

## The Influence of Process Oriented Guided Inquiry Learning (POGIL) and Direct Instruction (DI) Learning Models on Biology Learning Outcomes at MA Daarul Uluum Lido

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### ABSTRACT

The decline in learning outcomes and student interest is a serious concern in the learning process. The selection of inappropriate learning methods can affect the learning process and outcomes. The Pogil model is one of the alternatives to increase students' interest and learning outcomes. This study aims to explore the effectiveness and advantages of Pogil compared to direct instruction in biology subjects. This research is an experimental research. The results of the study showed that there were student learning outcomes with the pogil model that were superior compared to the direct instruction model in biology subjects with the results of  $F_{cal} = 11.4 > F_{tabel} = 3.96$  at a significance level of 0.05. The results of the study showed the influence of interaction between the learning model (pogil and direct instruction) and interest on learning outcomes from the results of  $F_{cal} = 4.40 > F_{tabel} = 3.96$  at a significance level of 0.05. The results of the study also revealed that the learning outcomes of students, both those who had low interest and high interest in the pogil model, had superior learning outcomes compared to the direct instruction model. The use of the pogil model significantly improved students' learning outcomes and interest in learning compared to the Direct Instruction model. Thus, pogil becomes an effective learning model in overcoming low learning outcomes and students' interest in biology subjects.

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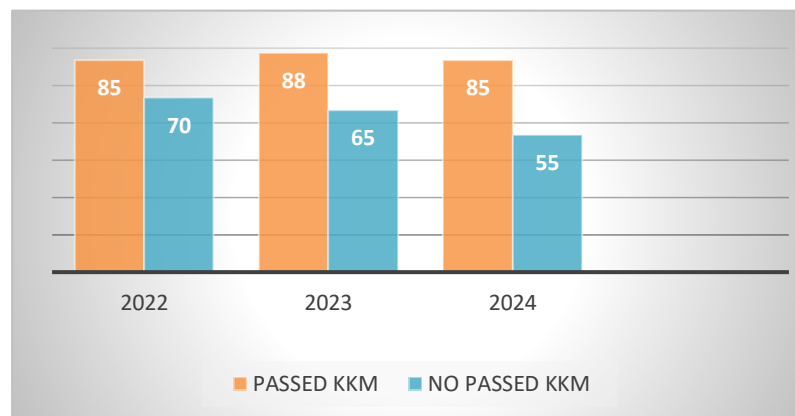
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### Introduction

An effective learning process is a series of activities that integrate material with learning methods, strategies, or models according to learning objectives. In the era of 21st century education, critical thinking, problem-solving, collaboration, and communication skills are the main competencies that must be mastered by students. However, in reality, the learning process in many schools, including MA Daarul Uluum, is still dominated by

teacher-centered learning lectures and learning methods, so that students' active involvement in the learning process has not been maximized.

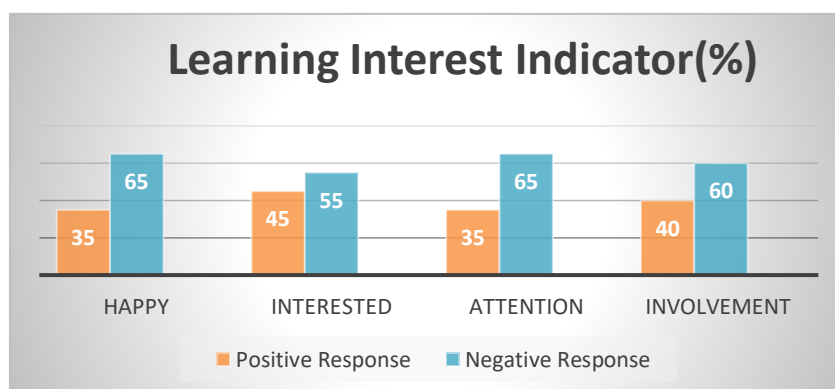
MA Daarul Uluum is committed to improving the quality of learning by actively engaging students. Therefore, every three years the school conducts a thorough evaluation of the teaching and learning process. In the field of Natural Sciences and Mathematics, teachers who are members of the Teacher Conference for Studies (MGBS) routinely conduct internal research to obtain data related to learning outcomes, interests, motivations, and student obstacles in learning. This information is used as a basis for evaluating and improving learning designs, models used, and improving teacher competence. The following is a graph of the research results from the MGBS Mathematical Science Daarul Uluum team:



