Active Learning with SPSS Assisted Guided Discovery Learning Method to Improve Student's Statistical Learning Achievement

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Abstract. Guided discovery learning (GDL) is a learning method that uses a two-way system, namely the learning process involving students and lecturer who interact actively. The purpose of this study is to determine the effectiveness of learning statistics for students of Electrical Engineering at the Islamic University of Nahdlatul Ulama Jepara by using the SPSS-based GDL method. The sample consisted of 12 students taken from 87 students by means of random sampling. The type of research used is a mix method research, namely by comparing the means of the pre-test and post-test scores to determine the increase in student knowledge from a quantitative point of view then answer sheet analysis and interviews are conducted to determine effectiveness from a qualitative point of view. Qualitative data were taken from data from two subjects who were selected by means of purpose sampling. Quantitatively and qualitatively, the results of this study indicate that the GDL method is effective in improving student achievement in statistics courses.

1. Introduction
Statistics is a compulsory subject that is taught in almost every university study program. Learning statistics is very useful for students as a provision for students in compiling research, especially those interested in researching with quantitative methods. Without sufficient statistical knowledge, it will certainly make students who take quantitative research methods very difficult and even wrong procedures in processing research data. Therefore, statistics are an inseparable part of the material studied at the tertiary level where statistics are useful to support student research as their final study project. Correct procedures and calculations are needed to analyze research data, especially for quantitative research that must use statistical data processing.

In fact, in the field there are still many students who take statistics courses experiencing difficulties. From the researcher's observations, most of the electrical engineering students at the Islamic University of Nahdlatul Ulama Jepara who take statistics courses still have difficulty studying statistics. This can be seen from the student test scores. As many as 80% of students' statistical test scores are still low. This is supported by several studies such as research from [1], the difficulties of students in learning statistics include difficulties in computational statistics, understanding mathematical symbols, connecting statistical concepts in hypothesis testing, and present the results of the analysis in language. In research [2] revealed that the results of the survey conducted on Balearic Islands University students showed student attitudes in learning negative statistics, this can be seen from the low interest in student learning...
towards statistics which resulted in the tendency of students not to use quantitative research methods in their research.

Low learning outcomes are one indicator of the difficulty of statistics material, learning outcomes are certainly obtained from students' understanding of the material being taught in the learning process. The learning process is a two-way interaction involving students and lecturers. Learning that goes well will certainly make it easier for students to form their knowledge of the knowledge they are learning. According to the constructivist view, knowledge is a construction of the learning process carried out by students by encouraging students to find, discuss and interpret the knowledge obtained [3]. Therefore, learning is not just a transfer of knowledge from teachers to students. Learning will be effective if students are given the opportunity to construct their own knowledge and teachers as facilitators, and guides for students to acquire knowledge [4]. Students must be directed to become active participants in learning not passively absorb information from the teacher [5].

Active learning is seen as the right solution to improve learning outcomes [6],[7]. Several studies have shown that active learning that is applied in the classroom can increase learning motivation, interest in learning, memory of the material being taught, and effective knowledge transfer [8]. One learning method that can stimulate active students in learning is the guided discovery learning (GDL) method [9]. The guided discovery learning method aims to train students to find and understand their own knowledge under the guidance of the teacher [10]. According to [11] the guided discovery learning method can facilitate students to be able to find their own knowledge through learning activities designed by the teacher, thus allowing students to make their own conclusions based on critical thinking. Several studies [12],[13],[14],[15] show that the use of the guided discovery learning method is effective in increasing self-efficacy, interest in learning, student independence, and abilities. solution to problem.

The development of technology allows the emergence of various facilities for humans. Various existing applications can be used as learning media. The use of appropriate learning media will make learning more effective and efficient, so that the use of appropriate learning media can be a solution to problems that exist in the learning process [16]. In processing statistical data that is identical to many formulas, of course it will be difficult to remember all formulas and procedures for processing statistical data. One of the tools to facilitate statistical calculations is the SPSS application. With this application we can easily process statistical data by simply entering the data obtained then the application will automatically process the data. The use of the SPSS application is certainly very helpful in processing data and when we study statistics at the college level for students. With the ease of processing statistical data using the SPSS application, it is hoped that it will give students interest in learning statistics, because they do not need to memorize all statistical formulas which for some students find it difficult to learn statistics. In this study, the researcher tried to find out whether learning using the SPSS-assisted guided discovery learning method was effective in improving student learning outcomes and also to find out whether there was an increase in student interest in learning statistics after being taught using the SPSS-assisted guided discovery learning method.

