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The Influence of the Discovery Learning Learning Model and Interest in Learning on Students' Physics Learning Outcomes

Juniar Rasyid[1*], Muhammad Sidin Ali[1], Pariabti Palloan[1]

[1]Physics Education, Postgraduate Program, Univeristas Negeri Makassar, Makassar, Indonesia.

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Corresponding Author:
Juniar Rasyid
juniarrasyid1806@gmail.com

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Abstract: This research is a true experimental design using a 2x2 factorial design. The aim of the research is to: find out whether or not there is an influence of the application of the discovery learning learning model and interest in learning on physics learning outcomes for class XI MIPA, and diagram the interaction of the learning model and learning interest on physics learning outcomes. The independent variable in this research is the learning model, the moderator variable is interest in learning and the dependent variable is physics learning outcomes. The sample in this study was taken randomly using a simple random sampling technique which resulted in 60 people from class XI MIPA 2 and XI MIPA 3. Data from the research results were obtained by giving students interest in learning questionnaires before being taught using the learning model, and the learning outcomes tests were carried out after the students were taught using the learning model in the research. The data analysis technique used is analysis of variance (ANOVA). Based on the results of the inferential analysis, it was obtained: Fcount (9.60) > Ftable (1.30), it can be concluded that there is a significant difference between students who were taught the discovery learning learning model and students who were taught using the Inquiry Based learning model, Fcount (0. 10) < F table (1.30), it can be concluded that there is no interaction between the learning model and learning interest on physics learning outcomes.

Keywords: Discovery Learning; Inquiry Based Learning Model; Learning Model; Interest in Learning Physics, Learning Outcomes

Introduction

Education is a process of human interaction between teachers and students to achieve educational goals (Xiao et al., 2023); (Ratnasari & Haryanto, 2019). Education involves knowledge and skills that require a person to master and understand various scientific disciplines in order to be able to keep up with increasingly sophisticated developments (Darling-Hammond et al., 2024); (Haleem et al., 2022); (Javaid et al., 2023). In the educational context, student learning outcomes are a very important indicator for measuring the effectiveness of the education system. Good learning outcomes reflect understanding, increased skills and achievement of educational goals. Therefore, improving student learning outcomes is the main goal of education. These educational objectives are implemented in several subjects, one of which is Physics. Physics is a branch of Natural Science (IPA) which is closely related to behavior, the structure of objects and is one of the lessons which is very closely related to human activities in everyday life.

Physics as knowledge that studies natural events and phenomena makes it an interesting subject to discuss. Therefore, physics learning should focus more on the process of direct activities, discovery (Diani et al., 2020). Related to this, the physics learning process at school is expected to provide scientific experience to students, providing opportunities to work together to

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solve problems so that they can achieve better results (Sengul, 2024); (Montenegro-Rueda et al., 2023). The learning process is an activity undertaken by students in an effort to achieve educational goals with activities that have educational value (Murphy et al., 2023). Educational values color the interactions that occur between teachers and students and interactions between students. Every teacher hopes that their students will have a high interest in learning and can achieve maximum learning results, but the opposite often happens.

One of the causes of low student learning outcomes is that students have low interest in learning and students are not involved much in the learning process which builds a concept that starts from observing through direct interaction with experimental tools or materials and fellow students (Tong et al., 2022); (Tullis & Goldstone, 2020). Students are rarely given the opportunity to discuss and think logically to analyze problems in learning (Ahmar et al., 2018); (Ananda et al., 2023). An effective learning process is the key to achieving optimal learning outcomes. In this context, learning models and learning interests are two factors that may influence student learning outcomes (Han et al., 2021); (Lo et al., 2022). One appropriate learning model is the discovery learning model which places greater emphasis on the active role of students in exploring and discovering knowledge through observation and experimentation which can make it easier for students to understand and think logically before making decisions to review and evaluate carefully before giving a statement or answer.