**Figure 1. Average Diagram of Viral Material Learning Outcomes**

Source : MGBS SCIENCE MATH DU Team

Research results over the past three years show a significant decrease in the average learning outcomes of students, especially in viral materials in biology subjects in class X. Of the 160 students, only 43% obtained scores above the Minimum Completeness Criteria (KKM), while the majority of 57% are still below the KKM. Viral material is considered difficult because it is abstract, namely about the form, structure, and reproduction process of the virus. This decrease in learning outcomes is accompanied by a decrease in students' interest in learning biology subjects. . In addition to the decrease in average student learning outcomes in virus material in biology subjects, researchers also found data on a decrease in student interest in biology subjects. The results of this mini-research were obtained from interviews with students and observations in the field of researchers during the biology learning process. The following is data related to students' learning interests in biology subjects at MA Daarul Uluum.



## Figure 2. Biology Subject Students' Learning Interest Chart

Source : Researcher

According to the results of interviews and observations, students gave negative responses to biology subjects, learning methods used, and difficult materials. More than 50% of students admitted that they were less interested, less attentive, and less actively involved during biology lessons. In addition, the monotonous learning model and the lack of discussions and practicums in the laboratory make learning feel boring for students.

The conditions of biology learning at MA Daarul Uluum still use many lecture methods with a teacher-centered approach. The teacher's focus is more on completing the material without optimizing student engagement. As a result, students become passive, lack communication, and lack critical thinking and problem-solving practice. This causes a low understanding of students' concepts and has a direct effect on the decline in learning outcomes and interest in the subject.

Seeing this phenomenon, it is necessary to innovate learning models that are able to encourage active student involvement and improve learning outcomes, especially in difficult materials such as viruses. One suitable approach is group discussion-based learning that allows students to take scientific steps directly, facilitating engagement and procedural understanding while increasing students' interest in learning.

The Process Oriented Guided Inquiry Learning (POGIL) learning model is one of the innovations that can be used as an option. POGIL prioritizes a group-based structured inquiry process with specific roles, so that students are actively involved in concept discovery. This model also focuses on developing process skills such as communication, cooperation, and responsibility. Various studies have shown that the application of POGIL is effective in improving student learning outcomes and interests.

Based on these conditions and data, this study aims to examine the influence of the POGIL learning model compared to Direct Instruction (DI) on the biology learning outcomes of MA Daarul Uluum students, especially on virus material. This research is in the area of educational technology design, with the hope of producing a learning model that can significantly increase student activities, learning interests, and learning outcomes.

### Theoretical Studies

Learning outcomes are a process characterized by changes in individuals that include knowledge of both cognitive, affective and psychomotor aspects, understanding, changes in attitudes and positive behaviors (Sudjana, 2014).

Biology, in essence, is the science of thinking skills related to how to understand nature systematically, so that it is not only limited to the mastery of knowledge in the form of facts, concepts, or principles but rather as a process of discovery. Biology has special characteristics as a cluster of sciences, the characteristics of biology include the objects studied, namely living things, themes or problems of biological objects that occur in nature and methods to solve problems in biological objects through scientific methods (Trianto, 2012). Some of the objects of study in biology in the form of concrete objects that can be captured by the five senses are developed based on real experience and have systematic steps (Bagod, 2015).

Based on the presentation of the theories of the experts above, it can be concluded that the results of biology learning in this study are changes in individual behavior that include cognitive, affective and psychomotor aspects as measured by the indicators of biology subjects in viral material as follows; mentioning the characteristics of viruses, the nature of viruses, remembering the reproductive sequence of viruses, describing the understanding of viruses, classifying viruses, identifying the forms of viruses, showing the

types of viruses and abnormalities in viruses, analyzing the structure and reproduction of viruses.

