Differences in Academic Achievement of Male and Female Students in the Faculty of Sciences and Technology Universitas Terbuka

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Abstract

It is suspected that male and female students at the Faculty of Science and Technology, Universitas Terbuka, have different levels of academic achievement. This paper aims to analyze the differences in academic achievement between male and female students at the Faculty of Science and Technology, Universitas Terbuka. In this paper is a comparative study with a quantitative approach. The population in this study were students of the Faculty of Science and Technology, Universitas Terbuka. The sampling technique uses the Proportional Stratified Random Sampling method. Data collection is done by means of documentation. The data obtained were analyzed using descriptive and inferential statistics with the t-test technique. The results of the study descriptively showed that the average GPA of male students was 1.87 and the average GPA of female students was 1.98. The results of hypothesis testing using t-test obtained Sig (2-tailed) > absent or (0.153 > 0.05). This shows that between male students and female students at the Faculty of Science and technology, Universitas Terbuka, there was no significant difference in academic achievement. The implication of the results of this study is that students should exchange information more frequently without looking at gender.

Keywords:
Differences in academic achievement, proportional random sampling, documentation data, descriptive statistics, inference statistics, and t-test.

1. Introduction

The development of science and technology has brought fundamental changes to the role of women. A change that has taken place is a shift in the role of women, which was originally connoted as roles in the family environment, shifting towards roles in the public sector. The current and future role of women in the public sector covers various development fields. This is also reinforced by the Republic of Indonesia's Presidential Regulation Number 9 of 2000 concerning Gender Mainstreaming in National Development, which contains gender equality and justice through policies and programs in various development fields (Affrida and Suprapti, 2017). Given the demands of the public role, the development of women in accessing education has also increased. That is, the demands of an increasingly complicated job cause their educational level must also be high. The logical consequence is that women must be able to get the same education as men. One of the demands as a student is the achievement of learning achievement, namely the results of the assessment of learning activities in the form of symbols, numbers, and letters as a form of evaluation of students' abilities in the learning process. One indicator of student achievement can be seen from the Grade Point Average (GPA). Armed with higher education with an excellent GPA, not a few women can explore various prestigious positions. If their achievements in public roles in certain fields are good enough and are not inferior to men, then their academic achievements are also worthy of testing (Dayioglu and Türüt-Asik, 2004; Goni et al., 2015).

Several studies on testing differences in academic achievement between male and female students have been conducted. Yuniarti (2017) and Gustavsen (2019) examined differences in academic achievement between students and students. Gustavsen showed that the average score of students was significantly lower than that of female students. This shows that the consequences of equal rights that have been processed since the Kartini era have shown results. On the other hand, Gumel and Galadima (2014) also showed that student academic achievement was lower in student geometry. Gumel and Galadima examined the academic abilities of students who took geometry courses showed that the average value of geometry courses obtained by college students was significantly greater than the scores obtained by students for the same course. On the other hand, Nuryoto (1998) showed that academic achievement in Yogyakarta between men and women did not show a significant difference. In other words, through his two means difference analysis, Nuryoto showed that there were similarities in academic achievement between men and women at IKIP PGRI Yogyakarta. This condition leads to the conclusion that due to equal rights in education, academic achievement between men and women is not much different. Nuryoto's research is also in line with the research of Delucchi (2014) and Sam (2016) in Latin American countries. Delucchi found that the academic achievements of high school students in mathematics, history, and geography did not differ significantly between men and women.

Noting the various findings above, this paper intends to carry out an analysis of the differences in academic achievement between male and female students at the Faculty of Science and Technology, Universitas Terbuka. The aim is to find out the extent of differences in academic achievement between male and female students based on their GPA achievements. Data and information analyzed in this study, using secondary data from the Faculty of Science and Technology, Universitas Terbuka.

2. Methodology

2.1 Object and Type of Research

In this paper, the research was conducted using a quantitative approach, where the type of research is comparative. The study was conducted to determine differences in academic achievement based on the Grade Point Average (GPA), between male students and female students at the Faculty of Science and Technology, Universitas Terbuka. The technique for collecting data and information is done by using value documents.

