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The Application of the Group Investigation (GI) Learning Model to Improve Student Learning Outcomes in the Introduction Demography Course

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Abstract: This research aimed to apply the Group Investigation (GI) learning model to enhance student learning achievement in the Introduction to Demography course. This intervention was motivated by suboptimal student learning outcomes and the use of traditional lectures. The study was conducted from February to April 2024 using classroom action research comprising two cycles, each including planning, implementation, observation, and reflection stages. Participants included 13 students in the 4th semester of the mathematics study program for the 2023/2024 academic year enrolled in the Introduction to Demography course. Data collection methods included tests and observations across three phases: pre-cycle, Cycle I, and Cycle II. At the pre-cycle stage, students averaged a score of 62.2, with 53.8% scoring above 65. Following Cycle I, there was an improvement with an average score of 69.2, and 84.6% of students achieved scores above 65. By Cycle II, the average score further increased to 79.9, with 92.3% of students scoring above 65. The findings suggest that implementing the group investigation learning model effectively enhanced student learning outcomes in the Introduction to Demography course.

Keywords: group investigation; learning; demography; mathematics

A. Introduction

Today's rapid developments in technology are also based on developments in mathematics in various fields, such as number theory, algebra, analysis, probability theory and discrete mathematics. To master and create technology in the future, strong mastery of mathematics is needed from an early age (Muhassanah, 2023). One of the elective courses in the Mathematics Study Program given to semester 4 students is Introduction to Demography. Every student in the Mathematics Study Program must master all the material in this course because it is an elective subject related to applied science which is quite easy compared to other elective courses. However, unfortunately, the level of student mastery in the Introduction to Demography course is still not optimal, where the majority of students' scores on the first quiz, totaling 13 students, only 7 students (54.8%) got a score above 65. This means that some students (46.1%) still got a score below 65. This certainly makes the lecturer feel dissatisfied with results like that. In the learning process, students must have the ability to solve

mathematical problems. With these abilities, students will gain a deeper understanding of mathematics and the goals of education will be achieved (Amany & Nuha, 2023).

These low learning outcomes are also accompanied by the relatively low level of student activity during the learning process. When the lecturer delivered the material, all students paid careful attention, but when the lecturer invited students to ask questions, almost no students wanted to ask. It seems like they already understand the material given, but when the lecturer asks questions as feedback, almost no students want to answer the questions given. And when they have to answer because their name was called by the lecturer, generally the answers given are not satisfactory.

This happens because of several factors that influence both internal and external factors. Internal factors are factors that come from within the student, for example student abilities, student interest in learning, attitudes, ways of learning, etc. Meanwhile, external student factors are factors that come from outside the student such as lecturer abilities, learning facilities, learning atmosphere, school environment, learning models used, learning media used, etc (Slameto, 2010).

Among external factors, the learning model used in the classroom is still classical. This means that the learning used in class is still centered on the lecturer. Learning that is still lecturer-centered means that learning does not require an active role from students. Students only receive and listen to the lessons given by the lecturer. The dominance of lecturers in carrying out learning that does not provide students with opportunities to ask questions and motivate students to develop their respective abilities causes students to be passive (Mutmainah, 2013:3). This problem is also in line with previous research which states that learning is dominated by lecture and question and answer methods (Irwan & Sani, 2015) (Nadiya et al., 2016).

Based on the problems found, there is a need for innovative solutions that can improve learning outcomes through the application of a learning model that is more centered on efforts to develop student participation and activity (Devi et al., 2021). In this case, learning activities no longer only prioritize products, but prioritize the processes experienced by students in acquiring knowledge. Learning with a cooperative model, students can develop their abilities by working together with their group of friends, so that students can develop their abilities optimally without being limited by the lecturer. Apart from that, students can discuss with friends if they have difficulty understanding material, especially in the Introduction to Demography course.

One cooperative learning model that has aspects of building student knowledge is the group investigation (GI) type cooperative learning model. This learning model can be used to increase student activity and cooperation abilities between students. Students learn in small groups who help each other and carry out investigations to find and solve problems. The cooperative group investigation (GI) type model was chosen to improve learning outcomes because it can actively involve students in the teaching and learning process and be directly involved in determining the problem to be investigated. The GI type cooperative learning model is a form of cooperative learning model which has an emphasis on student participation

and activity to find the material or everything regarding the subject matter to be studied (Devi et al., 2021).

By applying this group investigation model in learning, it is hoped that students can easily absorb and accept the learning material in the Introduction to Demography course. The purpose of writing this study is to provide inspiration for solutions for lecturers in facing learning problems related to learning models so that learning can take place well and be enjoyable.

