The Effect of Sleep Time and Learning Duration on Student Achievement

Heruna Tanty[1*], Brandon Timotius Santo[2], Defina Puspita Sari[3], Eliezeri Yeremi Soeprianto[4]

[1] Mathematics & Statistics Department, School of Computer Science,
[2,3,4] Industrial Engineering Department, Faculty of Engineering,
Bina Nusantara University
Jakarta 11480, Indonesia
heruna@binus.ac.id; brandon.santo@binus.ac.id; defina.sari@binus.ac.id;
eliezer.soperianto@binus.ac.id

*Correspondence: heruna@binus.ac.id

ABSTRACT

The study was conducted to determine the relationship between study time and sleep time with the Grade Point Average (GPA). Data collection used as many as 103 respondents with a student background majoring in Industrial Engineering at Bina Nusantara University. The results of descriptive statistics show that the average respondent uses 1 to 2 hours of study time per day. The results of descriptive data processing show that the average respondent uses 5 to 7 hours of sleep per day. Inferential statistical results with a correlation test show that there is a correlation between learning activities and sleep with the GPA of Industrial Engineering students at BINUS University. The reliability test showed that there was a correlation between the frequency of sleepiness and the concentration level of students with the acquisition of a Cronbach Alpha score of 0.7277. The reliability test shows that there is a correlation between hours of sleep and the frequency of using the alarm with a Cronbach Alpha value of 0.6363. The reliability test shows that there is a correlation between GPA and the duration of student self-study with a Cronbach Alpha value of 0.6575.

Keywords: *Study Time; Sleep Time; Grade Point Average (GPA)*

INTRODUCTION

Sleep is a basic need that is needed by every human being. The COVID-19 pandemic condition requires students to immediately adapt to the new system, where almost all lecture activities are carried out online. The rapid adaptation process can trigger sleep disturbances and stress (Putri, Dasuki, & Agustina, 2021). Good quality of sleep activity is able to create stable emotional stability in students (Rifai, Utami, & Farich, 2020).

Sleep quality can significantly influence the level of depression, anxiety, and stress of medical students. Low sleep quality can cause serious disturbances to human health, so it is hoped that institutions can implement learning programs and provide knowledge on sleep quality that supports sleep quality and student psychological health. Assessment of sleep quality can be done by looking at the quantitative and qualitative aspects. The quantitative aspect can be seen based on the duration of sleep, while the qualitative aspect can be seen based on the physical condition of the body, sleep disturbances, and dysfunction during the day. Sleep quality can also be influenced by changes in people's lifestyles that are currently happening, social relations with the community, and the influence of increasingly developing technology (Aryadi, Yusari, Dhyani, Kusmadana, & Sudira, 2018).

Factors that can affect the success of each child's learning consist of many things. There are two factors that influence the success of each child's learning, namely internal and external factors (Sari, 2019). Internal factors consist of the condition of the body from oneself, such as physical and spiritual, attitudes, and talents (Rifai, Utami, & Farich, 2020). External factors include the environmental conditions around the child, such as the duration of learning and the learning equipment used (Sari, 2019).

Through the results of Arfianingsih Dwi Putri's research, it was shown that there was a relationship between sleep quality and academic scores in students, as evidenced by the results of her research which showed that students who had poor sleep quality would have an impact on their declining academic assessment (Putri A. D., 2017). The success or academic achievement of a student can be seen through the Grade Point Average (GPA) (Putri, Mayangsari, & Rusli, 2018). GPA will be used as an index to assess student achievement in this study.

Since the COVID-19 pandemic hit in Indonesia, Bina Nusantara Kemanggisan University has implemented a policy of online teaching and learning activities. The problem that arises is that online lectures trigger many changes and encourage students to adapt quickly to new learning conditions. Thus, the new learning conditions that are included in the fast-paced lifestyle cause students' sleep and study times to become irregular. This can also be seen from the academic results of the 2019 Industrial Engineering Students, which are not a little below the Bina Nusantara University average target. Based on these problems, hypothesis testing, bivariate analysis, and multivariate analysis will be carried out to prove the relationship between sleep time and student learning with academic scores obtained. This analysis was conducted to provide suggestions and solutions to students in order to improve sleep time and study time ideally. In addition, parties who play a role in the teaching and learning process can be in the form of campus guiding students so that they can adjust the learning schedule to the personal needs of each student.

