

# Effectiveness of Student Learning Results Using Group Investigation Method and Brainstorming on Expert System Currency

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**Abstract**—This study aims to (1) know the results of student learning using the group survey method (2) know the results of student learning using the brainstorming method (3) know the difference between the learning outcomes of students using Group Investigation research methods and brainstorming in courses on expert systems. The population of this research includes the students of the fourth semester of STMIK Amik Logika Medan's IT department, ie 134 students divided into 4 classes. The sample of this study is followed by 2 classes of classes A and B composed of 36 B composed of 34 students. The sampling in this study was conducted using a cluster sampling technique in which one class is treated with the group search method and the other class with a brainstorming method. Based on the above calculation, there is a significant difference from the student's learning outcomes in the expert system course methods for research methods and brainstorming, the learning outcomes using the upper group method. The results of the mean post-test using the group survey are 80.14 and the results after the test with the average brainstorming 77.94.

**Keywords**—*results of student learning; group investigation method; brainstorming method*

## I. INTRODUCTION

The role of education is based on form and virtues, no doubt for the purpose of teaching and shaping the character (building a character). According to what Rokhman et al. have expressed, education is the best way to make the nation a great country in all sectors [1]. Over the past decade, efforts to reform the scientific education have been increasingly anxious. become like modeling. and teach them to help develop their epistemology [2]. One of the efforts to improve the quality of education in the Indonesian country can compare education to other countries with a much better quality of education. used as a reference for the objective and reasonable suppression of the process and results of education applied at all levels of education and having made improvements or developments in accordance with the requirements of the world era.

To reach the speaker's skills, most educators (teachers, professors, and others) have made changes and / or modifications to the approach, for example: a learning-oriented approach to learning (teacher-centered learning) is to focus on

the student approach (student-oriented learning). With this approach, teachers can present themselves as a facilitator and a dynamic enabling students to assume most of the roles and functions of teachers, autonomous learning (individual learning) or group learning. A vision of the constructivist flow says that the implications of theoretical education and constructivist education models eg, L. Vigotski influence children's cognitive development by acquiring cultural values and beliefs and strategies to solve them the problem through dialogue with others [3]. In addition, educators have also used different sources and learning materials that can provide important support to ensure an optimal learning atmosphere and process. An educational perspective focused on these skills and competencies leads more to the standards of competence of the educator. To achieve the student-centered learning process, educators, as facilitators, depend on their innovative cognition [4].

Programming has skills and strategic strength in the 21st century with all activities that are surrounded by a program feature, such as smartphone, tablet, PC and technology used in everyday life. However, learning to program and develop is not easy even with a variety of widely used programming languages [5,6]. Even Winslow says that an expert programmer is 10 years old. A student who is just beginning to learn a programming language will encounter many difficulties, including programming skills, intervention, and debugging. Before understanding and understanding what he understands, he understands the concepts and syntax of the programming language. language to develop problems and the ability of the algorithm [6-8].

The above problems, the approach to improving students' learning outcomes in the area of understanding the topics of expert systems has been largely achieved. A concept of learning model and brainstorming with different approaches has been realized. The approach followed by the development of interactive learning based on simulation has been developed [9,10]. An approach to learning to develop functions in the form of a popular character in the form of animation has also been developed [11,12], another approach to learning by applying the Scratch application in the form of interactive

stories, cartoons, games, music composition and digital simulation [13,14].

In each learning process, a speaker will never be separated from the method. Because to achieve the learning objectives, a speaker must use the method to present the subject. The method is the method that an educator uses to present a subject. The method plays a very important role in learning because it provides a bridge between teachers and students for the purpose of education.

The success or failure of education is one of the factors favoring the implementation of education itself. If problems arise in the field of education, the teacher must be able to classify the problem into existing factors. If all factors were considered good, with the exception of the method of this method, the speaker should describe and classify the problem of smaller and more detailed teaching methods. Teachers can use many methods to implement the learning process, such as presentations, discussion methods, demonstration method, thinking method, question and answer to the method, role play and other methods. If instructors use a variety of methods to carry out learning activities, the learning outcomes achieved by the student will be enhanced by providing the opportunity to participate directly in learning activities. In other words, students actively participate in the learning process. In addition, it can also lead to a close relationship between teachers and students, students and friends and also the environment.

#### *A. Group Investigation Method*

The GI Learning Method is a learning method that promotes student participation in learning activities. Sudjana argued that the GI was developed by Herbert Thelen with the aim of combining educational strategies to develop academic assessment processes. Next, Joyce and Weil add that Thelen's GI learning method is based on the opinion of John Dewey and Michaelis, who stated that education in a democratic society should directly teach democracy [15].