2.2 Descriptive Data Analysis

Descriptive data analysis is used to determine or describe academic achievements in the form of a GPA of male and female students at the Faculty of Science and Technology, Universitas Terbuka. Descriptive data analysis in this study includes the following steps (Bolboaca et al., 2011; Kim, 2015).

a) The average statistics can be determined using the equation:

$$\bar{X} = \frac{\sum_{i=1}^{k} f_i x_i}{\sum_{i=1}^{k} f_i}, \tag{1}$$

where $\bar{X}$ is the average; f_i is the i data interval frequency; x_i is the middle value of the i-th data interval; and $i = 1,2,\cdots,n$.

b) Statistics on the percentage value of frequency can be determined using the equation:

$$p_i = \frac{f_i}{\sum_{i=1}^{k} f_i} \times 100, \tag{2}$$

where p_i is the percentage value of the i-th data interval frequency; f_i is the i data interval frequency; and $i = 1,2,\cdots,n$.

c) Standard deviation statistics can be determined using the equation:

$$S = \sqrt{\frac{\sum_{i=1}^{k}(f_i x_i - \frac{\sum_{i=1}^{k} f_i x_i}{\sum_{i=1}^{k} f_i})^2}{\sum_{i=1}^{k} f_i - 1}}. \tag{3}$$

d) The categories of measurement of academic achievement can be measured based on the Grade Point Average (GPA) obtained by each student, where the range of GPA is given in Table 1.

Table 1. Grade Point Average (GPA)

Grade Point Average (GPA)	Predicate
3.50 – 4.00	Very good
3.00 – 3.49	Well
2.50 – 2.99	Enough
2.00 – 2.49	Less
0.00 – 1.99	Failed

Source: Yuniarti (2017)

2.3 Normality Test Using Q-Q Plot

Kim (2015) explains that the quantile point q for the random variable X is a fulfilling point

$$P(X \le q) = F_X(q) = p,$$

where F_X is the cumulative distribution function of X, then it is assumed that the inverse of the cumulative distribution function (CDF) is

$$q = {F_X}^{-1}(p).$$

This function is usually called a quantile function. Next to define the quantile plot points of the two random variables X and Y as parametric curves $C(p)$ with $p \in [0,1]$, i.e.

$$C(p) = \left({F_X}^{-1}(p), {F_Y}^{-1}(p)\right).$$

$F_X(q)$ measure the proportion of the random variable X less than the value of q given. Suppose $X_1, \dots, X_n$ random sample of n. Then, sort in ascending order

$$X_{(1)} = \min(X_1, \dots, X_n) \le X_{(2)} \le \dots \le X_{(n)} = \max(X_1, \dots, X_n).$$

Suppose $X_{(j)} \le q < X_{(j+1)}$. Then this states that there is a sample j which is smaller than q. Then CDF approaches

$$\widehat{F_X}(q) = \frac{j}{n}.$$

Quantile of $\frac{n}{j}$-th sample is $X_{(j)}$. Some authors define this as the $\frac{(j-0.5)}{n}$-th quantile sample, where the factor 0.5 is for discretization.

In computer implementation it will be easier to use the step function $I_q(x)$ which is defined as $I_q(x) = 1$ if $x \le q$ and $I_q(x) = 0$ if $x > q$. Therefore, the CDF is estimated as follows

$$\widehat{F_X}(q) = \frac{1}{n}\sum_{i=1}^{n} I_q(X_i),$$

where $I_q(X_i)$ is calculated if X_i is less than q. In the practice of testing the suitability of a distribution model, if a set of data has gathered coincided around a straight line, then it is said that the data matches a theoretical distribution determined.

2.4 Homogeneity Test

Homogeneity test is done to determine the t-test that will be used in hypothesis testing, and to find out if the test results of the two population groups have the same variance or not. Homogeneity test or variant test can be carried out using the following equation

$$F = \frac{\text{The biggest variance}}{\text{The smallest variance}}. \tag{4}$$

Using the level of significance $\alpha = 0.05$ and degree of freedom $df = n_k - 1$, if $F < F_{Table}$ then it means the variance of the two data groups is the same (Hdii and Fagroud, 2018; Mwangi and Ireri, 2017).

2.5 Inferential Statistical Analysis

Refer to Nnamani and Oyibe (2016) and Yuniarti (2017) Inferential statistical analysis is used to analyze sample data and the results are applied to the population. The inferential statistics used in this paper are two independent sample t-tests. The equation for the t-test of the two independent samples is

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}, \quad (5)$$

where $\bar{X}_1$ is the average learning achievement of male students; $\bar{X}_2$ is the average learning achievement of female students; S_1^2 is the variance in male student achievement; S_2^2 is the variance of female student learning achievement; n_1 is the number of male student samples; and n_2 is the number of female student samples.

The hypothesis used in the analysis of this inference data is

$H_0 : \mu_1 = \mu_2$, meaning that there is no difference in academic achievement between male and female students;
$H_1 : \mu_1 \neq \mu_2$, it means that there are differences in academic achievement between male and female students;
where μ_1 is average acoustic achievement of male students; and μ_2 is average academic achievement of female students.