B. Methods

The research carried out is a type of Classroom Action Research to make improvements to the learning process. PTK itself is designed as one of the efforts carried out by teachers in the form of various activities as a form of learning practice to improve learning in the classroom (Masitoh et al., 2021). Classroom action research is a technique so that teacher-managed learning always experiences improvement through continuous improvement. The subjects in this research were students in the 4th semester of the Mathematics Study Program, Faculty of Science and Technology, Nahdlatul Ulama University, Purwokerto, academic year 2023/2024 who took the Introduction to Demography course with a total of 12 students.

The research method used is based on the Kurt Lewin model which consists of four stages, namely planning, action, observation and reflection (Muhassanah & Kartika, 2023) (Narsim, 2015). This classroom action research is planned to be carried out in several cycles, each cycle consisting of 4 stages, namely: planning, acting, observing and reflecting. The research design is as in Figure 1.

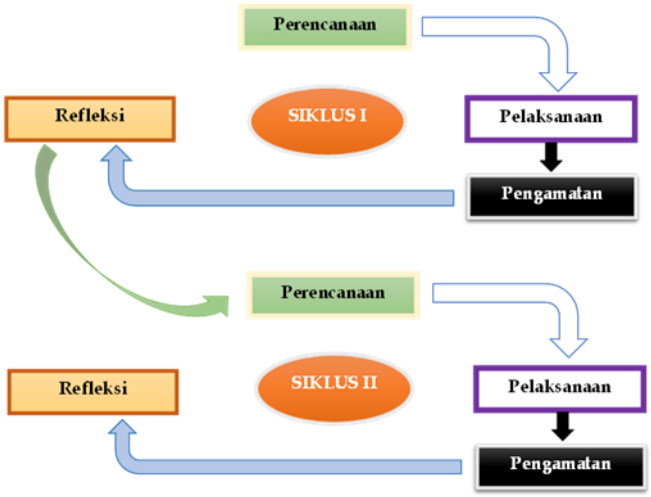

Figure 1. Classroom Action Research Design

This research uses data collection techniques in the form of tests and observations. Test techniques are used to obtain data about Mathematics learning outcomes. The test technique in this case is a post-test carried out twice, namely post-test cycle I and post-test cycle II. The cycle I post-test was given after the third meeting of cycle I ended, while the cycle II post-test was given after the third meeting of cycle II ended. The purpose of giving a post-test at the end of the cycle is to determine student learning outcomes in the Introduction to Demography

course after being given action or treatment using the group investigation (GI) learning model. The data collection instrument used in this research was 4 essay questions.

To clearly determine the scope of the research and as a guide in writing instrument items, a grid of the instruments to be used must be determined. Meanwhile, observation techniques are used to systematically observe students' attitudes and activities in the learning process. The instrument used in learning observations is an observation sheet consisting of group investigation (GI) learning steps with checklists and open questions related to findings during the learning process.

For the learning achievement indicators in this classroom action research, what the researchers hope is an increase in the average student score in the Introduction to Demography course and the percentage of students who get a score above 65 to reach 75%.

C. Results and Discussion

1. Implementation of Classroom Action Research

The Introduction to Demography course is an elective course in the Mathematics Study Program, where the material studied is related to demographic data sources, mortality, mortality tables, fertility, migration, population projections, etc. The material in this course is easier than other elective courses, however the results of student learning achievement so far have been less than satisfactory. For this reason, researchers carried out Classroom Action Research (PTK) in the Introduction to Demography course in two cycles, each cycle consisting of 3 meetings that applied the group investigation (GI) learning model. This classroom action research consists of 4 stages, as follows:

a. Planning

At this planning stage, what the researcher carried out was to prepare teaching material documents and research instruments needed during this research, such as: RPS for the Introduction to Demography course which was modified using Group Investigation (GI) learning, teaching materials related to the Introduction to Demography material, observation sheets prepared has been adjusted to the RPS and final test questions (post-test) used at the end of each cycle.

b. Implementation

The implementation phase of this classroom action research was carried out in 2 cycles, each cycle consisting of 3 meetings held from February – April 2024. For each cycle, a learning process was carried out using Group Investigation (GI). For Cycle I, 3 meetings were held on 22 February 2024, 29 February 2024, and 7 March 2024. Furthermore, for Cycle II there were also 3 meetings held on 21 March 2024, 28 March 2024, and 4 April 2024.