This study aimed to determine the effectiveness of FERA learning model (Focus, Explore, Reflect and Apply) with SAVIR approach in improving students' science process skills and critical thinking skills in physics learning. The method used in this research was Quasi-Experiment with non-equivalent control group design. The subject of this research was students in one of the senior high schools in Lampung District. MANOVA test (Multivariate of Variance) in SPSS 20 was used as a hypothesis test. The analysis result showed that there were differences in science process skills and critical thinking skills between the experimental class and the control class. The effectiveness of FERA learning model with SAVIR approach in improving students' science process skills and critical thinking skills in physics learning was tested by Effect Size test. The results showed that FERA learning model with SAVIR approach was more effective in improving students' science process skills and critical thinking skills than using discovery learning model. "Improving Students' Science Process Skills and Critical Thinking Skills in Physics Learning through FERA Learning Model (Getie, 2020).

Interest in learning is a feeling of preference and interest in something or activity without being told. Interest in learning refers to the level of interest, motivation and enthusiasm for learning, students who have a high interest in learning tend to be more enthusiastic, show more good interactions, participate actively and are more likely to achieve maximum learning results. Meanwhile, learning outcomes are changes in behavior, for example from not knowing to knowing (Erikson & Erikson, 2019); (Murtonen et al., 2017). Changes in students' learning processes are due to experience or practice carried out deliberately and consciously, not by chance. The level of achievement of learning outcomes by students is called learning outcomes (Kumpas-Lenk et al., 2018); (Tenenbaum et al., 2020).

Based on the results of observations, it was found that in the learning process the teacher carried out learning by expressing problems, formulating problems, formulating hypotheses, collecting data, testing and formulating conclusions. These learning steps are closer to the Inquiry Based Learning model or what is called the conventional learning model in this research. Furthermore, based on the statements of several students at SMAN 1 Sendana, it can be concluded that in the learning process, especially for physics subjects, several conclusions have been drawn, namely: students tend to think that learning physics is complicated, learning physics always discusses formulas, and students are less interested in physics lessons, which causes curiosity about physics lessons to decrease.

This was made clear by the results of an interview with one of the physics teachers at SMAN 1 Sendana who said that in the learning process at school, students tend to pay less attention to directions, cannot focus, and continue to want to play during the learning process. However, there are indeed some students who show high interest in learning every time the lesson takes place. This can be seen from the interaction between several students during the learning process which is followed by quite high learning outcomes scores in each assignment and daily tests, some students who have high interest in learning are in the sufficient range and the rest are in the poor range.

Seeing the problems that occur, it is necessary to make efforts to improve student learning by paying attention to the habits of students in the learning process who at their age have a higher curiosity, like to explore everything around them, and like to search or investigate. So, to meet the needs of students at this age, researchers want to see the influence of the discovery learning learning model and students' interest in learnings on learning outcomes in physics learning. This learning model hopes that students can more easily understand physics learning with discovery learning methods that involve students directly in finding every meaning in learning and at the same time can foster students' interest in learning to continue learning.

Based on this, the researcher wants to conduct a study entitled "The Influence of the Discovery Learning Learning Model and Interest in Learning on the Physics Learning Outcomes of Class XI MIPA Students at SMAN 1 Sendana, Majene Regency".

Method

Types of research

The type of research used was true experimental design using a 2 x 2 factorial design. The research carried out involved two classes, namely one class as an experimental class and another as a control class. The experimental class was given treatment, namely applying the discovery learning model, while the control class was still taught using the conventional learning model (Inquiry based Learning).

Research design

The research design used in this research is factorial design research (Zhao et al., 2020). In this design, there are two class groups that are research subjects, one group is given treatment using the discovery learning learning model (experimental class) and one class group is the control class using the Inquiry Based Learning model. Based on this research design, the research design used is a 2×2 factorial, depicted as in Table 1.