Descriptive analysis is an analysis conducted to examine research data descriptively. Descriptive analysis will be carried out based on the results of data processing, which will usually be presented in the form of graphs or tables. The use of this analysis can help researchers in assessing the characteristics of the data they have. Calculations for descriptive analysis consist of the average value, median value, data range, maximum data, minimum data, or standard errors generated by the data (Anggrawan, 2019).

Correlation test is a test carried out to see whether there is a relationship between the variables being tested. The correlation test will produce a p-value that can be used as a reference for a study. If the resulting p-value is positive, it will indicate a higher level of effectiveness between one variable and another. While the p-value, which is negative, indicates the level of effectiveness between one variable and another (Purhadi, Anisa, & Firmansyah, 2020). A correlation test can also be done to test the presence or absence of influence between the hypotheses that have been proposed in a study (Haqqu, 2020).

The reliability test, commonly referred to as the reliability test, is a research instrument that is used to obtain reliable information and is used for further research. Data collection can be done in various ways, starting with interviews, observations, and questionnaires. A data collection instrument can be trusted or (reliable) if the statement of the answers to the questionnaire is consistent in the accuracy of the data. There are several other reliability test methods, such as retrieving data to ensure that the data taken when compared to the first data has the same level of similarity. This is used to ripen the data to always be consistent and reliable. The level of reliability of a data can be measured by a reliability value that is getting closer to one. However, in general, the reliability test can be recognized as quite reliable if the Cronbach's Alpha value is more than 0.6 ($\alpha > 0.6$) (Wahyuni, 2014).

The ANOVA test is also one of the instruments used in this study. The ANOVA test is an analysis used to test the difference in the mean between groups. ANOVA (Analysis of Variance) is an analysis used to test the hypothesis of a study. The ANOVA test produces F table and F arithmetic, where if the value of the F table is smaller than the F count, then H0 is rejected or H1 is accepted. There are several types of ANOVA distributed based on the number of factor variables. The division of ANOVA is divided into two, namely univariate and multivariate. In this case, the type of ANOVA used is the multivariate one-way analysis of variance method because there is more than one dependent variable (Hidayat, n.d.).

In the daily activities of a student, of course, many factors affect student achievement and learning outcomes. One of the factors that can affect the achievement of a student is the factor of learning activities. A student's learning activities can be categorized from studying during college and independent study. The level of learning effectiveness while studying can be seen in the student's GPA. Similarly, the effect of the length of time each student's self-study has on the GPA achieved. In general, the longer a student spends time studying, the wider the insight received and the higher the GPA achieved. However, a long study time does not necessarily result in good

performance, because there are still some side factors such as the ratio of rest time to study time. If students use time to study excessively without resting, students can experience physical and mental fatigue so that the resulting achievement decreases. Therefore, this study also collects data about what time Industrial Engineering students generally sleep at night. These factors can be examined and examined for correlation between others. There are also students who use their personal study time a little because these students already understand the material when it is delivered in class. So, they also carried out data collection of how long it is used by students during learning activities in class. The level of student focus during class can also be affected due to the amount of sleep, which causes students to be sleepy during class. So, data on the frequency of sleepy students also needs to be taken to ensure the correlation between the data. Based on all the data taken, the reliability and correlation of each data must be researched and tested. If all the data can be trusted, then the research can be continued to examine the effect of sleep activities and student learning activities on the resulting GPA achievement.

METHODS

The data was obtained by using literature study and distributing questionnaires. Literature study is carried out by studying journals, scientific research results, and other sources related to the research topic chosen by the author. Second, questionnaires were distributed by distributing online questionnaires to active students from the Department of Industrial Engineering at Bina Nusantara University. The next step is to perform data processing and analysis of the results of the questionnaire that has been carried out. Processing research data using several statistical tests, namely correlation, reliability, and ANOVA. After data processing and analysis is done, the next step is to draw conclusions from the research that has been done. In data processing, grouping and coding were carried out for each criterion. The Grade Point Average (GPA) is grouped into 6 groups, independent study time is grouped into 4 groups, and sleep time is grouped into 4 groups. Each group represents each range.

