STATISTIKA PENELITIAN

karakteristik dan asumsi uji t, dan one sample t test

Aryan Eka Prastya Nugraha

2017

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)

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.

SOAL

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 frst-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

Data Entry

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

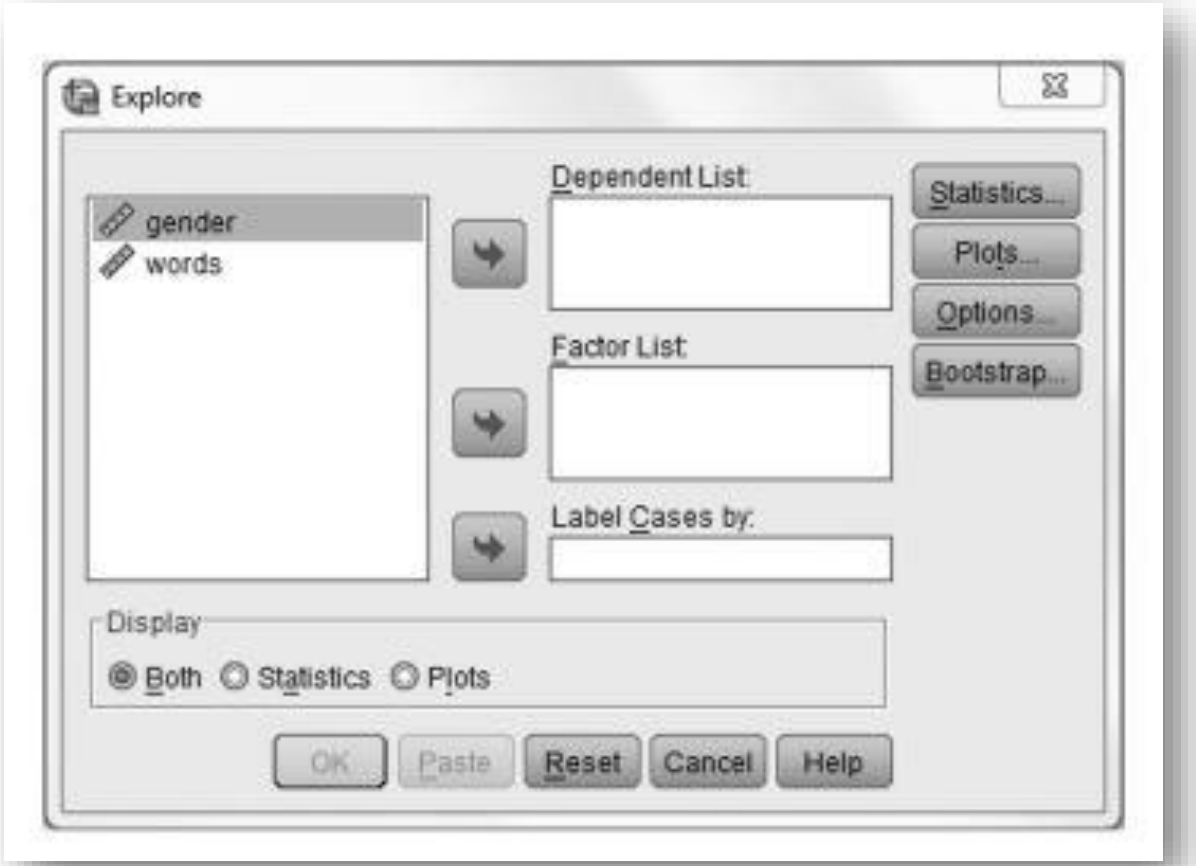
Testing Assumptions

Independence

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

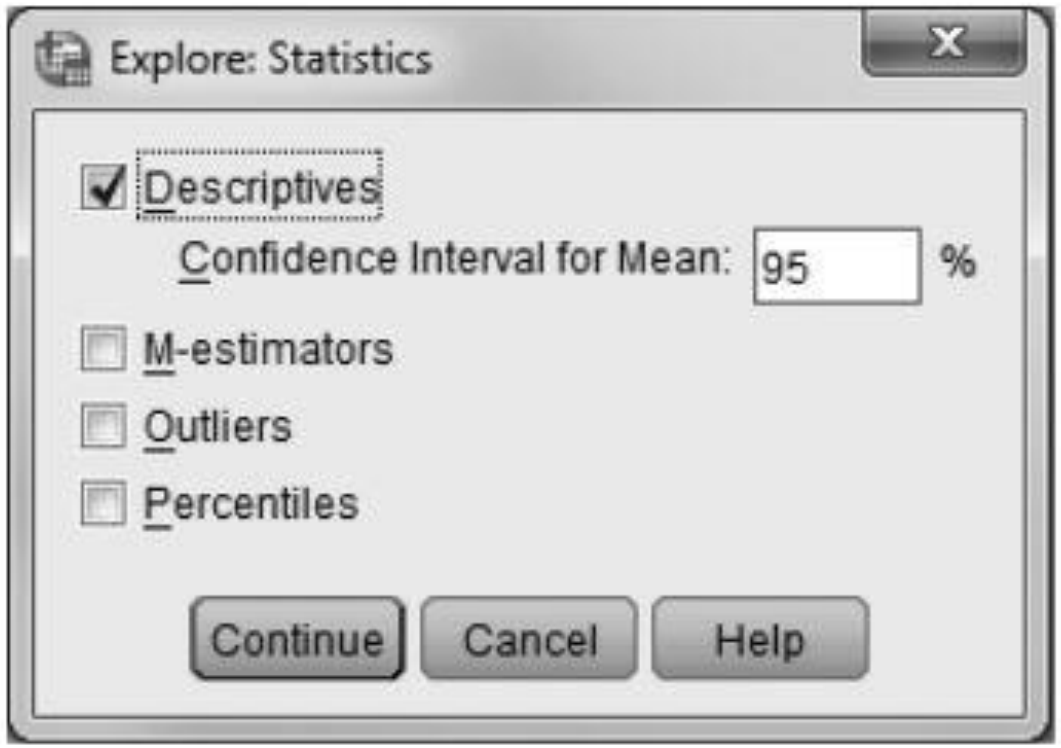
Normality

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

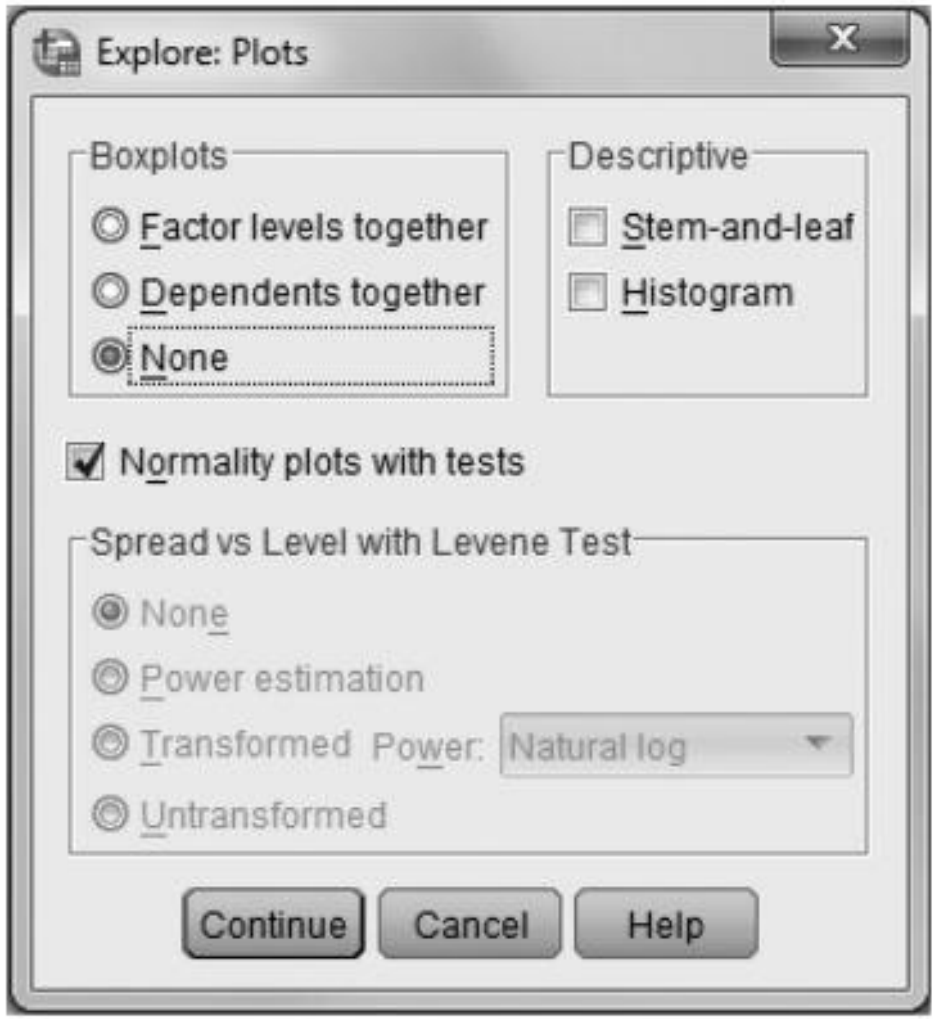


Transfer the **WORDS** variable to the **Dependent List:** field by clicking this variable (highlight) and then clicking  .

