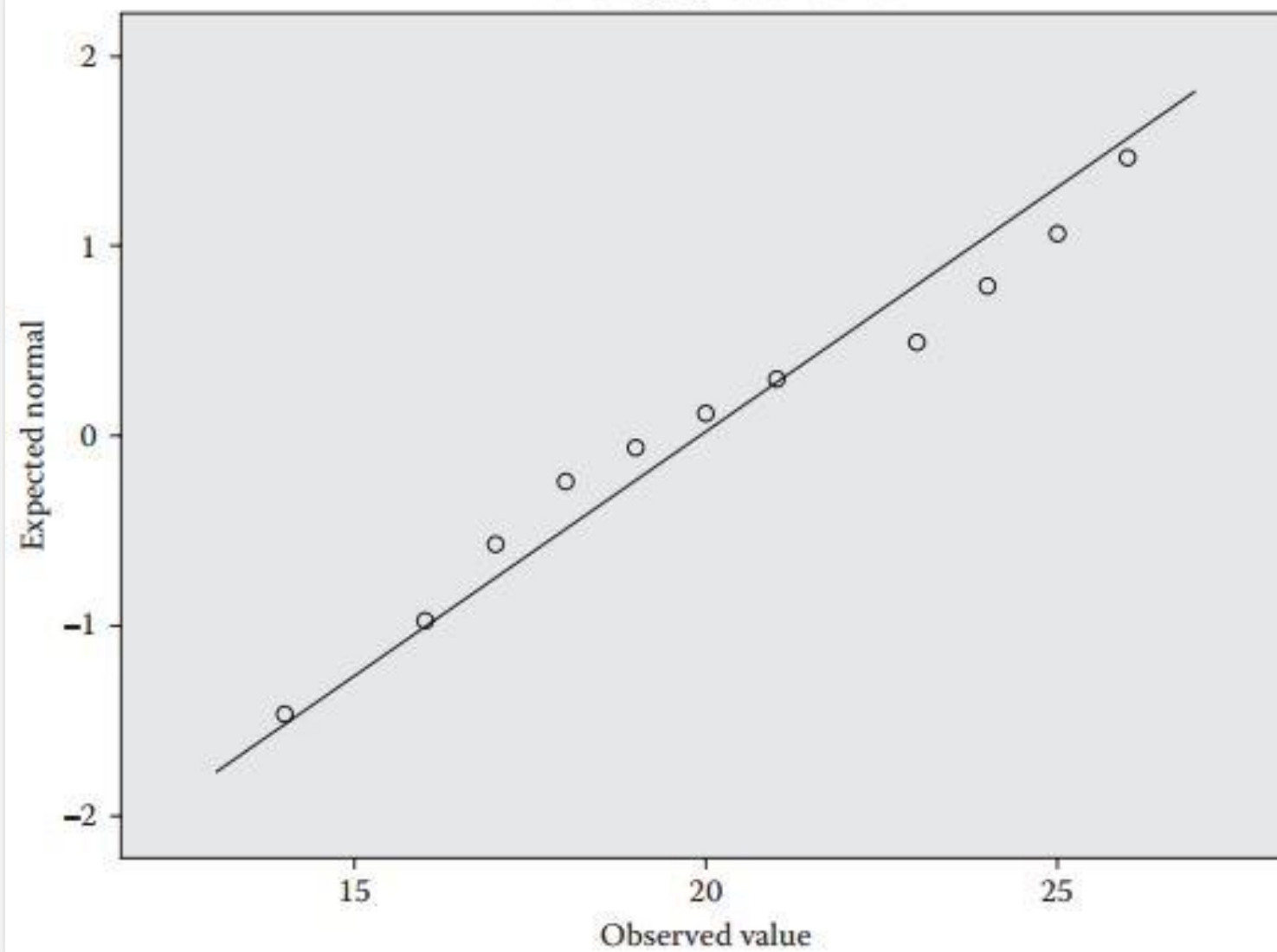
| Descriptives | | | Statistic | Std. Error |
|--------------|-------------------------------------|-------------|-----------|------------|
| Words | Mean | | 19.9000 | 0.87027 |
| | 95% Confidence Interval for Mean | Lower Bound | 18.0785 | |
| | | Upper Bound | 21.7215 | |
| | 5% Trimmed Mean | | 19.8889 | |
| | Median | | 19.5000 | |
| | Variance | | 15.147 | |
| | Std. Deviation | | 3.89196 | |
| | Minimum | | 14.00 | |
| | Maximum | | 26.00 | |
| | Range | | 12.00 | |
| | Interquartile Range | | 6.75 | |
| | Skewness | | 0.167 | 0.512 |
| | Kurtosis | | -1.234 | 0.992 |

| Tests of Normality | | | | | | |
|--------------------|---------------------------------|----|--------|--------------|----|-------|
| | Kolmogorov-Smirnov ^a | | | Shapiro-Wilk | | |
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Words | 0.137 | 20 | 0.200* | 0.936 | 20 | 0.201 |