RESULT AND DISCUSSION

Descriptive Analysis of the Effect of Study Time on Student Achievement

The study used two types of statistical analysis, namely descriptive and inferential analysis. Descriptive analysis begins by presenting research data first into tables and graphs. This can make it easier for writers and readers to understand the contents of the research discussed. The respondents used were 103 people with the background of the respondents being students majoring in industrial engineering at Bina Nusantara University (BINUS). Respondents are students from the class of 2019 to 2022.

Table 1 Study Time Research Results (Number of Respondents)

No	GPA Grouping	Research Result (Respondents)			
		Self Studty Time (<1 hours)	Self Studty Time (1-2 hours)	Self Studty Time (3-4 hours)	Self Studty Time (>5 hours)
1	1	1	1	0	0
2	2	8	0	1	1
3	3	5	7	5	1
4	4	3	25	7	6
5	5	2	8	14	7
6	6	0	0	1	1
	MAX	GPA 3.00-3.19	GPA 3.50-3.79	GPA 3.80-3.99	GPA 3.80-3.99
	MIN	GPA < 4.00	GPA 3.00-3.19	GPA < 2.99	GPA <2.99

The following is the resulting graph for a comparison between the Grade Point Average (GPA) and the study time used by students.
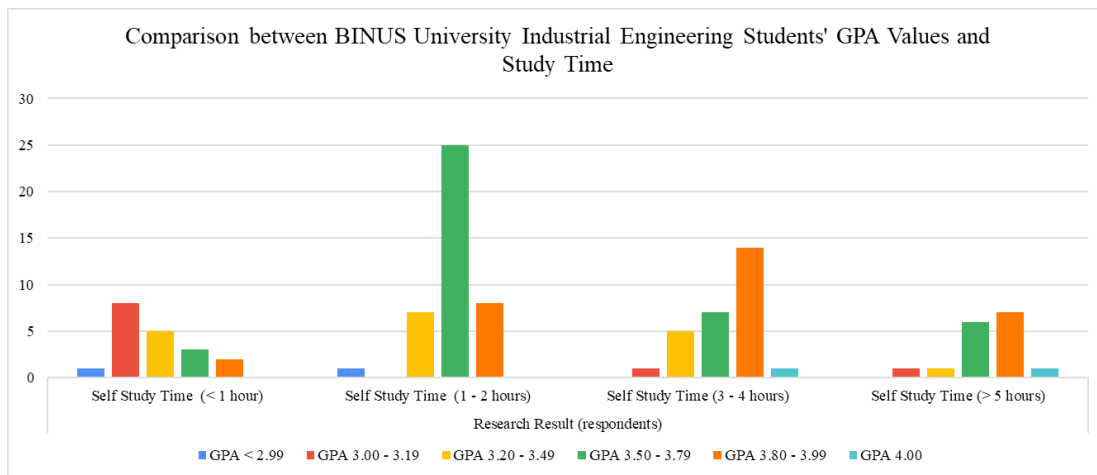
Figure 1. Comparison of BINUS University Industrial Engineering
Student GPA Values with Study Time

Based on the descriptive table of the relationship between GPA and the study time of Industrial Engineering students at Bina Nusantara University, students with a GPA of less than 2.99 have a study time of 1 – 2 hours or even less than one hour. There are 8 students with a GPA of 3.00 – 3.19 whose study time is less than one hour and there are 2 students whose study time is 3 – 4 hours or even more than 5 hours. Then, most students who have a GPA of 3.20 – 3.49 need 1-2 hours of study time and 3 –4 hours of study. Then, there are 25 students with a GPA of 3.50 – 3.79 who need 1 – 2 hours of study time, 3 students take less than 1 hour, 7 students take 3 – 4 hours, and 6 students take more than 5 hours. A total of 14 students with a GPA of 3.80 – 3.99 need 3-4 hours of study time, 7 students with more than 5 hours of study time, 8 students with 1 – 2 hours of study time, and 2 students with less than 1 hour of study time. Then, there is 1 student with a 4.00 GPA who takes 3-4 hours of study time and more than 5 hours. So, based on the table above, the students who have less than 1 hour of study time are students with a GPA of 3.00 – 3.19. Most students with 1 – 2 hours of study time have a GPA of 3.50 – 3.79. Then, the students with 3 – 4 hours of study time have a GPA of 3.80 – 3.99. Then, the students who have more than 5 hours of study time are students with a GPA of 3.80 – 3.99. Meanwhile, students who spend the least time studying less than 1 hour are students with a GPA of 4.00.