2. Method
The mix-method research design in this study is a combination of quantitative and qualitative designs. This quantitative research used pre-experimental research with one group pretest-posttest design. Descriptive qualitative research is used as a reinforcement of the quantitative conclusions. The sample in this study consisted of 12 electrical engineering students at the Islamic University of Nahdatul Ulama Jepara who were taken by random sampling from 87 students. Furthermore, two subjects were selected from 12 students who were selected with a purpose sampling technique. Apart from the researcher as the main instrument, two other instruments are learning achievement tests for statistics courses and interview guidelines. The learning achievement test questions consisted of two different types of questions, namely pre-test and post-test questions and both of them had been validated by experts. The scores of the pre-test and post-test were compared using the paired t test to see if there was an increase in student achievement. The results of the interviews and the answer sheets of the two selected subjects
were analyzed to determine whether the results obtained were mutually supportive. So that the validity of the data in this study uses triangulation of methods.

3. Results and Discussion

3.1. Data description

Before being given the treatment, first a preliminary test of the material that has been studied was carried out on the 12 selected samples, and conducted interviews with two students. Then the sample was treated by applying the GDL method assisted by SPSS for 7 meetings with new material. After completion, the sample was given a final test of the material taught using the GDL be SPSS method. As in the pre-test, the same subjects were interviewed. The following is a summary of the data from the results of the students' initial and final tests in the statistics course.

| Tabel 1. Data description |
|--------------------------|
| Result                   |
| N | Average | Standard deviation |
|---|---------|-------------------|
| Pretest | 12 | 77.5 | 10.8 |
| Posttest | 12 | 82.7 | 9.4 |

3.2. Quantitative testing

Quantitative testing uses the paired t test, where the paired t test requires that the data to be tested must be normally distributed. So before testing with paired t test, the data is first tested for normality, namely by using the Shapiro-Wilk test. The choice of the Sapiro-Wilk test was due to the small number of samples. By using SPSS, the output data is obtained as presented in Table 2 below.

| Tabel 2. Tests of normality |
|---------------------------|
| Statistic | Kolmogorov-Smirnov<sup>a</sup> | Shapiro-Wilk |
| df | Sig. | df | Statistic | Sig. |
| Pre_test | .175 | 12 | .200<sup>*</sup> | .948 | 12 | .615 |
| Post_test | .209 | 12 | .155 | .872 | 12 | .069 |

The results of the SPSS output shown in Table 2 show that the significance value of the Shapiro-Wilk test of the two data is 0.615 for the pretest data and 0.069 for the posttest data. By using a significance level of 5%, we can conclude that the two data come from a normally distributed population. This is because the significant value obtained is more than 0.05.

It has been confirmed that the two data are normally distributed, so a paired t test can be done to see whether the SPSS-assisted GDL method is effective in improving student learning achievement. The hypothesis used is the hypothesis for a one-tailed test with a significance level of 5%. Testing using SPSS assistance, following Table 3 is the output of the test results obtained.

| Tabel 3. Paired Samples Test |
|-------------------------------|
| Paired Differences | 95% Confidence Interval of the Difference | Sig. |
| Mean | Std. Deviation | Mean | Std. Error | Mean | Lower | Upper | t | df | (2-tailed) |
| Pre_test - Post_test | -5.167 | 4.064 | 1.173 | -7.749 | -2.585 | -4.404 | 11 | .001 |
Based on the results of the SPSS output presented in Table 5, the significance value (2-tailed) is 0.001 and \( t_{hitung} = -4.404 \). If seen from the significance value, the value obtained is less than 0.05 and when viewed from \( t_{hitung} \) then the value \( t_{hitung} < t_{table} \), where the value is \( t_{0.05,11} = 1.796 \), it can be concluded that the SPSS assisted GDL method is effective for improving student statistics learning achievement.