A learning model is a conceptual framework that describes a systematic (periodic) approach to organizing learning activities (experiences) to achieve learning objectives (learning competencies). In other words, a learning model is a design of learning activities to ensure that the implementation of KBM is relevant, interesting, understandable, and has a clear flow (Paradina, 2019).

The definition of Process Oriented Guided Inquiry Learning (pogil) according to Hanson (2006) is a process-oriented and student-oriented inquiry method, involving active learning in groups, and includes guided exploration activities to improve knowledge, questions that stimulate critical and analytical thinking skills, problem solving, metacognition, and personal responsibility. The Process Oriented Guided Inquiry Learning (pogil) model is also a collaborative method, where students are actively involved in learning activities in small groups (Warsono and Harjianto, 2013). Based on the definitions presented by the experts above, it can be concluded that the Process Oriented Guided Inquiry Learning (POGIL) learning model is a learning model that uses small groups in learning and guided inquiry-based learning by using the learning cycle and requires students to be active and emphasize the process components as well as the content of learning so that students in learning have good learning skills and understanding concepts and communication.

According to Joyce (2009), direct instruction is a structured teacher-centered approach whose main characteristics are the presence of teacher direction or control, high teacher expectations for students' progress for academic tasks, and efforts by teachers to minimize their influence on students. The learning model refers to the learning approach of learning objectives, stages in learning activities and classroom management. The hands-on learning model is a structured approach. Based on the presentation from the experts above, it can be concluded that direct learning is learning where the teacher is the center and active in learning but students are also involved in the learning process by holding feedback and training with teacher guidance and independent training, where learning activities focus on academic activities related to structured declarative and procedural knowledge.

## Method

This study uses a quantitative approach with a quasi-experimental research method (Quasi Experimental Design) by applying a 2x2 factorial design with a Nonequivalent Control Group Design research design. This approach was chosen because it aims to test the influence between free variables on bound variables. The quantitative approach allows researchers to objectively test hypotheses through statistical analysis based on measurable empirical data.

## Population and Research Sample

The population used in this study is students at the high school level in general. The target population in this study is class X students at MA Daarul Uluum Lido which totals 160 people. The sampling technique uses the purposive sampling method, with the following criteria:

1. Distribute interest questionnaires in the research population to capture two groups of students with the categories of students who have low interest and students who have high interest.
2. Distribution of control groups and experimental groups, sampling by students filling out pretest question sheets with multiple-choice objective test models that include biology subjects on viral material.

Based on these criteria, 20 students were obtained as an experimental class group and 20 students as a control class group.

### Data Collection Techniques

The data collection techniques in this study are:

1. Observation  
Observation Technique is one of the methods of data collection techniques by systematically observing and recording the symptoms that appear in the research object (Zainal, 20143).
2. Kuisoner  
Questionnaire means a data collection technique by giving a set of questions or statements to other people who act as respondents in order to answer questions from researchers (Sugiyono, 2009).
3. Test  
Test technique is a data collection technique that is carried out by giving a series of questions or tasks and other tools to the subject. the data is needed.

### Variable Operational Definition

1. Biology Subject Learning Outcomes  
Indicators used in cognitive aspects that are limited to viral material contribute to the level of remembering (C1), understanding (C2), using (C3), and analyzing (C4) in the form of facts, application in scientific concepts and procedures measured using tests and then accumulated in the form of scores in the form of numbers.
2. Interest in Learning  
The measured learning interest is high and low learning interest with the measured interest aspects being the student's sense of pleasure, involvement, interest and attention to biology subjects.

## Results

### 1. Learning Outcomes of Biology Subjects with POGIL Model

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 1 Frequency Distribution of Learning Outcomes of Biology Subjects Learned with the Process Oriented Guided Learning Model (POGIL)**

Value Range	Frequency
49.5 – 59.5	10
59.5 – 69.5	15
69.5 – 79.5	9
79.5 – 89.5	6
Sum	40

Source: Researcher, 2025

In this group, the number of students is 40 people, with scores obtained from the range of 60 to 85. The average score is 65.0 and the standard deviation is 9.56. The frequency distribution of student learning outcomes was learned using the Process Oriented Guide Model in Inquiry Learning (POGIL).