Table 2 Results of Calculation of the Size of Research Concentration Study Time

Self Study Time	
Mean	4
Modus	2
Median	4

Descriptive Analysis of the Effect of Sleep on Student Achievement

The following table is for grouping sleep time with a Grade Point Average (GPA) generated based on a questionnaire.

Table 3 Sleep Time Research Results (Number of Respondents)

No	GPA Grouping	Research Result (Respondents)			
		Sleeping Time (<3 hours)	Sleeping Time (3-4 hours)	Sleeping Time (5-7 hours)	Sleeping Time (> 8 hours)
1	1	0	1	0	1
2	2	3	0	3	3
3	3	1	3	11	3
4	4	1	8	31	1
5	5	1	5	16	9
6	6	1	0	1	0
	MAX	GPA 3.00-3.19	GPA 3.50-3.79	GPA 3.50-3.79	GPA 3.80-3.99
	MIN	GPA < 2.99	GPA 3.00-3.19	GPA < 2.99	GPA 4.00

The following image is the resulting graph for the comparison between the Grade Point Average (GPA) and the sleep time used by students.
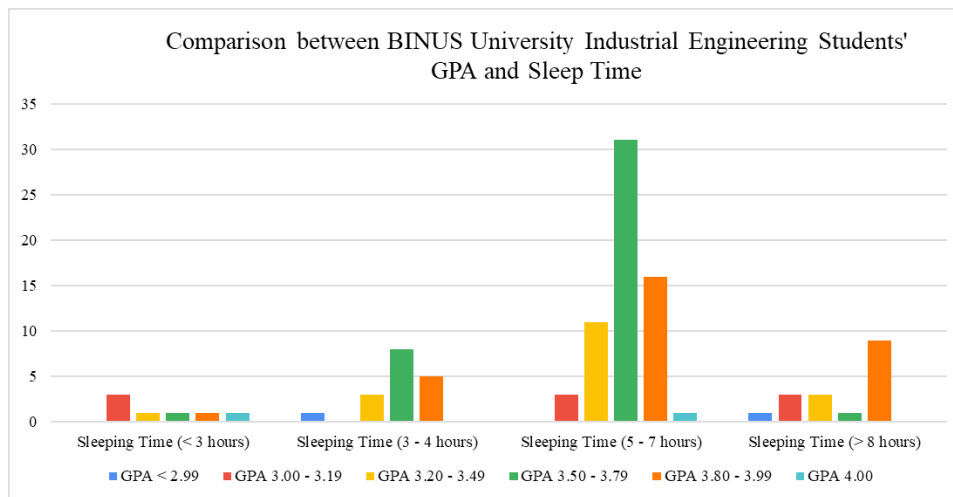
Figure 2. Comparison of BINUS University Industrial Engineering Students' GPA Values with Sleep Time

Table 4 Information on Student GPA Data

Details	
Descriptions	**Data Code**
GPA < 2.99	1
GPA 3.00 - 3.19	2
GPA 3.20 - 3.49	3
GPA 3.50 - 3.79	4
GPA 3.80 - 3.99	5
GPA 4.00	6

Table 5 Description of Student Sleep Time Data

Details	
Descriptions	**Data Code**
Sleep Time (>01.00 AM)	1
Sleep Time (23.00 PM - 01.00 AM)	2
Sleep Time (21.00 PM - 23.00 PM)	3
Sleep Time (<02.00 AM)	4

The results of data processing show that on average, respondents from various GPA ranges have 5 to 7 hours of sleep a day. The total number of respondents who had less than 3 hours of sleep is 7 people, dominated by respondents with a GPA range of 3.00 - 3.19. A total of 17 respondents who have 3 to 4 hours of sleep, dominated by respondents with a GPA range of 3.50 – 3.99 and followed by respondents with a GPA range of 3.80 – 3.99. A total of 62 respondents who have 5 to 7 hours of sleep, dominated by respondents with a GPA range of 3.50 – 3.79 and followed by respondents with a GPA range of 3.80 – 3.99. The total number of respondents who sleep more than 8 hours a day is 17 people, dominated by respondents with a GPA range of 3.80 – 3.99.