^a Lilliefors significance correction.

* This is a lower bound of the true significance.

Normal Q-Q Plot of Words



Interpretation

The Kolmogorov-Smirnov statistic and the Shapiro-Wilk statistic are tests for normality, and if their significance levels are greater than 0.05, then normality is assumed. The Shapiro-Wilk statistic is calculated when the sample size is small (<50).

For both the Kolmogorov-Smirnov and the Shapiro-Wilk tests, the computed significance levels are >0.05 (0.200 and 0.201, respectively). Therefore, normality can be assumed.

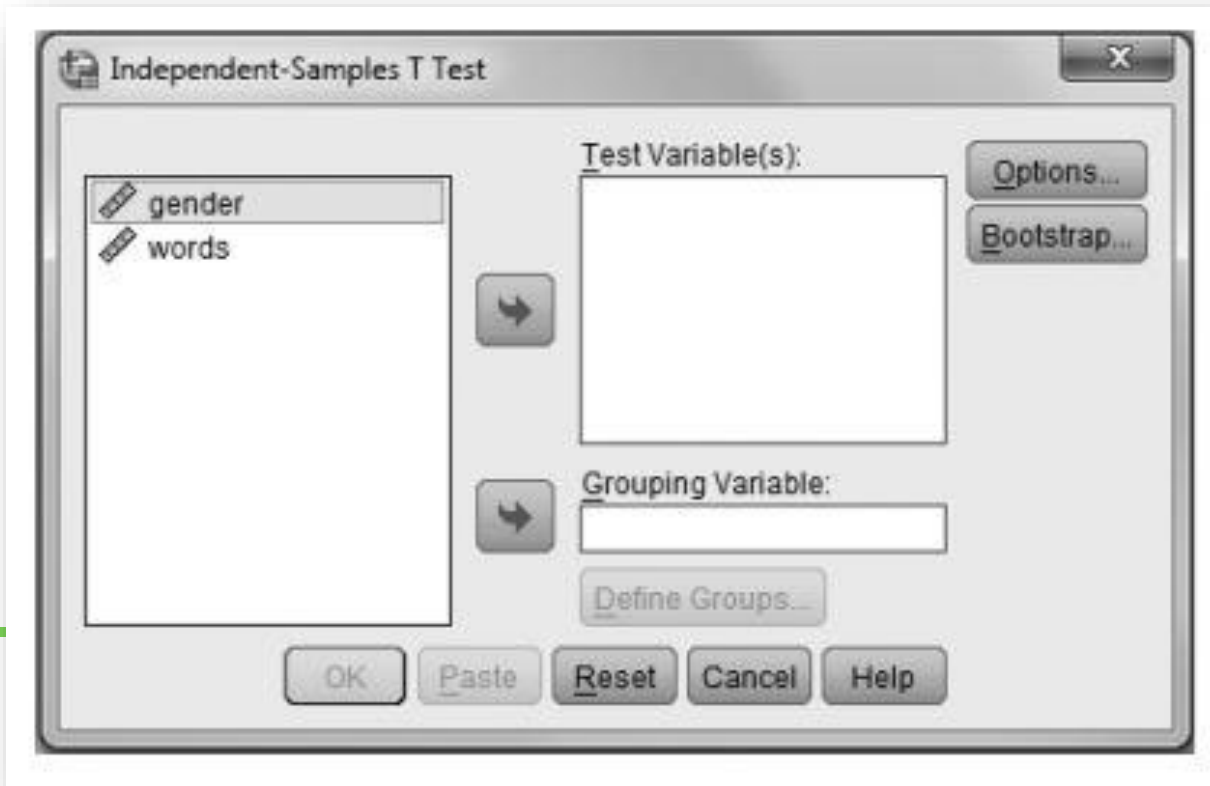
Another diagnostic test for normality is a visual check of the **Normal Q–Q Plot** that compares the cumulative distribution of the observed values with the expected values derived from the normal distribution.