The results of the implementation of classroom action research for two cycles carried out on Mathematics Study Program students who took the Introduction to Demography course with the application of Group Investigation (GI) learning are in Table 1 below.

Table 1. Application of the Group Investigation (GI) Learning Model in the Introductory Demography Course

Group Investigation (GI) Learning Stages	Learning Activities	Implementation of Lectures (Cycles)
Stage I **Identify topics and divide students into groups.**	1. The lecturer delivers introductory material in the Introduction to Demography course regarding demographic concepts and sources. 2. The lecturer explains the learning model for the next 6 meetings by applying the Group Investigation (GI) learning model. 3. Divide the class into 4 groups consisting of 3 students who are tasked with analyzing different topics, namely: a. Group 1: sources of demographic data, measurement and interpretation of demographic data. b. Group 2: Mortality c. Group 3: Mortality Tables and Their Interpretation. d. Group 4: Fertility For documentation in Phase I as follows:  Delivery of Initial Material and Group Division	1st Meeting (Cycle I and Cycle II)
Stage II **Planning Tasks**	Each group gathers with its group members to discuss the topics they have found and divide tasks for each group member. Following is the Phase II documentation.  Group Discussion	1st Meeting (Cycle I and Cycle II)

Stage III **Start an investigation**	1. Students start looking for sources or references related to the topic assigned to each group. 2. Students investigate and analyze the information they have obtained. 3. Summarize the results of discussion and analysis together with group members.	Discussions are held during lectures and continued outside of lectures depending on each group, whether studied independently or in groups.
Stage IV **Prepare the analysis results**	As a result of stage III, group members prepare the results of their discussions in the form of papers, PPTs, and Flipchart Papers as material for group presentations in front of the class. The following is a link to collect paper and PPT results from each group: https://drive.google.com/drive/folders/1eW8ugQgBwbXuRWvptFI5xMIz65MwT4GS?usp=drive_link	Carried out outside of lectures and prepared according to each group's presentation schedule.
Stage V **Presenting or presenting analysis**	1. Each group presents the results of the assignment according to the topic of each group. 2. After completing the presentation, other students are given the opportunity to ask questions and provide opinions. 3. The lecturer will provide reinforcement and feedback regarding the material that has been presented. The following is the Phase V documentation as follows:  Group 1 presentation  Group 2 presentation	2nd and 3rd meetings (Cycle I and Cycle II) each meeting has one group presenting the results of the analysis of the material/topic.

Group 3 presentation

Group 4 presentation

Stage VI **Evaluation**	In this evaluation stage, the lecturer will provide assignments or practice questions related to the material that has been presented for all students to work on, as an evaluation regarding the material that has been presented.	The 2nd and 3rd meetings (Cycle I and Cycle II) after each group presented the results of the analysis of the assigned material/topic.

c. Observation

The next stage of observation will be carried out simultaneously with the implementation stage, where the research team will observe the learning process and record important things that arise during the learning. Observations of the learning process were carried out using observation sheets, field notes, cameras and assisted by observers. The results of this observation will later be used as evaluation/reflection material for the implementation of the cycle which will then be used as a basis for corrective action in the learning process in the next cycle.

d. Reflection

The results of the observations were continued at the final stage in this research, namely the analysis and reflection stage. At this stage, the observation data is used to carry out analysis and evaluation related to teaching and learning activities that implement Group Investigation (GI) learning. Based on the results of observation data in Cycle I, it turns out that learning in the Introduction to Demography course was not optimal according to the plan and indicators of success of the action. There are several improvements in the learning process in Cycle I, namely: students are not used to presenting the results of their group analysis and discussions so that the delivery of the material is not optimal, not all students play an active role in their

groups, other students are still less active in asking questions regarding material from other groups and students do not fully understand the material or topic presented. Apart from the results of observations of learning activities, data was also obtained regarding the learning motivation displayed by students during the learning process. Even though they are still not used to the Group Investigation (GI) learning model, students are more motivated to understand the material because they are motivated to complete group assignments which must have outcomes and be presented in front of the class. The reflection results from each cycle are used to plan and implement improvements in the next cycle.

2. Results of Classroom Action Research

The aim of this research is to improve student learning outcomes in the Introduction to Demography course by applying the Group Investigation (GI) learning model. The results of applying the Group Investigation (GI) learning model were obtained from three tests carried out once before the action and twice at the end of the cycle, namely cycle I and cycle II. The results of the average student scores based on the results of the pre-cycle test, final test of cycle I and final test of cycle II can be shown in Table 2 below.