In addition, the learning method of the IG developed by Sharan and Sharen in 1970 in Israel. Meanwhile, Tsoi, Goh and Chia added that the learning method of the IG was derived from constructivists. Where to learn constructivist points of view is the result of cognitive construction through one's activities. The emphasis is on the fact that our knowledge is the result of our own training. The search is literally interpreted as an investigation by recording or recording the facts. In addition, research is a learning activity that provides students with the opportunity to develop their understanding through various activities and to correct results based on development. students.

#### *B. Brainstorming Method*

Suprijanto, a relatively new term introduced in the teaching method is brainstorming [16]. Brainstorming is a form of creative thinking. Thinking is therefore a creative initiative. Brainstorming is a learning technique practiced in groups where students have different knowledge and experience. Sudjana S, this activity is conducted to gather ideas and opinions to identify and select a variety of statements in

response to issues related to learning needs, resources, boundaries, etc [17].

According to Kang and Song, in the book Suprijanto, the brainstorming technique of adult education is a group discussion in which the Member States have a multitude of ideas or ideas without taking into account their practical application [16]. Spontaneity and creativity are important elements of brainstorming. Rostiyah N.K. in the book Istarani, learning method states that brainstorming is a teaching method or method given by classroom educators who pose a problem, expressing the students' reaction or their opinions or comments in order to: allow the problem to become a new problem, or it can also be a way to get a lot of ideas from a group of people in a short time [18].

Unlike group investigation in which the idea of a person can be treated (supported, organized, reduced or not approved) by other participants, with the advice of brainstorming others not to answer it. In the brainstorming method, each student has the opportunity to give his opinion or give ideas. Students who do not explain their thoughts should not criticize or discuss any ideas or opinions conveyed.

The opinion or idea is on the board or on the large paper included. Once written, the opinion or idea is evaluated and evaluated by the group or team conducting the study. The use of this method aims to eliminate what students think in response to the problem. Therefore, when applying this method, it is up to the educators to give problems that can stimulate the minds of the students, so that they can respond and the educators do not say that the opinions of the students are good or bad. to be closed.

## II. METHODOLOGY OF RESEARCH

### *A. Research Location and Research Design*

This research was conducted at STMIK Amik Logik Medan. This determination of location is based on the following considerations:

- The location of the study is close to the researcher's teaching.
- The design of this research is experimental research.

### *B. Population and Sample*

1) *Population:* The population of this study consisted of students from the Information Technology Department of Semester IV, STMIK Amik Logika, consisting of 4 classes and 134 students.

2) *Sample:* The sample is part of the population whose characteristics are considered to represent the population. The study sample consisted of 70 people composed of 2 classes, namely classes A and B. The sampling in this study was performed by a cluster random sampling technique in which one class will be treated with the group survey method and the other class will receive a brainstorming method. The determination of the search class is determined by lottery. After drawing class A as the experimental class, the class

taught with the conference learning strategy and class B as the control class, namely the class taught by the Brainstorming method. A for group survey classes up to 36 people and class B for brainstorming classes up to 34 people.

C. Data Collection Instrument

The instrument used in this study is a test of learning outcomes. According to Aiken, testing is a tool for measuring a person's behavior or performance. The measuring instrument is a series of statements submitted to each subject that requires the discovery of cognitive tasks. The form of the test used is a multiple choice test composed of 20 (twenty) elements and with response options (a, b, c, d and e).

The test given to the research sample is first tested on the non-sample. The results of the test were analyzed to verify the validity of the test, the reliability, the power of the various tests and the level of difficulty, in order to know if the test can be used as a research tool in accordance with the defined requirements.

D. Data Collection Techniques

Multi-choice tests totaling 20 questions to all students. Done in class according to the specified time. Tests in the form of pre-test and post-test. The pre-test will be given before learning begins to see the initial abilities of the students in both classes.

Once the processing of the different learning methods is completed in both classes, a post-test will be performed to determine the influence of the learning method on the learning outcomes. The form of the question between the pre-test and the post-test is the same.

E. Data Analysis Techniques

The data analysis technique used in this study is a difference analysis using the t test formula. Before taking the t-test, first test the normality and homogeneity of the two samples.