The normal distribution forms a straight diagonal line, and if a variable's distribution is normal, the data distribution will fall more or less on the diagonal. Inspection of the normal Q–Q plot shows very little departure from normality for the **WORDS** variable.

The **Detrended Normal Q-Q Plot** offers another visual check for normality. It shows the differences between the observed and expected values of a normal distribution, and plots the deviations of the scores from a straight line. If the distribution is normal, the scores should cluster around a horizontal line through zero with no pattern. The figure shows little deviation from normality

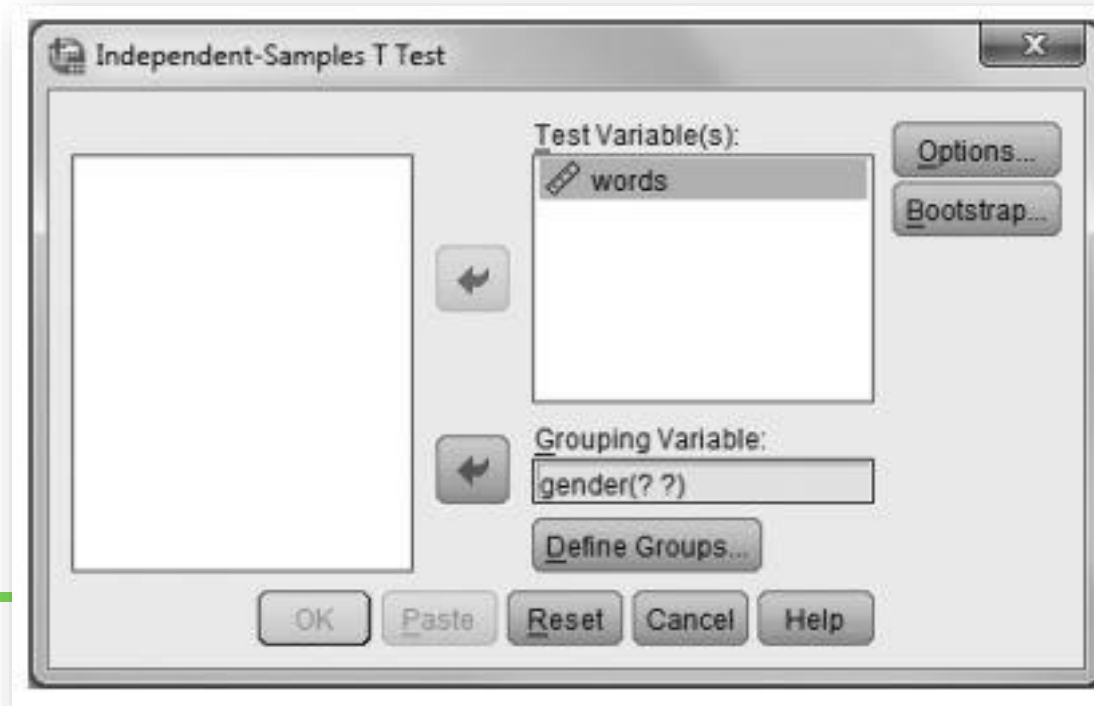
Homogeneity of Variance

The homogeneity assumption is checked in SPSS by Levene's test. From the menu bar, click **Analyze**, then **Compare Means**, and then **Independent-Samples T Test**. The following window will open.