Table 1. 2x2 Factorial Design

Interest in Learning (B)	Discovery Learning Learning Model (A1)	Inquiry Based Learning Model (A2)
High (B1)	$Y[A_1B_1]$	$Y[A_2B_1]$
Low (B2)	$Y[A_1B_2]$	$Y[A_2B_2]$
$\sum$	$Y[A_1B_1] + Y[A_1B_2]$	$Y[A_2B_1] + Y[A_2B_2]$

Population and sample

The population in this study were all students in class XI MIPA SMA Negeri 1 Sendana which consisted of 4 classes with a total of 120 students. The sample in this study was determined using a simple random sampling technique (lot system). In this simple random sampling technique, students are actually randomly selected, but considering that this could disrupt the learning process at the school, a class random sampling is only carried out. Class randomization is carried out by drawing lots for the classes that will be used as research samples. From the class summary, it was obtained that XI MIPA 2 and class This means that there are 15 students who are in the high physics learning interest group and 15 students are in the low physics learning interest group. Likewise with the control class.

Instrument

There are two research instruments used in this research, namely a questionnaire about interest in learning physics and a test of student learning outcomes. Determining interest in studying physics in this research took the form of a self-assessment-based questionnaire according to indicators of interest in learning. The student learning outcomes test used in this research is multiple choices test in the cognitive domain classification, where the cognitive domain is intellectual ability which includes: knowledge, understanding, application, analysis, synthesis and evaluation.

Research procedure

Preparation phase

Before carrying out physics learning through the discovery learning model and learning interest in physics learning outcomes as intended in this research, several preparations are first carried out, such as conducting observations at the research location and determining the class that will be used as the research object. Then analyze the curriculum to see competency standards and basic competencies so that the subject matter that will be taught is visible. Then create learning tools based on basic competencies that are adapted to the material being taught. The learning tools prepared are physics teaching modules in accordance with materials and books applicable at school. The next preparation is to prepare research instruments in the form of a physics learning interest questionnaire and a test instrument for students' physics learning outcomes.

Implementation Stage

Before the physics teaching module is applied in learning, an expert validity test is first carried out. Likewise, for instruments, before they are used, expert validation tests, empirical validity tests, reliability tests, difficulty level tests and different power tests are carried out on the instruments used. Empirical tests were carried out on classes that were not included in the research sample, namely 50 students in classes XII MIPA 1 and XII MIPA 2. Then, validity and reliability, difficulty and differentiation tests are carried out based on the data that has been obtained. This research was carried out by providing an interest in learning physics questionnaire sheet that had been prepared and validated before being given treatment to the two classes that had been selected as research samples. Providing this questionnaire sheet is used as a prerequisite in determining the sample size for each class which will be divided into two groups, namely students with high interest in learning physics and students with low interest in learning physics.

The sample obtained in the research was 50% of the total group. Because each class consists of high interest in studying physics and low interest in studying physics, a sample of each high and low group is obtained, namely 50% × 30 = 15 students, so that two groups obtain 4 × 15 = 60 students. After being given a questionnaire sheet regarding students' interest in studying physics directly, the learning process was then carried out by applying the discovery learning model in class XI MIPA 2, while the Inquiry Based learning model was carried out in class XI MIPA 3. Learning is carried out face to face for 4×40 minutes for physics subjects in 1 meeting. The learning material used was optical instrument material for 4 meetings.

Final Stage

In principle, this stage is carried out during the research, the activities carried out are treatment according to the model applied and giving questions in the form of multiple choices questions that have been validated and tried out and then given to students who are samples in the research after being given treatment. This test aims to see student learning outcomes. Next, carry out an analysis of the data obtained, then draw conclusions based on the results of data analysis by comparing the research results of the experimental class and the control class. Lastly, make a research report.

Data analysis technique

The data analysis technique in this research is divided into two parts, namely data analysis related to the instruments that will be used in the research and analysis of data obtained during the research (hypothesis testing).

Result and Discussion

The collected data is examined to answer the hypothesis by carrying out prerequisite tests. The prerequisite tests in this research consist of a normality test and a homogeneity test. Normality test results in Table 2 and Table 3.