### 2. Learning Outcomes of Biology Subjects with the DI Model

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 2 Frequency Distribution of Learning Outcomes for Biology Subjects Learned with the Direct Instruction (DI) Model**

Value Range	Frequency
39.5 - 49.5	20
49.5 - 59.5	8
59.5 - 69.5	12
Sum	40

Source: Researcher, 2025

In this group, the number of students is 40 people, with scores obtained from the range of 40 to 60. The average score is 50.25 and the standard deviation is 7.82. Distribution of the frequency of student learning outcomes learned using the Direct Instruction Model.

### 3. Learning Outcomes of Biologist Subjects of Students Who Have a High Interest in Learning

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 3 Frequency Distribution of Biology Subject Results for Students Who Have a High Interest in Learning**

Value Range	Frequency
45.5 - 55.5	10
55.5 - 65.5	15
65.5 - 75.5	9
75.5 - 85.5	6
Sum	40

Source: Researcher, 2025

In this group, the number of students is 40 people, having scores obtained from the range of 50 to 85. The average score is 64.25 and the standard deviation is 10.41. Distribution of the frequency of learning outcomes of students who have high interest.

### 4. Biology Subject Results Students Who Have Low Learning Interest

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 4 Frequency Distribution of Biology Subject Results for Students Who Have Low Learning Interest**

Value Range	Frequency
35.5 - 45.5	20
45.5 - 55.5	8
55.5 - 65.5	12

Source: Researcher, 2025

In this group, the number of students is 40 people, with scores obtained from the range of 40 to 60. The average score is 50.0 and the standard deviation is 7.68. Distribution of the frequency of learning outcomes of students who have low interest.

### 5. Biology Subject Results of Students Who Are Taught with POGIL Who Have High Learning Interest

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 5 Frequency Distribution of Biology Subject Results for Students Who Have a High Learning Interest POGIL Model**

Value Range	Frequency
54.5 - 64.5	5
64.5 - 74.5	9
74.5 - 84.5	6
Sum	20

Source : Researcher, 2025

In this group, the number of students is 20 people, with scores obtained from the range of 65 to 85. The average score is 50.0 and the standard deviation is 6.76. The distribution of the frequency of student learning outcomes was learned using the Process Oriented Guided Learning (POGIL) Model.

#### 6. Learning Outcomes of Biology Materials for Students Learned with the Pogil Model Who Have Low Learning Interest

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 6 Frequency Distribution of Learning Outcomes of Biology Subjects Learned with Pogil Model That Have Low Learning Interest**

Value Range	Frequency
44.5 – 54.5	8
54.5 – 64.5	12
Sum	20

Source: Researcher, 2025

In this group, the number of students is 20 people, with scores obtained from the range of 50 to 60. The average score is 57.0 and the standard deviation is 3.40. The distribution of the frequency of student learning outcomes was learned using the Process Oriented Guided Learning (POGIL) Model.

#### 7. Learning Outcomes of Biology Materials for Students Who Are Taught with the DI Model Who Have a High Interest in Learning

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 7 Frequency Distribution of Learning Outcomes of Biology Subjects Learned with the Oriented Guide Inquiry Learning process that has a high interest in learning**

Value Range	Frequency
44.5 – 54.5	8
54.5 – 64.5	12
Sum	20

Source: Researcher, 2025

In this group, the number of students is 20 people, with scores obtained from the range of 50 to 60. The average score is 55.5 and the standard deviation is 3.94. Frequency distribution of student learning outcomes learned using the Direct Instruction Model

#### 8. Learning Outcomes of Biology Materials for Students Learned with the DI Model Who Have Low Learning Interest

The frequency distribution of student learning outcomes can be illustrated in the form of the table below:

**Table 8 Frequency Distribution of Learning Outcomes of Biology Subjects Learned with DI Who Have Low Learning Interest**

Value Range	Frequency
39.5 – 44.5	8
44.5 – 54.5	12
Sum	20

Source: Researcher, 2025

In this group, the number of students is 20 people, with scores obtained from the

range of 40 to 45. The average score is 43.0 and the standard deviation is 2.13. Distribution of the frequency of student learning outcomes learned using *Direct Instruction*.