In testing hypotheses using two independent sample t-test statistics, there are a few things to note, i.e.

a) If there are many sample members $n_1 = n_2$ and homogeneous variance $\vartheta_1^2 = \vartheta_2^2$, then you can use t-test, both for separated and pool variance. To get a statistical value t_{table} used degree of freedom $df = n_1 + n_2 - 2$.
b) If there are many sample members $n_1 \neq n_2$ and homogeneous variance $\vartheta_1^2 = \vartheta_2^2$, then you can use t-test, pooled variance. To get a statistical value t_{table} used degree of freedom $df = n_1 + n_2 - 2$.
c) If there are many sample members $n_1 = n_2$ and homogeneous variance $\vartheta_1^2 \neq \vartheta_2^2$, then you can use t-test, both for separated and pool variance. To get a statistical value t_{table} used degree of freedom $df = n_1 - 1$ or $df = n_2 - 1$.
d) If there are many sample members $n_1 \neq n_2$ and homogeneous variance $\vartheta_1^2 \neq \vartheta_2^2$, then you can use t-test, both for separated and pool variance and pool variance. To get a statistical value t_{table} used degree of freedom $df = n_1 - 1$ or $df = n_2 - 1$.

The decision criteria for testing this hypothesis are

a) At the significance level α, if the value of $t > t_{table}$ or Asymp.Sig < α, then the hypothesis H_0 is accepted. This means that there is no difference in academic achievement between male and female students.
b) At the significance level α, if the value of $t \leq t_{table}$ atau Asymp.Sig $\geq \alpha$, then the hypothesis H_0 is accepted. This means that there are differences in academic achievement between male and female students.

3. Results and Discussion

3.1 Analyzed Data

In this study, academic achievement data were analyzed based on students' Grade Point Average (GPA) at the Faculty of Science and Technology, Universitas Terbuka. Based on the documents obtained by the student GPA data, students are grouped into male and female students. The GPA data for male and female students are statistically discrete as given in Table 2.

Table 2. Descriptive Statistics

Variable	Male	Female
Total Count (n)	21204	7538
Mean	1.5594	1.6109
Standard Deviation	0.5294	0.5859
Variance	0.2802	0.3433
GPA Minimum	0.0000	0.0000
GPA Maximum	4.0000	4.0000

Table 2 shows that the number of male students is 21204, and the number of female students is 7538 so that the total number of students is 28.742. It appears that the average GPA of male students is 1.5594, and the average GPA

of female students is 1.6109. It appears that the average GPA of female students is relatively higher, compared to the average GPA of male students. In each group, male students had a GPA variance of 0.2802, and female students had a GPA variance of 0.3433. This also shows that the variance of the GPA of female students is higher, compared to the variance of GPA of male students.

Both the GPA data for male students and the GPA data for female students can be expressed as polygon histograms as given in Figure 1.a. and Figure 1.b. This histogram polygon was created using Minitab 16 software.

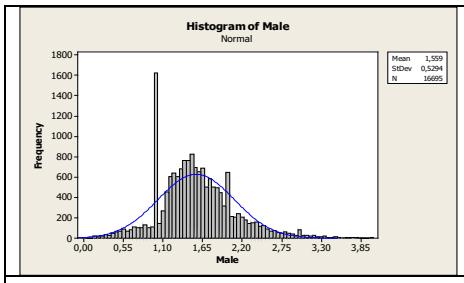

Figure 1.a. Histogram Data on Male Students' GPA

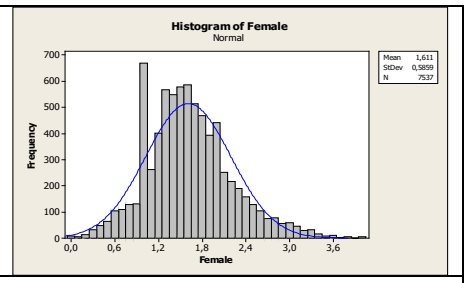

Figure 1.b. Histogram Data on Female Students' GPA

Paying attention to Figure 1.a. and Figure 1.b. it appears that the relative GPA data is gathered around averages and symmetries, thus forming a bell. However, it is good in Figure 1.a. and Figure 1.b. there is data around the value of GPA = 1 having a very high frequency, compared to other GPA frequencies. This shows that both the majority of male and female students have a GPA of around one.

3.2 Data Normality Testing

This section intends to conduct a normality test on the academic achievement data of male and female student groups. Testing the normality of data for each group is carried out using the Q-Q method approach of the plot refer to the discussion in section 2.3, and carried out with the help of Minitab software 16. The test results are given in Figure 2.a. and Figure 2.b.