This information shows that the average sleep time needed by respondents with a GPA range of less than 2.99 is from 3 to more than 8 hours. Respondents who have a GPA range of 3.00 – 3.19 have an average sleep time of fewer than 3 hours to more than 8 hours. Respondents who have a GPA range of 3.20 – 3.49, a GPA range of 3.50 – 3.79, and a GPA range of 4.00 have an average sleep time of 5 to 7 hours.

Table 6 Calculation Results of Sleep Time Research Concentration Size

Sleep Time	
Mean	3
Modus	3
Median	3

Calculation of the measure of concentration for the study consisted of the mean, median, and mode. The mean shows the average or center value of the data, the median indicates the middle value of the data, and the mode indicates the most values that appear in the study. Calculations show that in the sleep time research data, the mean, median, and mode values are 3, i.e., the sleep period is 5 to 7 hours.

Correlation Test Analysis

The first inferential data analysis is the Correlation Test between the variables tested using Minitab software.

Table 7 Pairwise Pearson Correlations

Sample 1	Sample 2	95% CI for p	P-Value
GPA	Self Study	(0,330; 0,626)	0
Need to Use an Alarm	GPA	(-0,470; -0,118)	0,002
Need to Use an Alarm	Sleep Time	(0,029; 0,398)	0,025
Time to Sleep	Sleep Time	(0,116; 0,469)	0,002
Often Sleep	Need to Use an Alarm	(0,072; 0,434)	0,008
Time to Sleep	Need to Use an Alarm	(0,316; 0,617)	0
Often Sleepy	Difficult to Concentrate	(0,426; 0,689)	0
Time to Sleep	Often Sleepy	(0,130; 0,480)	0,001

Based on the calculation results of the correlation test using the Minitab application, the data obtained are as shown in the Pairwise Pearson Correlations Table. The use of the Pearson correlation method is done by comparing the sampling of the two research samples. The study used Google Form and obtained data from as many as 103 respondents. Respondents were given questions about their Grade Point Average (GPA), resting activities (sleep), and learning activities. This comparison is done to find out the p-value where:

H_0 = There is no correlation between learning activities, sleep, and BINUS University Industrial Engineering GPA scores.

H_1 = There is a correlation between learning activities, sleep, and the GPA of BINUS University Industrial Engineering students.

The first hypothesis will be rejected if the p-value of the sample comparison is greater than 0.01. So, if we look at the calculated data, we get one uncorrelated sample comparison, namely the need to use an alarm at bedtime. This is thought to be because some students are used to getting up in the morning before class starts before entering college, so they don't need an alarm. In addition, there is another correlation that is close to the value of 0.01 with a p-value of 0.008, namely the correlation between sleepiness and needing an alarm to wake up. The need for alarms in activities is generally caused because students are not accustomed to getting up at certain hours so when they are forced to wake up by using an alarm, students become relatively sleepy. The strongest correlation based on the tested sample is the relationship between GPA scores with independent study and often sleepy with difficulty concentrating, each of which has a p-value of 0.000. Students who spend time studying independently for long periods of time tend to have better grades, in contrast to students who have less time to study. Sleepy students will also find it difficult to concentrate, this is generally caused by fatigue to a lack of interest in doing independent learning activities.

Through the correlation test, it can be concluded that there is a correlation between learning activities, sleep, and the GPA of Industrial Engineering students at BINUS University (accepting H1 / rejecting H_0). Students who have more study hours have relatively little sleep time but get a better GPA than students who spend less time sleeping and studying.

ANOVA Test Analysis

ANOVA test analysis in research activities is generally used to analyze several groups of different data samples. ANOVA test analysis has a relationship with regression analysis. ANOVA test should also be performed for testing more than two samples. Analysis of the ANOVA test in this research was carried out with the aim of proving the effect of correlation between learning activities and sleep activities on the GPA of Industrial Engineering students at Bina Nusantara University. The ANOVA test conducted in this research used a significant value of 95% (0.05). This comparison is done to find out the p-value where:

H_0 = There is no correlation between study activities, sleep, and BINUS University Industrial Engineering GPA scores.