Table 2. Normality Test of Physics Learning Results for Experiment Class and Control Class

Class	Sample Size	L count	L table	Information
Experiment	30	0.12	0.16	Normal
Control	30	0.13	0.16	Normal

The normality test was carried out using the Liliefors test. The testing criteria are based on the largest calculated Liliefors value with a significance level of α = 0.05%. Based on Table 2 for α = 0.05 with a sample size of 30 students in the experimental class, the calculated L = 0.122 and L table = 0.161, which means the data is normally distributed. In the control class with a sample size of 30 students, L count = 0.13 and L table = 0.16, which means the data is normally distributed. Thus, it can be concluded that the learning outcomes of experimental class and control class students at SMAN 1 Sendana who use the discovery learning learning model in the experimental class and the Inquiry Based learning learning model in the control class are normally distributed.

Table 3. Homogeneity Test of Learning Results

Class	Sample Size	Varians	f count	f table	Information
Experiment	30	10.70	1.27	1.50	Homogen
Control	30	13.60			

The test criteria are if $F_{hitung} \le F_{tabel}$, then the data is homogeneous. From the calculation results, it is obtained that F_count <F_tabel or 1.27 < 1.50 from F_tabel for a significance level of 5%. Thus, it can be concluded that the student learning outcome score data for classes taught using the discovery learning model and the Inquiry Based Learning model is homogeneous. After fulfilling the prerequisite tests, the hypothesis was tested using two-way ANOVA. Hypothesis testing using two-way ANOVA can be carried out to test the differences in the influence and interaction of the independent and moderator variables on the dependent variable. Explanation of hypothesis test results in Table 4.

Table 4. Two Way ANOVA Test Results

		Learning Model (A)		
Interest	Statistics	*Discovery Learning* (A1)	*Inquiry based learning* (A2)	
High (B1)	n	15	15	30
	∑Y	195	157	352
	∑Y^2	2563	1677	4240
	∑y^2	28	34	62
	Y (Average)	13	10.50	23.50
Low (B2)	n	15	15	30
	∑Y	131	95	226
	∑Y^2	1213	621	1834
	∑y^2	69	20	89
	Y (Average)	8.70	6.30	15
∑K	nt	30	30	60
	∑Yt	326	252	578
	∑Yt^2	3776	2298	6074
	∑yt^2	97	54	151
	Yt (Average)	21.70	16.80	38.50

Overall, there are differences in the learning outcomes of students who are taught using the discovery learning model and those taught using the Inquiry Based learning model.

Table 5. Summary of Anava Test Results

Sources of Variance	JK	db	RJK	F_{hitung}	$F_{table\ 0.05}$	Decision Criteria
In Group (D)	242	26	9.30	-	-	-
Between Groups (A)	90	1	90	9.60	1.30	Rejected
Between Rows (B)	264	1	264	28.30	1.30	Rejected
Interaction (AB)	1	1	1	0.10	1.30	Accepted
Total	597	29		-	-	-

Based on Table 5, it shows F_{count} = 9.60 and F_{table} = 1.30 (F_{count}=F_{table}) so H_0 is rejected. This means that there is a difference between the learning outcomes of students who are taught using the discovery learning model and those who are taught using the Inquiry Based learning model. Based on the inferential analysis that has been processed, it can be seen that statistically, the discovery learning model provides different learning outcomes compared to the Inquiry Based learning model. The difference is also clearly visible through the average score of learning outcomes in the class taught using the discovery learning model, which gets a higher score compared to the control class taught using the Inquiry Based learning model. There is no interaction between the learning model and learning interest on students' physics learning outcomes. Interaction effects with sources of variance of the project-based learning model and physics learning motivation results F_{count} = 0.10 dan F_{table} = 1.30 ($F_{count} \leq F_{table}$). H_0 accepted. This means that there is no interaction between the learning model and interest in learning physics on students' physics learning outcomes. The interaction pattern can be seen in Figure 1.