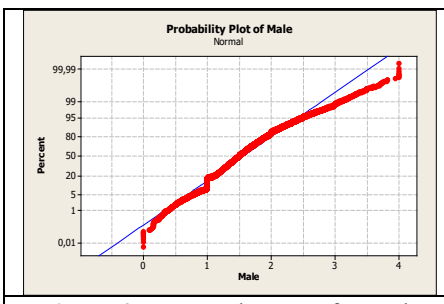

Figure 2.a. Q-Q Plot Data for Male Students' GPA

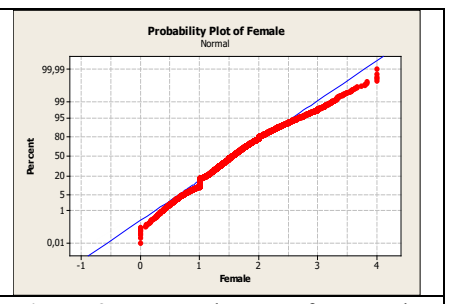

Figure 2.b. Q-Q Plot Data for Female Students' GPA

Looking at Figure 2.a, it appears that the Grade Point Average (GPA) of male students are all located almost coincide with a straight line. Therefore, it can be said that the academic achievement data of male students is normally distributed, with an average of 1.5594 and a variance of 0.5294, or can be written as $X_1 \sim N(1.5594, 0.5294)$. Likewise, if you pay attention to Figure 2.b, it appears that the Grade Point Average (GPA) of all female students are located almost coincide with a straight line. Therefore, it can be said that the academic achievement data of female students is normally distributed, with an average of 1.6109 and a variance of 0.5859, or can be written as $X_2 \sim N(1.6109, 0.5859)$. After the data is tested for normality, then the data is tested for homogeneity.

3.3 Homogeneity Testing Data

In this section homogeneity testing of academic achievement data of male and female students is carried out. The homogeneity test hypothesis here is

H_0 : variations in academic achievement between male and female students alike (homogeneous);

H_1 : variations in academic achievement between male and female students is not the same (not homogeneous).
The test is carried out by referring to equation (4), and carried out with the help of Minitab 16 software. The test results are obtained by statistical statistics F_{Count} = 1.225196288, and Asym.Sig = 0.01. Using the level of significance $\alpha = 0.05$, degree of freedom $df_1 = n_1 - 1$ = 21203 and $df_2 = n_2 - 1$ = 7538 - 1 = 7537, obtained F_{table} = 1.00000. Because F_{Count} > F_{table} or Asym.Sig < α, the hypothesis H_0 rejected, which means that the academic achievement variance between male and female students is not the same (not homogeneous).

3.4 Inferential Statistics Testing

Based on the results of normality and homogeneity data tests that have been carried out in sections 3.2 and 3.4, then in this section, inferential data testing is performed, wherein the inferential data testing is parametric statistics using independent sample t-tests. The inferential data test hypothesis here is
$H_0 : \mu_1 = \mu_2$; there is no difference in the academic achievements of male and female students;
$H_1 : \mu_1 \neq \mu_2$; there are differences in the academic achievements of male and female students.
Refer to Table 2, because of the large number of sample members $n_1 \neq n_2$ and homogeneous variance $\vartheta_1^2 \neq \vartheta_2^2$, then you can use t-test, both for separated and pool variance and pool variance. The test is carried out by referring to equation (5), and carried out with the help of Minitab 16 software. The test results are obtained by statistical statistics t_{Count} = 7.050045555. Using the level of significance $\alpha = 0.05$, degree of freedom $df_1 = n_1 - 1$ = 21203 and $df_2 = n_2 - 1$ = 7538 - 1 = 7537, obtained t_{table} = 1.645000, and Asym.Sig = 0.01. Because t_{Count} > t_{table} or Asym.Sig < α, the hypothesis H_0 rejected, which means that the average academic achievement between male and female students is different.

3.5 Discussion

This section discusses the results of the data analysis that has been done in the previous sections. Based on the results of the analysis showed that between the academic achievement of male and female students, at the Faculty of Science and Technology, Universitas Terbuka, there were significant differences. This difference, referring to Table 2, can be from the average of Grade Point Average (GPA), where male students have an average GPA of 1.5594, while female students have an average GPA of 1.6109. The difference in GPA between male and female students is 0.0515, and places that female students have higher academic achievement, compared to male students' academic achievement.

But in the classic discussion about the differences between men and women, Saraswati (2015) concluded that men have better mathematical and visuospatial abilities, while women are better in verbal abilities. But in several studies suggest that in obtaining academic achievement in higher education is not influenced by gender. Although men have higher self-confidence than women, to achieve academic achievement is very dependent on how students carry out the learning process during their college education.

4. Conclusion

In this paper, an analysis of the differences in academic achievement between male and female students is held at the Faculty of Science and Technology, Universitas Terbuka. Based on the results of descriptive data analysis it can be concluded that male students have an average GPA of 1.5594, while female students have an average GPA of 1.6109. At first glance, it does seem that the average GPA of female students is higher than the average GPA of male students. Then, the different test results can indeed be concluded that the academic achievements of male students, different from the academic achievements of female students. However, it cannot always be said that the academic achievements of female students. Because to obtain academic achievement is greatly influenced by how students follow the learning process during their college education.

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