



## E-learning-based group investigation (gi) effectiveness on student biology learning outcomes

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### ARTICLE INFO

#### Article history

Received: 31 December 2021

Revised: 11 August 2022

Accepted: 13 March 2023

#### Keywords:

Cooperative

Distance learning

E-learning

Group investigation (GI)

Learning outcome



### ABSTRACT

Learning outcomes are one of the parameters of achieving learning objectives. The Covid-19 pandemic condition causes learning to take place remotely so that the delivery of material cooperatively and interactively is hampered. Learning that is not interactive can affect student learning outcomes so appropriate learning models and media are needed. This study aims to determine the effect of using the e-learning-based cooperative learning model type GI (Group Investigation) on student learning outcomes on the material of the circulatory system. This research was conducted in the odd semester of the 2021/2022 academic year at SMA Negeri 44 Jakarta, Indonesia. This type of research is quantitative with a quasi-experimental method and a pretest-posttest non-equivalent control group design. The sample in this study amounted to 67 students with 34 students in the experimental class and 33 students in the control class. The data analysis technique used was the Mann-Whitney test with a significant level ( $\alpha$ ) = 0.05. The results of the Mann-Whitney test show a significance of 0. This means that the GI model based on e-learning is effective in improving student learning outcomes on the material of the circulatory system.

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Azrai, E. P., Razak, A. A., & Sartono, N. (2023). The E-learning-based group investigation (gi) effectiveness on student biology learning outcomes. *Biosfer: Jurnal Pendidikan Biologi*, 16(1), 176-185. <https://doi.org/10.21009/biosferjpb.25015>

## INTRODUCTION

Education is one of the most important aspects in creating quality human resources so that it is expected to form a developed country. One of the most important activities in education is the learning and learning process. Therefore, it is necessary to implement a learning process that is right on target in order to provide appropriate learning outcomes. According to Suryanda et al (2020) the teacher's role as a professional in implementing learning activities, teachers are required to have skills in designing learning. So it cannot be denied that the teacher is one of the vital elements in the success of the learning and learning process.

It has been almost two years that Indonesia has been hit by the Covid-19 pandemic since it was first officially confirmed in 2020. In order to break the chain of transmission of the Corona virus, the government has implemented various policies in various fields of human life. The education sector was also not spared from the implementation of this policy. Based on Circular Letter Number 4 of 2020 concerning Implementation of Education Policy in the Emergency Period of the Spread of Coronavirus Disease (Covid-19), learning and learning activities for all levels of education must be carried out with distance learning (PJJ) online or in the network.

The implementation of distance learning provides several new problems. Problems that arise such as limitations in delivering material by teachers, difficulties in communication between students and limitations in using technology in creating cooperative and interactive learning (Purwanto et al, 2020). In research conducted by Simanjuntak & Kismartini (2020) PJJ causes learning to become teacher-centered and students lack enthusiasm for learning. In addition, students also feel bored because there is no direct and free communication (Izzatunnisa et al, 2021; Fikri et al, 2021). Lack of interest and motivation to learn will also greatly impact student learning outcomes, because there is a positive and significant relationship between learning motivation and learning outcomes (Firmansyah et al, 2018). Learning outcomes are an important indicator of the success of the learning process (Amin & Ahmad, 2015). Learning will be said to be successful if student learning outcomes tests achieve or exceed KKM (Minimum Completeness Criteria) where this shows students are complete in learning (Amin & Ahmad, 2015).

Circulatory system material is one of the Biology materials that has a fairly high level of difficulty. This material has quite a lot of sub-chapters (Zulfa, 2021), among other things, students must study the processes of large and small blood circulation, the organs that play a role in this material are quite numerous and complex, blood components, blood groups, and diseases and disorders of the circulatory system blood. Based on the results of interviews with class XI students at SMAN 3 Makassar, this material is considered difficult to understand (Azis et al, 2018). Based on research conducted by Lee & Kim (2014) it also shows that students have difficulty learning this material and research by Tambunan et al (2018) also shows 60% of students are still incomplete in the daily assessment of this material.

Teachers are expected to find a way out in overcoming these problems. One of them is by applying a learning model that is considered appropriate to the existing conditions so that it can increase the efficiency and effectiveness of the learning and learning process. As stated by Suryanda et al (2018), through effective learning it is expected to achieve the desired learning objectives. One of the learning models that can be used is the Group Investigation (GI) cooperative learning model. The group investigation model is a form of cooperative learning model that emphasizes students' thinking skills through group activities to investigate a particular problem or topic (Komala et al, 2020).