Table 2. Recapitulation of Pre-Cycle Learning Results, Cycle I, Cycle II

No.	Aspect	Pre-Cycle	Cycle I	Cycle II
1	Average value	62.2	69.2	79.9
2	The highest score	72	80	89
3	Lowest Value	50	57	60
4	Number of students with scores below 65 (<65)	6	2	1
5	Number of students with scores above or equal to 65 (≥65)	7	11	12
6	Percentage of students with scores above or equal to 65 (≥65)	53.8%	84.6%	92.3%

Based on Table 3 above, it can be seen that the test results in the pre-cycle, cycle I and cycle II experienced an increase in student learning achievement after implementing the Group Investigation (GI) learning model. This is shown by the class average score which was initially 62.2. After actions were taken in cycle I, the class average score was 69.2. Furthermore, the average class score in cycle II was 79.9. This shows an increase in student learning achievement in the Introduction to Demography course. These results are supported by research that the learning outcomes of students who apply the Group Investigation (GI) learning model experience a significant increase (Pratami et al., 2019).

In addition, the research results show an increase in the percentage of students who get a score above 65 according to the achievement indicators in this research. The percentage of students who got a score above 65 for the pre-cycle stage was 53.8% (7 students) after taking

action by implementing the Group Investigation (GI) learning model in cycle I, it increased to 84.6% (11 students) and cycle II to 92.3% (12 students). The results of this research show that the indicators determined in this research have been achieved, namely an increase of up to 75%.

The increase in student learning outcomes in the Introduction to Demography course shows that by implementing the Group Investigation (GI) learning model students can solve problems according to the learning material, students also appear more active with group division and presentation of group results. Apart from that, students' ability to analyze material can train their mindset to be more creative and innovative in solving given problems. So, implementing the Group Investigation (GI) learning model can improve student learning outcomes.

The factors that make the Group Investigation (GI) learning model able to improve student learning outcomes are as follows: First, the Group Investigation (GI) learning model in its learning stages has divisions into groups to work on solving given problems. Implementation of the Group Investigation (GI) model emphasizes students being able to participate and engage in independent learning activities to seek knowledge about the material being studied using existing learning resources in their learning environment and discussing it with their group members (Widiasari & Sumantri, 2020). Having good cooperation between children will help the learning process be better because they share what they know with each other. They help each other to achieve the goals they want to achieve, namely successful learning together, so that children with different abilities complement each other. Peers help, guide, and support fellow peers, so that they are able to build learning through interaction and collaboration (Andersen, T., & Watkins, 2018).

Second, students' success in understanding and mastering the material is also influenced by the syntax of the Group Investigation (GI) type cooperative learning model. Learning steps Each of these syntaxes has advantages that can influence students' activeness in acquiring knowledge and interactive communication habits, so that learning is more student-centered. The syntax contained in the group investigation type cooperative learning model helps students to master certain concepts and develop interaction, cooperation and student involvement in learning (Ariadi, 2014). Group Investigation (GI) consists of several steps, namely identifying topics and organizing students in groups, planning assignments, investigating, making a final report, presenting the results of the final report, and evaluating (Ismiyati, 2015).

Third, the group investigation type cooperative model provides students with the opportunity to express opinions, discuss and find out the truth of the assignments made by asking questions or expressing ideas they have. Each stage in learning makes students better understand the material they study independently. With the Group Investigation (GI) learning model, students are able to work actively to understand, interpret, identify, and be able to explain concepts in detail (Lestari et al., 2019). Apart from that, by implementing group investigation (GI) learning, students are able to understand and communicate well with their group friends (Devi et al., 2021).

D. Conclusion

The conclusion of this research is that Group Investigation (GI) learning can improve the learning outcomes of Mathematics Study Program students in the even semester of the 2023/2024 Academic Year in the Introduction to Demography course. This can be seen from the increase in student learning outcomes. The learning outcome data obtained by students at the pre-cycle stage was with an average score of 62.2 and a score above 65 reaching 53.8%, the first cycle experienced an increase with an average score of 69.2 with a score above 65 reaching 84 .6%, and cycle II obtained an average score of 79.9 and student scores above 65 reached 92.3% of students.

The application of the group investigation learning model can improve student learning outcomes because it is caused by several factors, namely the Group Investigation (GI) learning model is a cooperative model. The learning process combines cooperation and an investigative process in solving the given problem. Lecturers give students the opportunity to express opinions, discuss and find out the truth of the assignments made by asking questions or expressing ideas they have.

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