H_1 = There is a correlation between learning activities, sleep, and the GPA of BINUS University Industrial Engineering students.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Pukul Tidur	3	9,827	3,276	3,22	0,026
Error	99	100,697	1,017		
Total	102	110,524			

Figure 6. ANOVA Test Results between Hours of Sleep and GPA Results

Based on the picture above, the P-value relationship with a significant value is a p-value smaller than the significant value (0.026 < 0.05) which indicates that H_0 was successfully rejected. This shows that there is a correlation between sleep activity and the GPA of Industrial Engineering students at Bina Nusantara University.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Belajar mandiri	3	32,56	10,8517	13,64	0,000
Error	98	77,96	0,7956		
Total	101	110,52			

Figure 7. ANOVA Test Results between Independent Learning Activities and GPA Results

Based on the picture above, the P-value relationship with a significant value is a p-value smaller than the significant value (0.000 < 0.05) which indicates that H_0 was successfully rejected. This shows that there is a correlation between learning activities and the GPA of Industrial Engineering students at Bina Nusantara University.

CONCLUSION

Based on the data processing that has been done, there are many factors that affect the GPA results of Industrial Engineering students at Bina Nusantara University. The tests that have been carried out in this research prove that each factor has a relationship with the GPA results. The reliability test that has been carried out proves that the data that has been collected has a Cronbach's Alpha value above 0.6 ($\alpha > 0.6$) where the data is reliable and can be used for research. The correlation test that has been carried out also shows that each correlation has a P-value of less than 0.05 where all the variables involved in this study have a relationship or correlation with one another. The last test carried out in this study was the ANOVA test where the results proved that there was a correlation between learning activities and sleep activities with the GPA results of Industrial Engineering students at Bina Nusantara University.

REFERENCES

Anggrawan, A. (2019). Analisis Deskriptif Hasil Belajar Pembelajaran Tatap Muka dan Pembelajaran Daring Menurut Gaya Belajar Mahasiswa. *Jurnal MATRIK, 18*(2), 339-346. doi:10.30812/matrik.v18i2.411

Aryadi, I. H., Yusari, I. A., Dhyani, I. A., Kusmadana, I. E., & Sudira, P. G. (2018). Korelasi Kualitas Tidur terhadap Tingkat Depresi, Cemas, dan Stres Mahasiswa Kedokteran Universitas Udayana. *Callosum Neurology, 1*(1), 10-15.

Haqqu, R. (2020). Uji Uses and Gratifications dalam Intensitas Menonton Program Talk Show melalui Televisi. *Journal of Strategic Communication, 10*(2).

Hidayat, A. (n.d.). *Penjelasan Lengkap ANOVA sebagai Analisis Statistik*. Retrieved from Statiskian.com: https://www.statistikian.com/2017/06/anova-sebagai-analisis-statistik.html

Purhadi, L. I., Anisa, R., & Firmansyah, M. (2020). Korelasi antara Kualitas Skenario dan Keefektifan Diskusi Tutorial terhadap Prestasi Akademik Mahasiswa. *Jurnal Bio Komplementer Medicine, 7*(2).

Putri, C. P., Mayangsari, M. D., & Rusli, R. (2018). Pengaruh Stres Akademik Terhadap Academic Help Seeking Pada Mahasiswa Psikologi UNLAM dengan Indeks Prestasi Kumulatif Rendah. *Jurnal Kognisia*, 28-37.

Putri, S. A., Dasuki, B. I., & Agustina, T. (2021). Hubungan Pola Tidur dan Tingkat Stres dengan Prestasi Mahasiswa FK UMS Selama Perkuliahan Online. *The 13th University Research Colloqium 2021*, 158-165.

Rifai, C. F., Utami, D., & Farich, A. (2020). Kualitas Tidur dan Kestabilan Emosi dengan Hasil Prestasi Belajar pada Mahasiswa Fakultas Kedokteran. *Jurnal Ilmiah Kesehatan Sandi Husada*, 72-77.

Sari, B. T. (2019). Pengaruh Durasi Belajar Terhadap Hasil Belajar Matematika Siswa Kelas 5 Ledok 006 Salatiga. *Jurnal Review Pendidikan Pengajaran*, 139-144.

Wahyuni, N. (2014, November 01). *BINUS University*. Retrieved from https://qmc.binus.ac.id/2014/11/01/u-j-i-v-a-l-i-d-i-t-a-s-d-a-n-u-j-i-r-e-l-i-a-b-i-l-i-t-a-s/