The cooperative model of the group investigation type is expected to be able to overcome the problems that have been mentioned. Based on several previous studies, the application of the cooperative group investigation model has a positive impact on learning outcomes. As research conducted by Adinata et al. (2013), the application of the Group Investigation (GI) model face-to-face can improve student learning outcomes in cycle I by 55% and in cycle II by 90% and is proven to be more effective than the conventional model for improving student learning outcomes. Supported by the results of research conducted by Richvana et al. (2012) that the Group Investigation (GI) learning model has a better influence on student learning outcomes in Biology.

The application of the group investigation cooperative model in this study will be carried out remotely based on e-learning (Zoom and Google form). E-learning-based learning is essentially conventional learning that utilizes digital formats through internet technology, so that learning occurs virtually (Seribulan et al, 2014). Through e-learning makes learning more fun and easy (Moore et al,

2011). According to research by Lin et al (2017) it was concluded that e-learning can have a positive effect on motivation and learning outcomes.

The application of the e-learning-based group investigation cooperative learning model is expected to foster group investigative abilities among students and create more interactive learning even though learning is carried out remotely. It is hoped that these conditions will have a positive impact on student learning outcomes. This research was conducted with the aim of knowing the effect of the e-learning based group investigation learning model on student learning outcomes in circulatory system material.

## METHODS

### Research Design

This research is included in the quantitative research with quasi-experimental methods. The variables used are the GI cooperative learning model based on e-learning and the dependent variable of learning outcomes. The type of quasi-experimental design chosen in this study is the pretest-posttest non-equivalent control group design which is presented in Table 1.

**Table 1**

Pretest-Posttest Non-Equivalent Control Group Design

Pretest	Treatment	Posttest
O <sub>1</sub>	X	O <sub>2</sub>
O <sub>3</sub>	C	O <sub>4</sub>

Note:

O<sub>1</sub>: Pretest score of learning outcomes of the circulatory system in the experimental class

O<sub>3</sub>: Pretest score of learning outcomes of the circulatory system in the control class

O<sub>2</sub>: Posttest scores of learning outcomes of the circulatory system in the experimental class

O<sub>4</sub>: Posttest scores of learning outcomes of the circulatory system in the control class

X: Treatment with cooperative learning model type investigation group based on e-learning

C: Treatment with the Direct instructional model in the control class

### Population and Sample

The population in this study were all students of class XI MIPA at SMA Negeri in East Jakarta, Indonesia. Through a purposive sampling technique, two classes XI MIPA at SMA Negeri 44 Jakarta, Indonesia were selected. Then from a total of 80 students, 67 students were obtained as a sample by simple random sampling technique using the Slovin formula.

### Instrument

In this study, instruments were used in the form of learning outcomes test instruments (pretest-posttest) and learning implementation observation sheets. The learning outcomes test instrument was tested for validity using the point biserial formula at  $\alpha = 0.05$  with the Kuder-Richardson 20 reliability test. The instrument made consisted of 46 multiple choice questions with five answer choices. The results of the reliability test showed that the research instrument was highly reliable with a reliable coefficient of 0.882. The instrument grid is presented in Table 2.

**Table 2.**

Learning Outcomes Instruments

Question Indicators	Cognitif Aspects (C1-C6)						Number of Questions
	C1	C2	C3	C4	C5	C6	
Explain the relationship between the structure and fuction of the organ-compossing tissues in the human circulatory system.	9, 13, 18, 25, 26*, 28, 29	14, 17, 20, 22*, 24	21, 23*	32	19, 30		17
Connect the structure of the organ-composing tissue in the human circulatory system with	1, 2, 3, 5, 39, 40	12, 15, 16, 41	27, 31	4, 6*, 7, 10, 11, 33, 38		8	20

Question Indicators	Cognitif Aspects (C1-C6)						Number of Questions
	C1	C2	C3	C4	C5	C6	
the bioprocesses that occur in it.							
Connect the structure of the organ-composing tissue with disorders and abnormalities in the human circulatory system.	38*, 40		39*	41, 42, 45	43	44, 46*	9
Number of Questions	16	12	5	11	3	3	46

\*Questions are not valid Source: Anderson dan Krathwhol (2001)

### Data Analysis Technique

Data analysis techniques used in this study include prerequisite data analysis and hypothesis testing. The data analysis prerequisite tests were the Kolmogorov-Smirnov normality test ( $\alpha = 0.05$ ) and the homogeneity test with the F-test ( $\alpha = 0.05$ ). The hypothesis test is in the form of the Mann-Whitney test ( $\alpha = 0.05$ ).