3.3. Qualitative analysis

Qualitative analysis was carried out by first selecting 2 subjects with a purposive sampling method. The data were obtained from the results of the test answers, the researchers’ observations on the subject and the results of the interviews conducted with the two selected subjects. Analysis of the results of the answers and interviews was carried out after the pretest and after the posttest with the same 2 subjects. This was done to obtain data related to whether or not there was an increase in statistical learning achievement that showed the effectiveness of using the SPSS-assisted guided discovery learning method where the results of the analysis were used to support the results of quantitative analysis.

The results of the pre-test showed that the subject still had difficulty working on the statistical questions given. Subject 1 cannot work on the given questions completely. From the results of observations to subject 1 when working on the subject, it seems that they often erase answers due to miscalculation, besides that the subject also looks confused in applying the procedure for using statistical formulas even though at the time of the test the subject was given the opportunity to bring notes containing statistical formulas to avoid the reason that the subject forgot the formula. The same thing was experienced by subject 2, even subject 2 was unable to work on question number 2 because it seemed focused on working on question number 1 so that time ran out to answer question number 2. When solving question number 1, it was seen that the subject often looked and flipped through the notes to make sure the formula used was correct. true or not, other than that when calculating it seems like you are hesitant by repeating the calculation. This made subject 2 take too long to work on question number 1 so that it could not take full advantage of the given time.

The mistakes made by subject 1 and 2 after being corrected include errors in procedures or required prerequisites and also calculations. Then the researcher conducted interviews with subject 1 and subject 2 to find out whether the interest in learning statistics from the two subjects affected the difficulties experienced by the two subjects in working on the given questions. From the results of the interview after the pre-test, there were several expressions from the two subjects that statistics were complicated both from a lot of formulas and procedures and when doing calculations manually. According to subject 1, the amount of data that must be calculated makes subject 1 often not careful in calculating so that in carrying out the calculations must repeat again to make sure the calculation is correct. The same thing was expressed by subject 2, according to subject 2 complex calculations made the subject lazy to try the questions that were often given during learning. In completing the calculation when given the pre-test questions, the subject revealed that he often miscalculated so that the final result did not match which then made subject 2 repeat the calculation and made a lot of time spent on the test to repeat the calculation.

Increased interest in learning can be seen when given treatment in the form of the guided discovery learning method assisted by SPSS. From the activities carried out the subject looks enthusiastic in participating in the learning. Often subject 1 and subject 2 ask questions when confused about using the SPSS application. The use of the guided discovery learning method provides opportunities for both subjects to explore in processing the data provided in learning activities. Both subjects looked active in trying to work on the questions given then processed the data from the questions given using the SPSS application. In addition, when given post test questions. Subject 1 is correct in giving answers to 2 questions given. Whereas subject 2, there was an error when reading the table in providing a conclusion to answer number 2. From the results of observations and analysis of the answers, it was seen that there had been an increase in the learning outcomes of the two subjects. To find out the increase in interest in learning the subject then conducted interviews with the two subjects.
Interviews were conducted after subjects worked on post-test questions to ensure that there was an increase in interest in learning statistics after being taught by the guided discovery learning method assisted by SPSS. From the results of the interview with subject 1, it was revealed that the use of SPSS media made calculations very easy. The guided discovery learning method used also according to subject 1 provides the opportunity for subject 1 to try to process the data by themselves. Researchers try to find out by conducting interviews related to the learning being carried out. Subject 1 revealed that with the help of the SPSS application it seemed easy to process data, therefore the subject was excited about taking part in learning by trying it himself. Because according to subject 1 when trying it himself will know the features in the SPSS that are not yet known, so the subject will immediately ask the lecturer when they encounter these obstacles. Subject 1 was not afraid to ask questions, because according to subject 1 all that needed to be done was to understand the features in the application. In contrast to counting manually, the subject is not active in learning because they want to ask questions, they are confused about what to ask.

Subject 2 also revealed a pleasant learning experience with the discovery learning method. From the interviews conducted, subject 2 revealed that statistical learning using the SPSS-assisted discovery learning method was very enjoyable. According to subject 2, the use of SPSS applications such as playing and creating statistics is no longer complicated. In learning, subject 2 also reveals that if given statistical questions, students can try themselves so they will quickly understand the use of applications rather than being taught using lectures without being given the opportunity to practice. With direct practice, the features in the SPSS application can be explored on their own, then when you don't know the usefulness of the feature, you can ask the teacher who teaches. This increase in interest is the main factor in increasing student achievement.