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



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



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

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

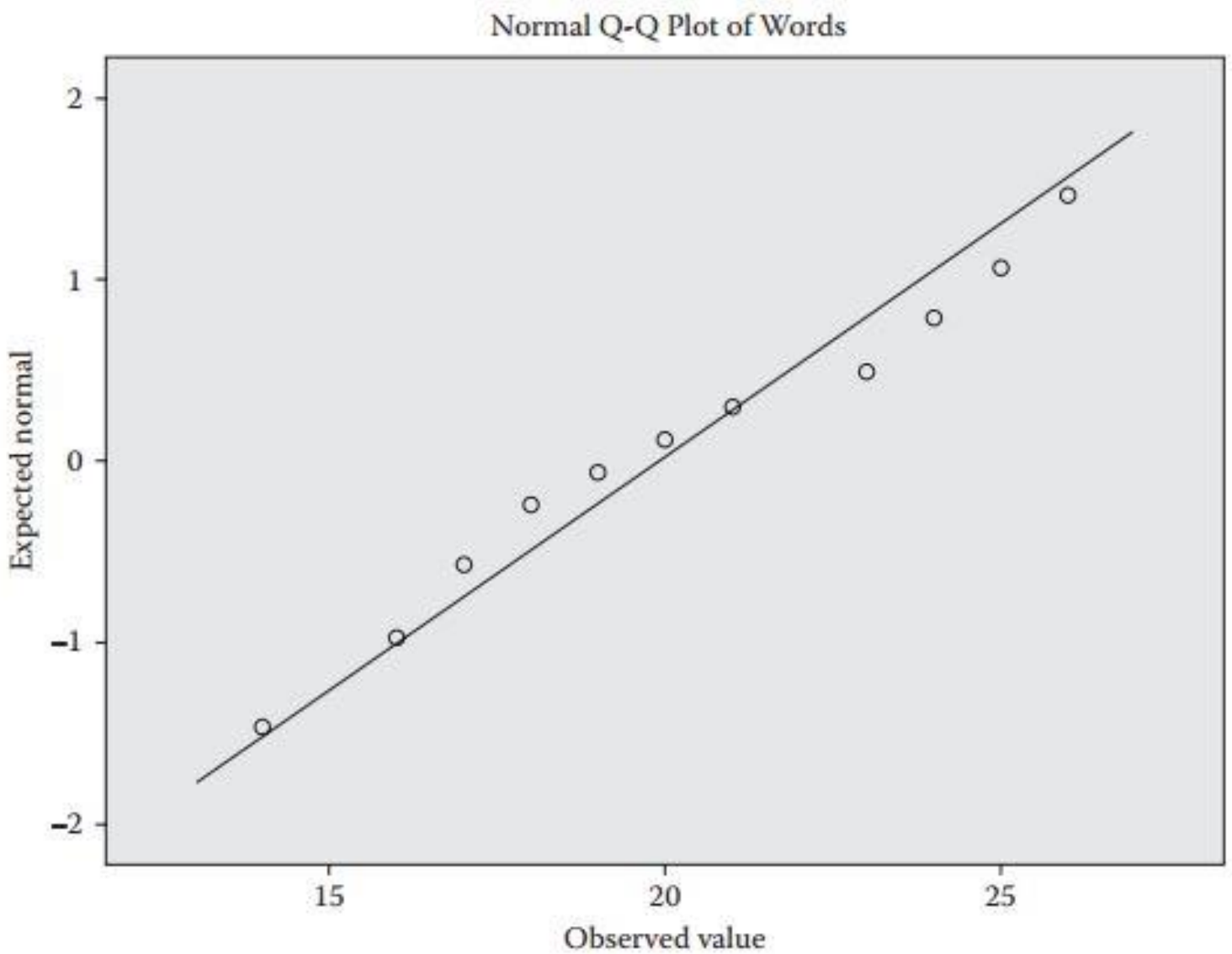