### RESULTS AND DISCUSSION

Based on the research results, descriptive statistical calculations are obtained; the lowest value, highest value, average value, and standard deviation are presented in full in [Table 3](#).

**Table 3**

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Experiment Class (GI)	34	34.88	86.05	72.50	13.2934
Posttest Experiment Class (GI)	34	53.49	100.00	85.70	12.1645
Pretest Control Class (DI)	33	23.26	93.02	78.58	17.2684
Posttest Control Class (DI)	33	23.26	100.00	80.34	18.0419

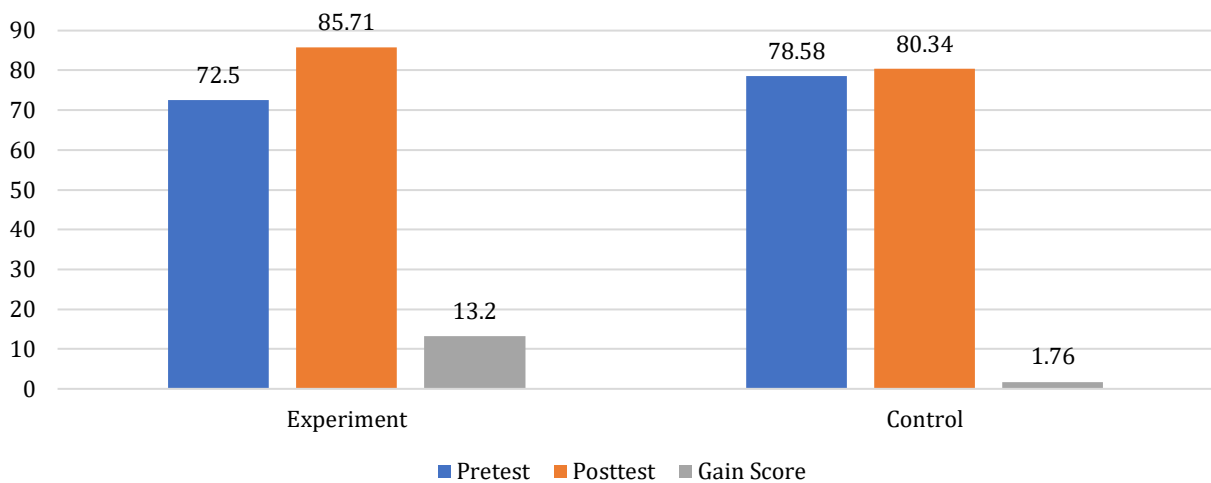
[Table 3](#) shows the average pretest score in the experimental class using the GI-based cooperative learning model based on e-learning is lower than the control class using the DI learning model. In the experimental class, the average posttest score is greater than the control class. The pretest and posttest values of the experimental and control classes were calculated for the percentage of learning success and then interpreted in the student completeness criteria presented in [Table 4](#).

**Table 4**

Interpretation of Values Based on Learning Completeness Criteria (Aqib, 2011)

	Percentage	Categori
Pretest Experiment Class (GI)	61,76%	Low
Posttest Experiment Class (GI)	85,29%	Very High
Pretest Control Class (DI)	81,81%	Very High
Posttest Control Class (DI)	81,81%	Very High

Based on [Table 3](#) in classes that use the e-learning-based GI cooperative model, there has been a significant increase. In the pretest learning completeness is still in the low category while the posttest results are in the very high category. In the control class using the DI model did not show an increase, the percentage of learning completeness was 81.81% (very high) respectively. In addition, the gain score is also obtained which is the difference between the pretest and posttest results which are presented in the diagram [Figure 1](#).



**Figure 1.** Average score of Pretest, Posttest, and Gain Score

After that, the N-Gain test was also carried out to determine the increase in student learning outcomes after each learning model was applied. The experimental class has an average N-gain of 0.5 while the control class is 0.12. The N-gain value category can be seen in [Table 4](#).