III. DISCUSSION AND RESULT

A. Students' Learning Outcomes are Taught Using the Group Investigation Method

To determine the initial skills of the students before the treatment, a pre-test with 20 (twenty) questions is performed to obtain the pre-test learning outcomes of the students using the group investigation method.

a. Mean ( $\bar{x}$ ).

$$\begin{aligned} \bar{x} &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{1985}{36} \\ &= 55,138 \end{aligned}$$

b. Varians ( $S^2$ ) and standar deviation (S).

$$\begin{aligned} S^2 &= \frac{n \sum f_i x_i^2 - (\sum f_i x_i)^2}{n(n-1)} \\ &= \frac{(36)(116025) - (1985)^2}{36(36-1)} \\ &= \frac{4176900 - 3940225}{1260} \\ &= \frac{236675}{1260} \\ &= 187,837 \end{aligned}$$

$$\begin{aligned} S &= \sqrt{187,837} \\ &= 13,705 \end{aligned}$$

On the basis of the student figures above, it can be seen that the average value of the students is 55,138.

After a preliminary test, the students undergo a treatment, which is taught using the group investigation method. After treating the students with the group investigation method, they undergo a post-test with the same questions as the pre-test, which aims to determine the ultimate skills of the students after the treatment to get the test results learn the following:

a. Mean ( $\bar{x}$ )

$$\begin{aligned} \bar{x} &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{2885}{36} \\ &= 80,138 \end{aligned}$$

b. Varians ( $S^2$ ) and standar deviation (S).

$$\begin{aligned} S^2 &= \frac{n \sum f_i x_i^2 - (\sum f_i x_i)^2}{n(n-1)} \\ &= \frac{(36)(239825) - (2885)^2}{36(36-1)} \\ &= \frac{8633700 - 8323225}{1260} \\ &= \frac{310475}{1260} \\ &= 246,4087 \end{aligned}$$

$$\begin{aligned} S &= \sqrt{246,4087} \\ &= 15,69741 \end{aligned}$$

The acquisition of student grades above shows that the value of students after treatment is learned using the group investigation method. This is illustrated by the highest average value, that is, before treatment, the average value of students is 55,138, increased to 80,138 after treatment.

B. Learning Outcomes of Students Using Brainstorming Methods

To determine the initial skills of the students before the treatment, a pre-test with 20 (20) questions is performed to obtain the pre-test learning outcomes of the students using the brainstorming method. From the research data obtained:

a. Mean ( $\bar{x}$ )

$$\begin{aligned}\bar{x} &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{2050}{34} \\ &= \mathbf{60,294}\end{aligned}$$

b. Varians ( $S^2$ ) and standar deviation (S).

$$\begin{aligned}S^2 &= \frac{n \sum f_i x_i^2 - (\sum f_i x_i)^2}{n(n-1)} \\ &= \frac{(34)(130650) - (2050)^2}{34(34-1)} \\ &= \frac{4442100 - 4202500}{1122} \\ &= \frac{239600}{1122} \\ &= 213,5472\end{aligned}$$

$$\begin{aligned}S &= \sqrt{213,5472} \\ &= \mathbf{14,613}\end{aligned}$$

On the basis of the acquisition of grades of the most advanced students, it can be established that the average value of students before teaching is 60,294 according to the method of brainstorming.

After getting the pre-test, the students received a treatment that was learned using the brainstorming method. After treating the students with the brainstorming method, they undergo a post-test with the same questions as the pre-test, which aims to determine the final aptitude of the students after the treatment, in order to obtain the results of the test. learn the following:

a. Mean ( $\bar{x}$ )

$$\begin{aligned}\bar{x} &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{2650}{34} \\ &= \mathbf{77,94118}\end{aligned}$$

b. Varians ( $S^2$ ) and standar deviation (S)

$$\begin{aligned}S^2 &= \frac{n \sum f_i x_i^2 - (\sum f_i x_i)^2}{n(n-1)} \\ &= \frac{(34)(214250) - (2650)^2}{34(34-1)} \\ &= \frac{7284500 - 7022500}{1122} \\ &= \frac{262000}{1122} \\ &= 213,5472\end{aligned}$$

$$\begin{aligned}S &= \sqrt{213,5472} \\ &= \mathbf{14,61326}\end{aligned}$$

The students' grades above show that the value of students after a treatment is learned using an increased brainstorming method. This is illustrated by the highest average value, that is, before treatment, the average value per student is 60,294 and it reaches 77,941 after treatment.

1) *Normality test:* The normality test of the data includes pre-testing and post-testing in experimental classes 1 and 2 using the Liliefors test.

a) *Calculation of the normality of the learning outcomes learned by the group investigation method:* The calculation of the normality of students' pre-test learning outcomes in Experimental Class 1 before being taught using the Investigative Group Method can be seen in the following data:

From the data obtained,  $L_0 = 0.146$  with  $n = 36$  and the level  $\alpha = 0.05$  of the Liliefors critical list obtained by  $L_{table} = 0.148$ . Since the value of  $L_0 < L_{table}$  is the student's pre-test score data is normally distributed.