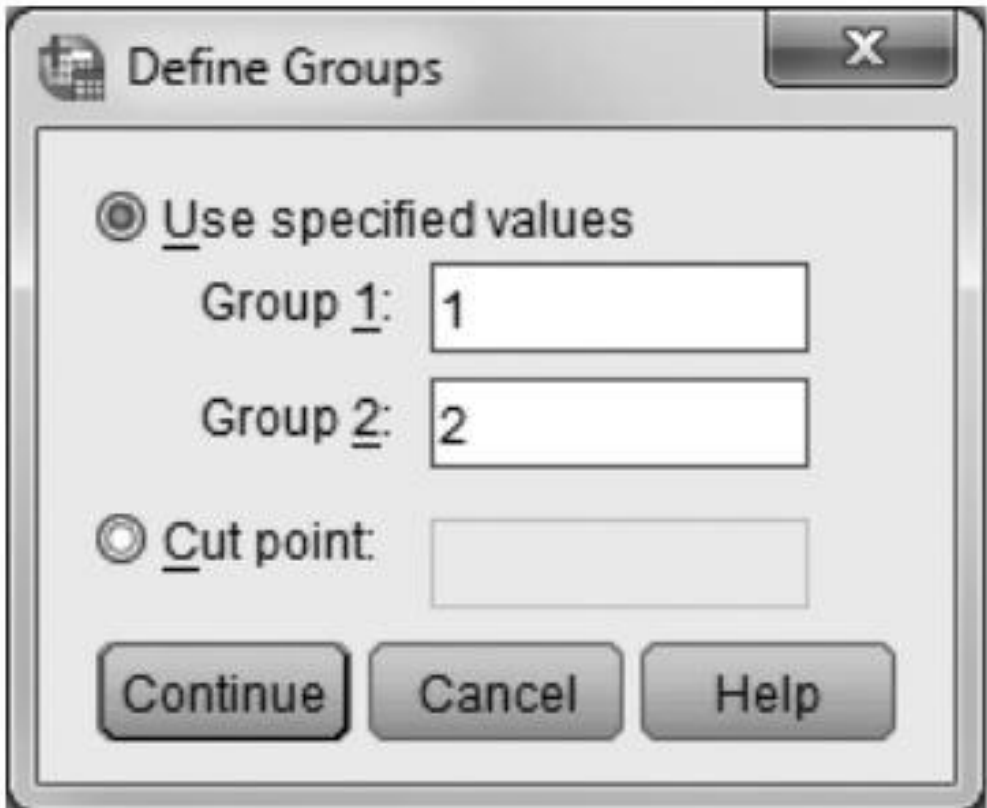


Since **GENDER** is the grouping (independent) variable, transfer it to the **Grouping Variable:** field by clicking (highlight) the variable and then clicking .

As **WORDS** is the test (dependent) variable, transfer it to the **Test Variable(s):** field by clicking (highlight) the variable and then clicking



Click to define the range for the grouping variable **GENDER** (coded 1 = male, 2 = female). When the following **Define Groups** window opens, type **1** in the **Group 1:** field and **2** in the **Group 2:** field, and then click .

The image shows the 'Define Groups' dialog box from SPSS. It has a title bar with a small icon and the text 'Define Groups', and a close button (X) on the right. Inside the dialog, there are two radio buttons. The first radio button is selected and is labeled 'Use specified values'. Below this, there are two text input fields: 'Group 1:' with the value '1' and 'Group 2:' with the value '2'. The second radio button is labeled 'Cut point:' and is currently unselected, with an empty text field next to it. At the bottom of the dialog, there are three buttons: 'Continue', 'Cancel', and 'Help'.