**Table 4**

The Category of N-Gain Value of Experiment Class and Control Class (Hake, 2002)

Learning Model	N-Gain	Category
Experiment Class (GI)	0.50	High
Control Class (DI)	0.12	Low

Based on the results of observations of the implementation of the learning carried out during the learning process, the percentage of the implementation of teacher and student activities in the experimental class is the same as the percentage of implementation in the control class, namely 100%. Based on the implementation criteria according to Riduwan (2015), the percentage of learning implementation in the experimental and control classes is included in the very good category.

### Prerequisite Test and Data Analysis

Based on the results of the pretest data normality test and the gain score, a significance value of less than 0.05 was obtained, namely  $0 < 0.05$  and  $0.001 < 0.05$ . This shows the rejection of  $H_0$  at  $\alpha = 0.05$ . It can be concluded that the data is not normally distributed. Data not normally distributed can be caused by an imbalance in the acquisition of learning achievement test scores that are very far away.

Based on the results of the pretest data homogeneity test and the gain score, a significance value of less than 0.05 was obtained, namely  $0 < 0.05$ . In addition, it was obtained  $F_{count} > F_{table}$ , namely  $7.49 > 3.91$ . This shows that the research data has a variance that is not homogeneous, because it rejects  $H_0$  at  $\alpha = 0.05$ .

### Statistical Hypothesis Test

Based on the results of the prerequisite analysis test, it was found that the research data were not normally distributed and not homogeneous, so further hypothesis testing was carried out using the non-parametric Mann-Whitney test at a significant level of 0.05. The gain score data was tested with the help of SPSS vol. 25, the significance value is lower than the significance level, namely  $0 < 0.05$  so reject  $H_0$  and accept  $H_1$ , which means that there is an influence of the Group Investigation (GI)-based cooperative learning model on student learning outcomes in the circulatory system material. Data from hypothesis testing results can be seen in [Table 5](#).

**Table 5**

The Results of Mann-Whitney Test Calculation

	<b>Mann-Whitney U</b>	<b>Z</b>	<b>Asymp. Sig. (2-tailed)</b>	<b>Remark</b>
Gain score	111.500	-5,758	0	There are significant differences

The purpose of this study is to determine the effectiveness of the e-learning based group investigation type cooperative learning model on student learning outcomes in the material of the circulatory system. Based on [Table 1](#), the average pretest scores in the experimental class with the GI model and the control class with the DI model are 72.5 and 78.58. In addition, the learning completeness category on the pretest score also showed a difference with the low category in the experimental class and the very high category in the control class. So that it can be said that there are differences in knowledge of the circulatory system between the experimental class and the control class. Learning is carried out in one meeting according to the syntax and learning tools of each model. Based on the percentage of learning implementation, it can be seen that the application of the GI model in the experimental class and the DI model in the control class is classified as very good with the same percentage. This shows that the teacher has maximized learning according to each model in both classes.

Improved learning outcomes in each class can be seen from the results of the posttest. The data in [Table 2](#) shows that there is an increase in learning outcomes in the experimental class and the control class. There is a difference in the average posttest score in the two classes. In the experimental class, an average of 85.7 was obtained, while the posttest average in the control class was only 80.34, so there was a difference of 5.36. In addition, in [Figure 1](#) it can be seen that the difference in the gain score of each class is quite far, namely 13.2 in the experimental class and only 1.76 in the control class. [Table 3](#) also shows an increase in the percentage of learning completeness in the experimental class from the low category with 13 students (61.76%) who did not complete the class to the very high category with only 5 students who did not complete (85.29%). whereas in the control class there was no increase in the percentage of mastery improvement, namely at a very high level with 6 students who did not complete (81.81%). Factors that affect the posttest average and gain scores in the higher experimental class are the use of learning models and media that are different from the control class. The GI-based cooperative learning model based on e-learning has a significant influence on student learning outcomes in the circulatory system material.