The post-test normality test results of students in experimental class 1 after being taught using group search can be seen in the following data  $L_0 = 0.103$   $n = 36$  and  $\alpha = 0.05$  degree of Liliefors critical list obtained  $L_{table} = 0.148$ . Because the  $L_0 < L_{table}$  value, students' post-test learning outcomes are normally distributed.

b) *Calculation of normality of student learning data taught by brainstorming methods:* The results of pre-test pre-test normality calculations of students in the experimental class before using methods taught brainstorming  $L_0 = 0.128$   $n = 34$  and  $\alpha = 0.05$  degree of Liliefors critical list obtained  $L_{table} = 0.152$ . Since the value of  $L_0 < L_{table}$  is the student's pre-test score data is normally distributed.

Calculation of normality post-test learning results student experimental class 2 after being learned using brainstorming methods obtained  $L_0 = 0.084$   $n = 34$  and  $\alpha = 0.05$  degree of Liliefors list obtained critical  $L_{table} = 0.152$ . Because the  $L_0 < L_{table}$  value, students' post-test learning outcomes are normally distributed.

2) *Homogeneity test:* Here is the calculation of the data homogeneity of the pre-test results of the students in the second sample of experience quality, namely the equality of two deviations test group  $X_1$  (group survey) and the group  $X_2$  (brainstorming) in the pre-test a series of calculations for the variance data and the sample obtained as follows:

Pre-test of variance (S2)  $X_1 = 187.84$

Pre-test of variance (S2)  $X_2 = 213.55$

So:

$F = 1.137$

The number of respondents was 70 then  $36-1 = 35$  df numerator and the denominator  $34-1 = 33$ . The value of table F for dk and dk = numerator 37 denominator = 33 to 1715. We can then conclude that  $F_{count} < F_{table}$  or  $1.137 < 1.715$  can be considered homogeneous in the variance of the two respondents.

Here is the calculation of post-test results of students in the second year of sample data experience, namely the equality of two deviations test group  $X_1$  (group survey) and group  $X_2$  (brainstorming) in the post-test of a series of calculations for the variance data and the sample obtained as follows:

Variance (S2) post-test  $X_1 = 246.41$

Variance (S<sup>2</sup>) post-test X<sub>2</sub> = 233.51

So:

F = 1.055

The number of respondents was 70 then  $36-1 = 35$  df numerator and the denominator  $34-1 = 33$ . The value of table F for dk and dk = numerator 37 denominator = 33 to 1715. We can then conclude with  $F_{\text{count}} < F_{\text{table}}$  or  $1,055 < 1,715$  that the variance of the two respondents is homogeneous.

3) *Hypothesis test*: The calculation of the hypothesis test data can be seen as follows:

By comparing the price of  $t = 0.593$  for the level of significance  $\alpha = 0.05$  dl =  $n_1 + n_2 - 2 = 68$  is between 70 and dk = 80. Then  $T_{\text{table}}$  calculated by interpolation is 0.235.

Because  $t > T_{\text{Table}}$  or  $0,593 > 0,235$  we can conclude that  $H_0$  is rejected and  $H_a$  accepted because there are differences in learning outcomes between students and methods taught using methods of thinking about subject of expert inquiry group systems.

This research involves teaching using group learning methods and brainstorming methods with the results of learning about courses on expert systems. Prior to learning, the researcher first gave a pre-test to both research classes to see students' initial knowledge of the teaching materials.

Meanwhile, the post-test results given to both classes after receiving treatment using different learning methods, then obtained the average learning outcomes of students using both of these strategies. The post-test results showed that the mean value using the group investigation method was higher than the mean value using the brainstorming method.

The results of this study show that the group investigation method and the basic brainstorming method improve students' learning outcomes. However, given the magnitude of the increase in both classes, the learning outcomes using the higher group survey method. The results of the post-test mean using the group survey is at 80.14 and the post-test results using the average brainstorming 77.94.

#### IV. CONCLUSION

The analysis carried out in this study makes it possible to draw certain conclusions as follows:

- Students' learning outcomes in the expert system area by applying the group investigation method showed that the average learning outcomes were 80,138 and the standard deviation of 15,697 with the highest score. low of 50 and the highest score of 100.
- The student learning outcomes from the expert system, applying average brainstorming methods, the learning outcomes are 77,941 and the standard deviation 14,613 with the lowest value 50 and the highest value high 100.

According to the calculations obtained,  $t_{\text{count}} = 0.593$  and  $t_{\text{table}} = 0.235$ . As the table above or  $0.593 > 0.235$ ,  $H_0$  is

rejected and  $H_a$  is accepted, we can conclude that there is a significant difference between the learning outcomes taught using group investigation methods and brainstorming methods

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