Tests of Normality

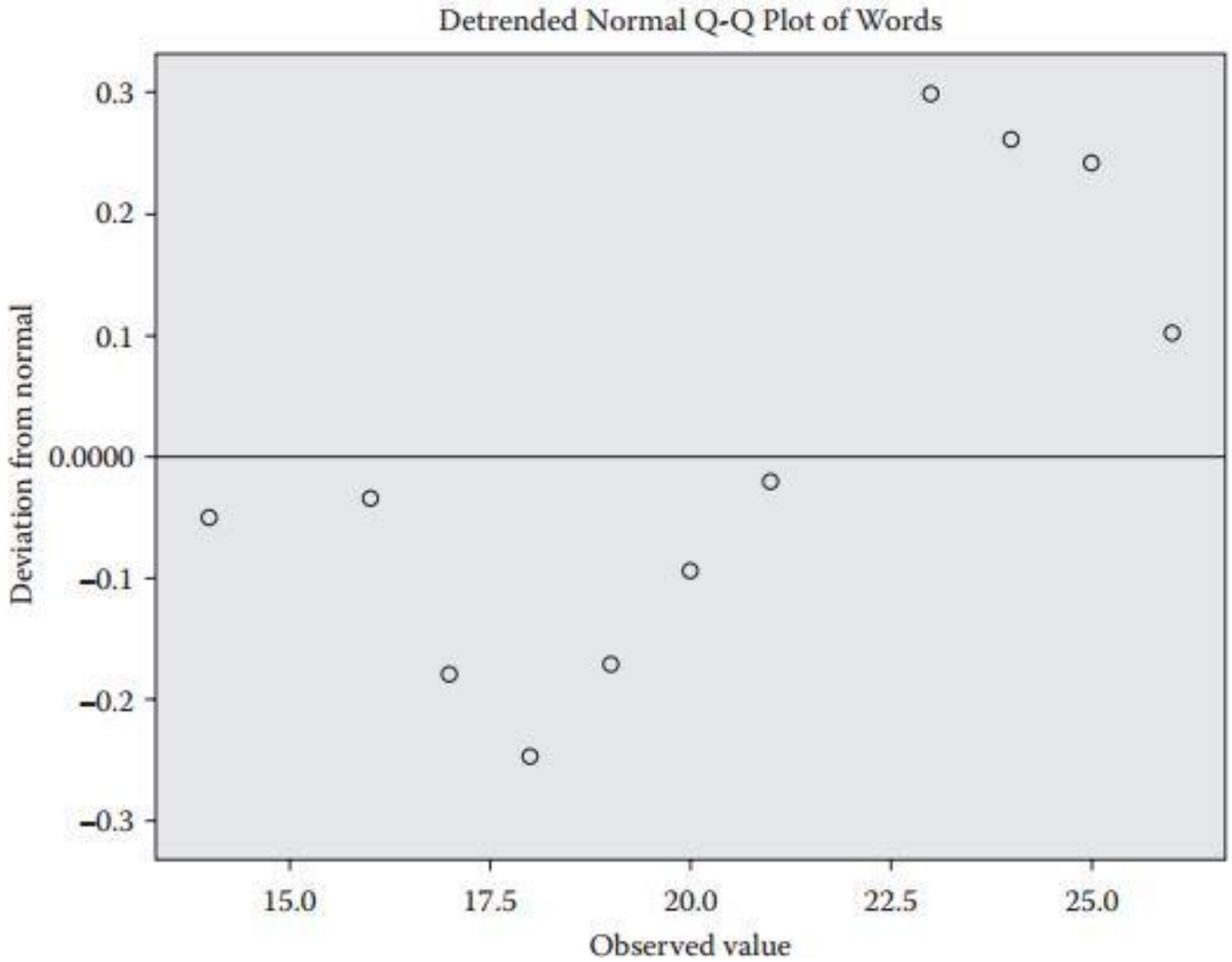
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	*df*	Sig.	Statistic	*df*	Sig.
Words	0.137	20	0.200*	0.936	20	0.201

[a] Lilliefors significance correction.
* This is a lower bound of the true significance.