Define Groups

☒ Use specified values

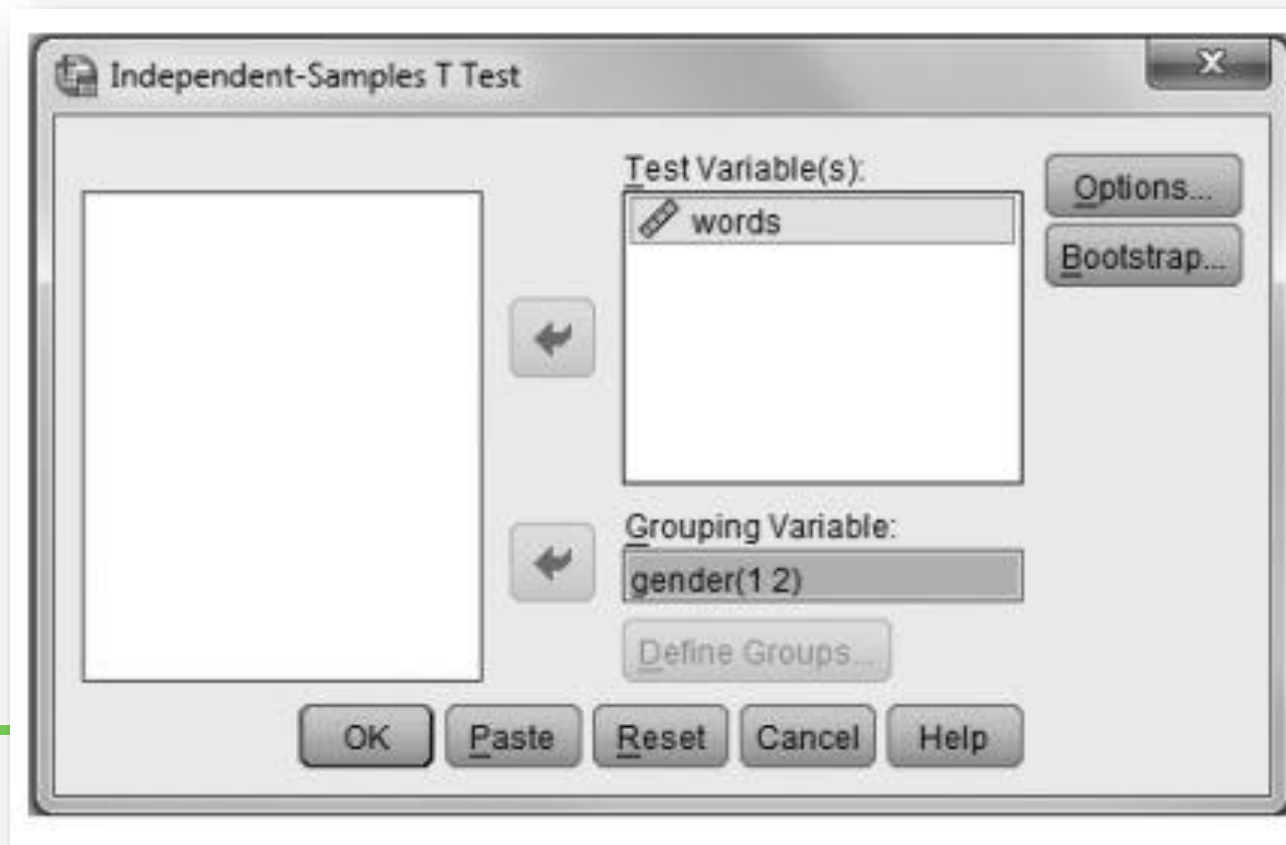
Group 1: 1

Group 2: 2

☐ Cut point:

Continue Cancel Help

When the following **Independent-Samples t Test** window opens, run the t test analysis by clicking Ok.



SPSS Output

Independent *t* Test Output

| Group Statistics | | | | | |
|------------------|--------|----------|---------|----------------|-----------------|
| | Gender | <i>N</i> | Mean | Std. Deviation | Std. Error Mean |
| WORDS | MALE | 10 | 17.7000 | 3.3350 | 1.0546 |
| | FEMALE | 10 | 22.1000 | 3.1780 | 1.0050 |

Independent Samples Test

| | | Levene's Test for Equality of Variances | | <i>t</i> test for Equality of Means | | | | | | |
|-------|-----------------------------|-----------------------------------------|------|-------------------------------------|-----------|-----------------|-----------------|-----------------------|-------------------------------------------|---------|
| | | <i>F</i> | Sig. | <i>t</i> | <i>df</i> | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| WORDS | Equal variances assumed | .087 | .772 | -3.020 | 18 | .007 | -4.4000 | 1.4568 | -7.4606 | -1.3394 |
| | Equal variances not assumed | | | -3.020 | 17.958 | .007 | -4.4000 | 1.4568 | -7.4611 | -1.3389 |

Results and Interpretation

The assumption of **homogeneity of variance** is tested by **Levene's test for equality of variances**, which tests the hypothesis that the two population variances are equal. In this example, the Levene statistic is $F = 0.087$ and the corresponding level of significance is large (i.e., $p > 0.05$)

Thus, the assumption of homogeneity of variance has not been violated, and the **equal variances assumed** t test statistic can be used for evaluating the null hypothesis of equality of means. If the significance level of the Levene statistic is small (i.e., $p < 0.05$), the assumption that the population variances are equal is rejected and the **equal variances not assumed** t test statistic should be used.

There is a significant difference between the male and female samples in the number of words correctly recalled, $t(df = 18) = -3.02$, $p < 0.01$. The mean values indicate that females correctly recalled significantly more words ($M = 22.10$) than males ($M = 17.70$)

The confidence interval information shows that the null hypothesis value (i.e., zero) does not fall within this interval (Lower = -7.4606, Upper = -1.3394). Therefore, the null hypothesis of equality of means can be rejected.

REFLEKSI

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





Thank You