3.4. Discussion
During the pre-test, students had been taught statistics material but used conventional methods. Subjects are taught by explaining formulas, and understanding these formulas to be used in solving problems. After obtaining the pre-test data, the subjects were taught statistics using the guided discovery learning method with the help of statistical data processing applications, namely the SPSS application. After being given treatment the subject is then given a test to obtain post-test data. Based on research analysis data using statistical tests, it was found that the post-test results by applying the guided discovery learning method could improve student statistical learning achievement. The posttest mean was higher than the pre-test results.

From the results of quantitative analysis, it shows that the guided discovery learning method assisted by SPSS is proven to be effective in improving student learning achievement. This is evidenced by the results of data processing using SPSS obtained a significance value (2-tailed) of 0.001 ($p < 0.05$), so based on statistical analysis it can be concluded that there are significant changes. Therefore, based on the pretest and posttest descriptive statistical analysis it is proven that the post-test results are higher than the pre-test. The use of the guided discovery learning method has been shown to significantly increase student achievement in statistical learning.

The increase in learning achievement which is shown from the results of statistical analysis, of course there are several factors that influence it. One of the factors that influence learning achievement is interest in learning. Several studies [17], [18] say that interest in learning has a significant effect on learning outcomes. Therefore, researchers conducted further analysis to determine student interest in learning before being given treatment in the form of learning using the guided discovery learning method assisted by the SPSS application. Analysis of student interest in learning was carried out using qualitative analysis. Researchers took 2 subjects to conduct interviews related to the student's learning interest in statistical material before being given treatment and after being given treatment. From the results of the interview, subject 1, before being given treatment, the subject felt lazy to learn statistics because he had to deal with a lot of formulas. Subject 1 said “learning statistics is complicated sir, there are many formulas besides that if you enter just a little wrong, the result will be wrong. Even though the process is long.” Subject 1 has no liking for statistics. According to [19] interest
is feeling happy about something, being interested, concentrating on observations, and being involved in achieving goals. Subject 1 was displeased with subject 1 because according to subject 1 the process was too complex and had to be careful in the completion process. What was expressed by subject 1 was also expressed by subject 2, that according to him doing statistics was difficult, it required accuracy so that subject 2 avoided understanding statistics.

Researcher’s efforts by providing treatment to provide learning with the guided discovery learning method assisted by SPSS turned out to result in changes in the subject's learning outcomes, therefore the researchers continued to interview the two subjects to find out how the subject's interest in learning statistics after being given treatment. After explaining how to use the SPSS application from observations, it appears that the subject is seriously paying attention to how to solve statistical problems. The two subjects also seemed active in trying to work on statistical problems using the help of the SPSS application. From these observations the two subjects have shown an interest in statistics. Both subjects meet the indicators of interest in learning, namely enthusiasm in participating in learning and being active in trying to work on the problems given [19]. After the observations were made the researcher conducted interviews with the two subjects to compare the results of the observations and the results of the interviews to ensure the validity of the data. From the results of the interviews, the two subjects revealed that using the SPSS application made it very easy to calculate statistics. With the ease of application of statistics the subject is increasingly interested in studying statistics.

From the interview analysis of the two subjects, it was found that the two subjects experienced an increase in interest in learning statistics. The increased interest in learning is due to the convenience provided when using the SPSS application. Memorizing so many formulas is no longer necessary because with the help of the SPSS application we only need to enter the data obtained and then perform operations using the application. Statistical calculations have been carried out automatically in the SPSS application besides that it only takes a very short time to get the results of statistical data analysis.

4. Conclusion
From the results of the quantitative analysis, a significance value (2-tailed) of 0.001 ($p < 0.05$), is obtained, so based on statistical analysis it can be concluded that there is a significant change. Therefore, based on the descriptive statistical analysis of the pretest and posttest, it is proven that the post-test results are higher than the pretest. The use of the guided discovery learning method has been shown to significantly improve student learning outcomes. The results of the quantitative analysis are also supported by the results of qualitative analysis that the use of the SPSS application makes it easier for students to calculate statistical data. With this convenience, students are enthusiastic in participating in learning and active in learning. Both of these meet the indicators of student interest in learning, with an increase in interest in learning, student statistical learning achievement will also increase. So from the results of this study it can be concluded that the use of the guided discovery learning method is effective in increasing student learning achievement in statistical material.

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