4.4.2.2.2 SPSS Syntax Method

```
EXAMINE VARIABLES = WORDS
/PLOT NPPLOT
/COMPARE GROUPS
/STATISTICS DESCRIPTIVES
/CINTERVAL 95
/MISSING LISTWISE
/NOTOTAL.
```


Normal Q-Q Plot of Words
Expected normal
2
1
0
−1
−2
15
20
25
Observed value


Detrended Normal Q-Q Plot of Words
Deviation from normal
0.3
0.2
0.1
0.0000
–0.1
–0.2
–0.3
15.0
17.5
20.0
22.5
25.0
Observed value

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 simple diagnostic test for normality is based on the skewness and kurtosis values. The statistical z value for the skewness value is calculated as:

$$Z_{skewness} = \frac{skewness}{\sqrt{s.e.\ skewness}}$$

The statistical z value for the kurtosis value is calculated as:

$$Z_{kurtosis} = \frac{kurtosis}{\sqrt{s.e.\ kurtosis}}$$

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.

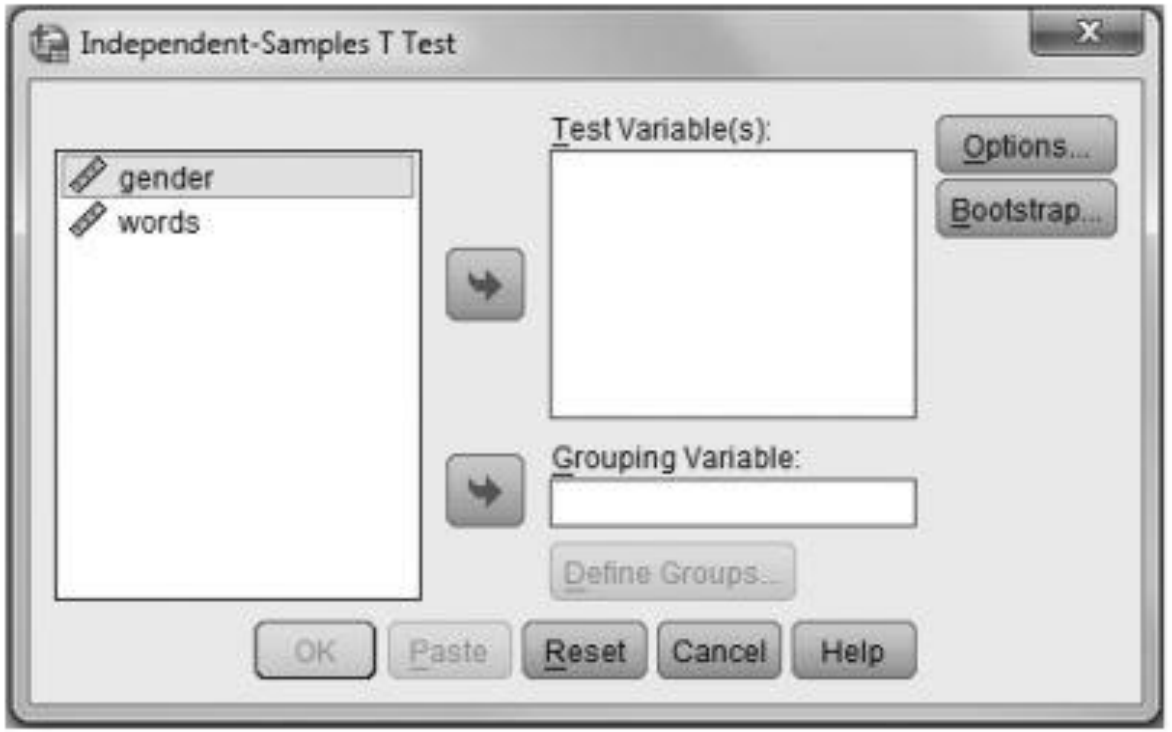
The normal distribution forms a straight diagonal line, and if a variable's distribution is normal, the data distribution will fall more or less on the diagonal. Inspection of the normal Q–Q plot shows very little departure from normality for the WORDS variable.