### Testing Requirements Analysis

#### 1. Normality Test

Based on the normality test, all learning groups had a p-value of  $> 0.05$ , namely: POGIL group ( $A1 = 0.200$ ), Direct Instruction ( $A2 = 0.200$ ), high interest ( $B1 = 0.128$ ), low interest ( $B2 = 0.244$ ), and a combination of  $A1B1 (0.425)$ ,  $A2B1 (0.054)$ , and  $A1B2 (0.171)$ . Since all p-values are greater than 0.05, it can be concluded that all data groups are from a normally distributed population. Thus, the assumption of normality was fulfilled for all groups in this study.

#### 2. Homogeneity Test

The results of the homogeneity test showed a p-value of  $> 0.05$  in all comparisons: between the POGIL and Direct Instruction groups ( $p = 0.59$ ), high interest and low interest ( $p = 0.61$ ), and the Bartlett test for all four groups ( $p = 0.57$ ). Thus, it can be concluded that all groups have homogeneous variance, thus meeting the homogeneity assumptions for advanced statistical analysis.

### Hypothesis Testing

#### 1. First Hypothesis

The results of the two-way ANOVA test showed that  $F_{cal} = 11.4 > F_{table} = 3.96$  ( $p < 0.05$ ), so that  $H_0$  was rejected, which means that there was a significant difference in the learning outcomes of viral material biology between students taught with POGIL (average = 73.0) and Direct Instruction (average = 57.5). Thus, POGIL is more effective and results in higher learning outcomes than Direct Instruction.

#### 2. Second Hypothesis

There is an interaction between learning models and learning interests on biology learning outcomes. The combination of POGIL with high interest ( $A1B1$ ) yields the highest value, while Direct Instruction with low interest ( $A2B2$ ) yields the lowest value. A consistent pattern of decline in learning outcomes from  $A1B1$  to  $A2B2$  indicates that both learning models and learning interests together affect students' academic achievement.

#### 3. Third Hypothesis

The results of the Tukey test ( $Q_{cal} = 4.890 > Q_{table} = 3.40$ ;  $p < 0.05$ ) showed that the learning outcomes of students with high interest who were taught using POGIL were significantly higher than those taught with Direct Instruction (mean 73.0 vs. 57.5). These findings support the acceptance of the third hypothesis and confirm that POGIL is a very appropriate learning model for highly motivated students.

#### 4. Fourth Hypothesis

The results of the Tukey test ( $Q_{cal} = 4.417 > Q_{table} = 3.65$ ;  $p < 0.05$ ) showed that the learning outcomes of students with low interest taught using POGIL (mean = 57) were significantly higher than those taught with Direct Instruction (mean = 43). Therefore, the fourth hypothesis is accepted, confirming the advantages of POGIL even in students with low learning interest.

### Discussion

1. The difference in biology subject learning outcomes between students who were taught using the POGIL model and the DI model at Madrasah Daarul Uluum.

The results of the ANOVA analysis showed a significant difference ( $F = 11.4$ ;  $p = 0.000$ ) in students' cognitive learning outcomes between the POGIL (average 73.0) and Direct Instruction (average 57.5) models, proving that POGIL is more effective in

improving the understanding of viral material. POGIL's strengths lie in its active, collaborative, and concept-discovery-based approach, which consistently encourages critical and analytical thinking—in line with previous research findings. Although Direct Instruction has a specific role, POGIL has proven to be superior in the context of conceptual science learning, making it worthy of being adopted as the primary model for improving student learning outcomes.

2. The effect of interaction between POGIL and DI with students' interest on biology learning outcomes at Madrasah Daarul Uluum.