The increase in learning outcomes in the experimental class which is higher than the control class can be analyzed based on the syntax of the GI learning model and the application of e-learning. The GI model consists of 6 syntax namely grouping, planning, investigation, organizing, presenting, and evaluating. All of these stages emphasize student activity and participation in finding information on their own according to the material to be studied through the available materials (Fauzi et al, [2021](#)). Communication and collaboration between students is the main activity in the GI model syntax so that it can have a positive impact if done effectively, for example, understanding and information will emerge from various sources. The teacher conveys the material very briefly in the form of the main topic of discussion then students are actively involved from the planning or selection of topics or the stages of the investigation that will be carried out. Provision of LKPD, teaching materials, and PPT using QR code technology so as to create learning that is more modern, easy, and interesting. This finding is in line with previous studies that the use of the QR code can significantly increase learning motivation (Rasul et al, [2017](#)). In addition, worksheets are also made more attractive and interactive by utilizing graphic design applications, puzzle websites, and liveworksheet websites. Worksheets that are made in an interesting and interactive way increase student learning motivation and involve students actively (Elistiyaningsih et al, [2021](#)), according to the activities implemented in the GI type cooperative learning model.

In the investigation stage with the help of the premium zoom application students collect information according to the topics on the selected LKPD, discuss with peers and teachers. Interaction with peers and teachers based on e-learning is an important step in improving student learning outcomes. First, the interaction between students in an e-learning environment allows for the exchange of information and sharing of knowledge which encourages increased learning outcomes (Goh et al, [2017](#)). Second, discussions with teachers allow students to get input regarding investigations that are being carried out with the help of the zoom application and can encourage increased learning outcomes (Lee et al, [2011](#)). At the organizing stage students in groups make reports in the form of presentations

so that they practice the ability to summarize investigative results creatively. The next syntax is presenting which involves all students in the main room to convey, listen to, and record the information obtained from the investigation results. Through the process of learning to find information on their own and in groups can foster feelings of pleasure so that interest and enthusiasm for learning grow (Mustari, 2015) and better learning outcomes.

Like other existing learning models, the implementation of the e-learning-based GI model also experiences several obstacles, including requiring longer time in the discussion process because students are still adjusting to the investigative discussion model which requires seeking information from various sources and preparing investigative reports in the form of PPT. In addition, e-learning learning using the zoom application also creates connection problems but can be overcome by collaboration between group members. However, during the implementation of learning in both the experimental class and the control class there were no significant obstacles. Students are able to adapt well to new learning models and follow instructions from the teacher.

Increasing student learning outcomes can be analyzed from the results of the average gain score and Normalized Gain (N-Gain). The average gain score is used when analyzing hypothesis testing to determine the number of learning achievement test scores that have increased while the N-Gain is used to determine the effectiveness of the applied learning model. In Figure 1 it can be seen that the experimental class has an average gain score that is much higher than the control class, namely 13.2 and 1.76. In addition, Table 4 shows that the N-Gain in the experimental class is much higher than the control class, namely 0.5 and 0.12. The experimental class with the GI type cooperative model based on e-learning is included in the high category while the control class with the DI model is included in the low category. This shows that the GI-based cooperative model based on e-learning is more effective than the DI model. The use of the GI model requires students to think critically and highly (Sasongko, 2014) so that it makes it easier for students to understand and increase knowledge of the material being studied (Simsek, 2012). Higher understanding and knowledge can directly provide higher learning outcomes as well.

The analysis prerequisite tests carried out were the Kolmogorov-Smirnov normality test and the homogeneity test. The test results show that the pretest and gain score data obtained are not normally distributed and are not homogeneous so that the hypothesis testing that can be used is a non-parametric hypothesis test such as the Mann-Whitney test. Based on testing the Mann-Whitney hypothesis, the data gain score with  $\alpha = 0.05$  obtained a significant value (2 tailed) of 0. The results of these calculations indicate that there is a significant difference between the data gain scores in the experimental class and the control class. This is consistent with the research hypothesis that there is an effective e-learning-based Group Investigation (GI) cooperative model for learning outcomes of circulatory system material.

## CONCLUSION

Based on the results of data analysis and discussion, it was concluded that the e-learning-based Group Investigation (GI) type cooperative learning model had an effect on student learning outcomes in the circulatory system material. Advice that can be given for the future is that teachers can apply the Group Investigation (GI) cooperative learning model according to the situation and conditions at school, especially during this pandemic because government policies are still changing. For future researchers, this research can be used as a source for future research that discusses the positive potential of using e-learning-based Group Investigation (GI) cooperative learning models. In addition, future researchers can also develop this model with different learning media and materials.

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