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 fgure shows little deviation from normality

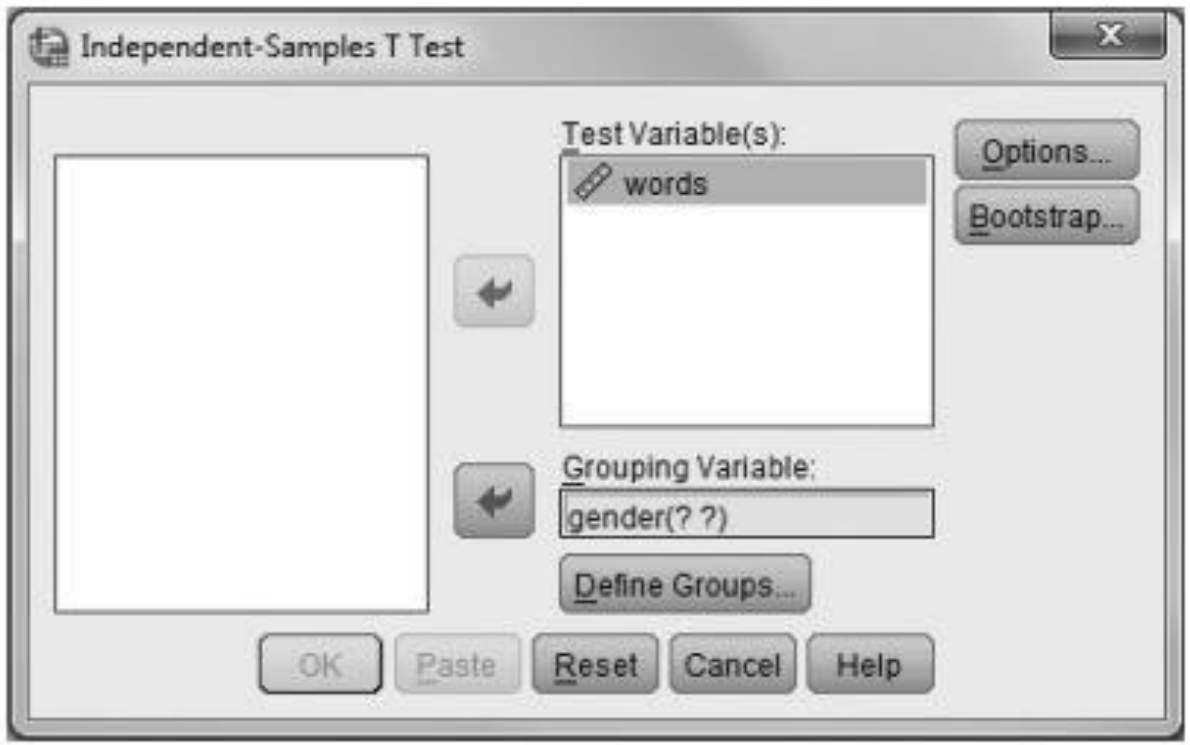
Homogeneity of Variance

The homogeneity assumption is checked in SPSS by Levene's test

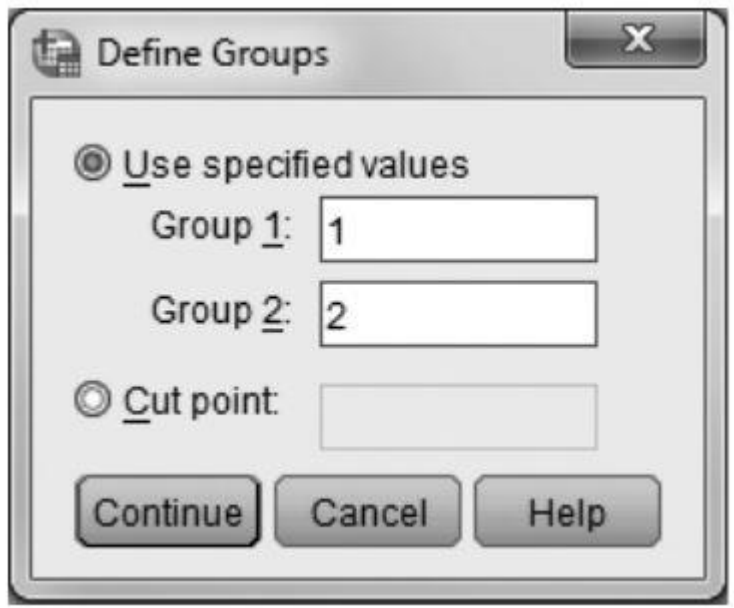
1. From the menu bar, click **Analyze**, then **Compare Means**, and then **Independent-Samples T Test**. The following window will open.



2. 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 ▸.



3. Click Define Groups... 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 Continue.



4. When the following **Independent-Samples *t* Test** window opens, run the *t* test analysis by clicking OK. See Table 4.2 for the results.