The results of the two-way ANAVA test showed that  $F_{cal} = 4.40 > F_{table} = 3.96$  ( $p < 0.05$ ), so there was a significant influence of interaction between the learning model (POGIL and Direct Instruction) and learning interest on biology learning outcomes. The application of POGIL is able to increase student involvement through group discussions and active learning, triggering enthusiasm, courage to express opinions, and better understanding of the material, in accordance with the findings of Putri et al. (2021) that group discussions develop cognitive, affective, and psychomotor aspects. In contrast to control classes that tend to be passive due to the dominance of lectures, POGIL places students at the center of learning, encouraging them to independently build concepts, identify problems, and improve critical thinking. Therefore, the combination of innovative learning models such as POGIL and high interest in learning is very effective in improving student learning outcomes.

3. The difference in learning outcomes of biology subjects for students who have a high interest in learning using POGIL and DI at Madrasah Daarul Uluum.

The results of the Tukey test showed that  $Q_{cal} = 4.890 > Q_{table} = 3.40$  ( $p < 0.05$ ), so there was a significant difference in the learning outcomes of students with high interest who were taught using POGIL (average 73.0) compared to Direct Instruction (57.5). This supports the acceptance of the third hypothesis, namely that POGIL is more effective in improving the learning outcomes of highly motivated students. POGIL's advantage lies in its active and collaborative learning structure through five phases: orientation, exploration, concept discovery, application, and closing, which encourages students to build concepts independently and develop critical thinking, communication, and teamwork. In this process, teachers play the role of facilitators, while students are active in group discussions, concept exploration, and knowledge application. The phases of POGIL also facilitate the development of cognitive, procedural, and epistemic knowledge, making them very effective for biology learning. Based on these findings, POGIL is the right learning model and should be applied to improve students' learning outcomes and critical thinking skills, especially for those who have a high interest in learning.

4. The difference in learning outcomes of biology subjects for students who have low interest who are taught using POGIL and DI at Madrasah Daarul Uluum

The results of the Tukey test showed that  $Q_{cal} = 4.417 > Q_{table} = 3.65$  ( $p < 0.05$ ), so  $H_0$  was rejected and  $H_1$  was accepted, which means that there was a significant difference between the learning outcomes of students with low interest taught using POGIL (mean = 57) and Direct Instruction (mean = 43). Although the difference is numerically quite large, the analysis concludes that POGIL remains more effective, so the fourth hypothesis is accepted. Students with low interest in learning get better results through POGIL than conventional learning which tends to be teacher-centered and only emphasizes memorization without deep understanding (Ramdani et al., 2020; Luzyawati, 2018). The lecture, discussion, and demonstration model that has been used so far has not been able to activate students optimally, so critical thinking, questioning, and analyzing skills have not developed. The lack of creativity of teachers in implementing the learning model also causes the learning process to be less interesting and makes students passive. Therefore, the application of POGIL that is

student-centered and critical thinking is highly recommended to overcome the limitations of conventional learning and improve learning outcomes, even in students with low interest.

## Conclusion

The conclusion of this study shows that the Process Oriented Guided Inquiry Learning (POGIL) learning model is significantly more effective than direct instruction in improving students' biology learning outcomes, both in students with high and low learning interest. POGIL, as a transformative learning model, encourages active engagement, group collaboration, and the development of critical thinking skills, which in turn strengthens conceptual understanding and knowledge retention. These findings reinforce the argument that the constructivist approach is more suited to the needs of 21st century learning than the traditional information transmission approach. More importantly, POGIL has been shown to overcome barriers due to low interest in learning, a common challenge in science education by creating a learning environment that stimulates intrinsic engagement, even in students who are initially less motivated. The interaction between learning models and learning interests also shows that learning effectiveness does not depend only on one variable, but on the synergy between the right method and student motivation. Therefore, teachers and educators are advised to strategically adopt POGIL as a primary alternative in biology teaching, especially to improve the success of inclusive learning. The implementation of POGIL not only improves academic outcomes, but also builds learning independence and scientific process skills that are essential for the holistic development of students. Therefore, POGIL deserves to be a leading model in the modern science curriculum. It is recommended that the next researcher develop authentic assessment instruments such as portfolios, study journals, or group projects to better reflect the learning process that occurs in the PONGIL model.

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