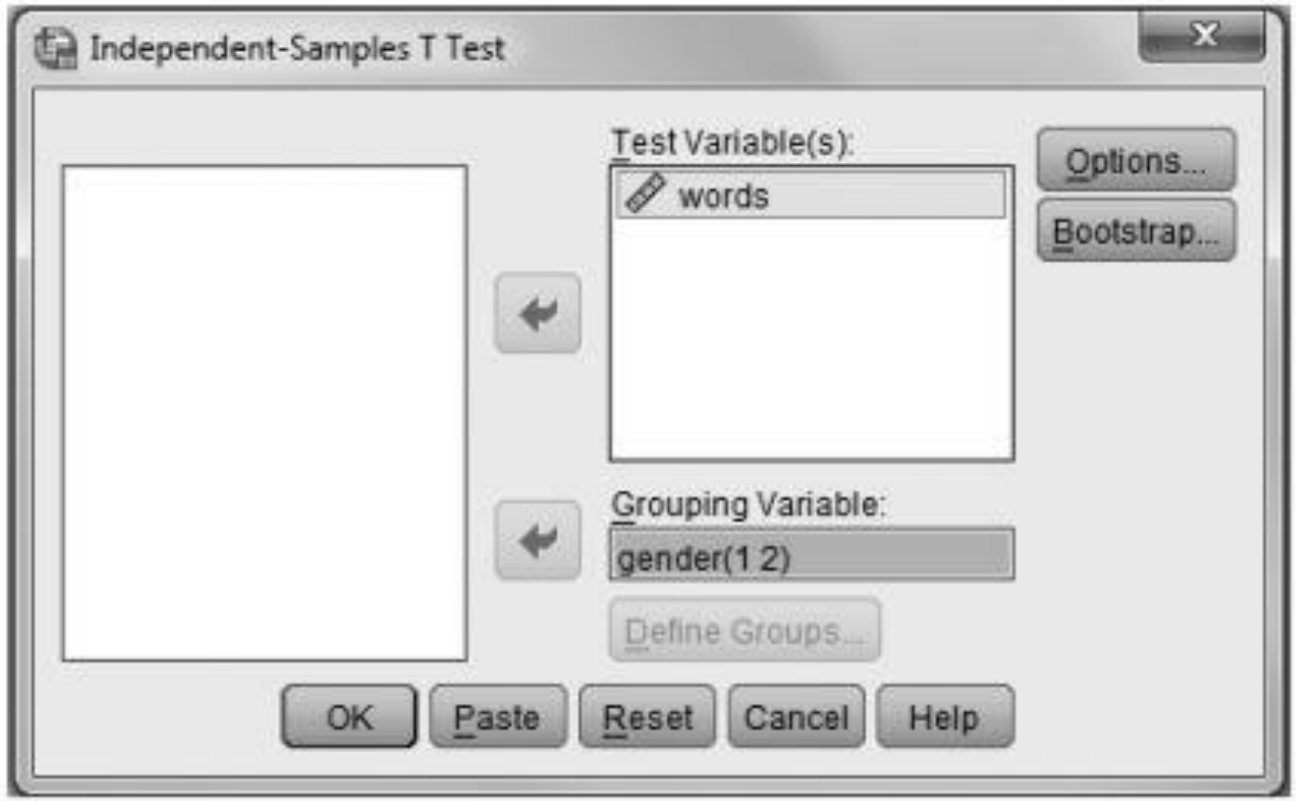


TABLE 4.2

Independent *t* Test Output

Group Statistics

	Gender	*N*	Mean	Std. Deviation	Std. Error Mean
WORDS	MALE	10	17.7000	3.3330	1.0546
	FEMALE	10	22.1000	3.1780	1.0050

Independent Samples Test

		Levene's Test for Equality of Variances		*t* test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
WORDS	Equal variances assumed	.087	.772	−3.020	18	.007	−4.4000	1.4568	−7.4606	−1.3394
	Equal variances not assumed			−3.020	17.938	.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., $p > 0.05$) (see Table 4.2). 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.

The results from the *t* test analysis indicate the following:

- 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.


UNIVERSITAS PGRI SEMARANG

REFLEKSI

1. **Informasi penting hari ini**

2. **Manfaat penting dari informasi penting hari ini**

3. **Tindak lanjut yang dapat saudara lakukan**

Thank you!

Any questions?