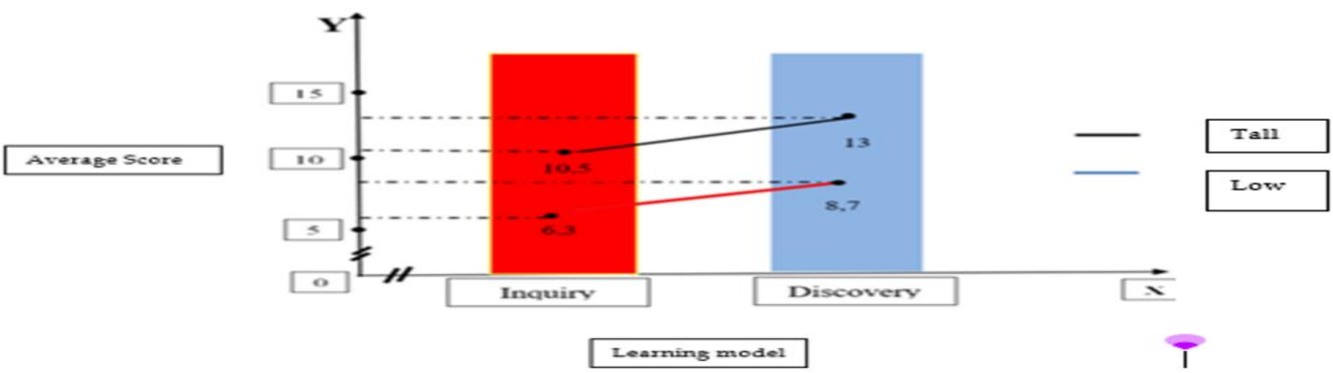

Figure 1. Interaction Patterns of Learning Models and Learning Interests on Students' Physics Learning Outcomes

In the second hypothesis, H_0 is accepted, which means there is no significant interaction between the learning model and learning interest on students' physics learning outcomes. The absence of interaction between the application of learning models and interest in learning is caused by many factors that influence the learning process. (Praweswari & Nur'aeni, 2021); (Y. Sari & Hidayatulloh, 2019) research states that there are several factors that influence learning outcomes, namely internal factors (within oneself) and external factors (outside oneself) of the subject, among which internal factors are students' interest in learning. All internal and external factors in learning are interrelated and influence one another, so that the learning process is not only influenced by the learning model and interest in learning but there are many influencing factors (L. D. K. Sari et al., 2023). Judging from the high interest in learning physics, there are differences in the physics learning outcomes of students who are taught using the discovery learning model and those taught using the Inquiry Based learning model.

Table 6. t test for categories of high interest in studying physics

Group	$\bar{x}$	n	s^2	s^2/n	t_{hitung}	t_{tabel}	Criteria
Experiment	13	15	2	0.13	4.71	1.69	Rejected
Control	10.50	15	2.40	0.16			

Based on Table 6, it shows F_{count}= 4.71 dan F_{table} = 1.69 (Fcount > Ftable). H_0 ditolak. This means that based on learning interest in the high category, there are differences in the physics learning outcomes of students who are taught using the discovery learning model and those taught using the Inquiry Based Learning model. This states that the influence of interest in learning on the physics learning outcomes of students in this research has a significant effect. This means that the higher the student's interest in learning, the higher the student's physics learning outcomes, and vice versa (Pramita & Tasa Ratna Putri, 2023); (Bitzenbauer & Hennig, 2023). Judging from the low interest in learning physics, there are differences in the physics learning outcomes of students who are taught using the discovery learning model and those taught using the Inquiry Based learning model (Arafah, 2020); (Wartono et al., 2017).

Table 7. t test for categories of high interest in studying physics

Group	$\bar{x}$	n	s^2	s^2/n	t_{count}	t_{table}	criteria
Experiment	8,7	15	4.92	0.32	3.42	1.69	Rejected
Control	6,3	15	3.17	0.21			

Based on Table 7, it shows Fcount = 3.42 and Ftable = 1.69 (F_{count}>F_{table}). (H_0) rejected. This means that based on low learning interest, there is a difference in the physics learning outcomes of students who are taught using the discovery learning model and those taught using the Inquiry Based learning model. According to the researcher's observations, the difference in learning interest between the experimental class and the control class in optical instrument material was caused by the learning interest of students in the class when taking part in the lesson (Sofna et al., 2023). In the experimental class, namely the class taught using the discovery learning model, students seemed more interested in learning (Nurkhojin et al., 2022).

This is in line with the findings of Ihdi., (Shaqila & Zetriuslita, 2023); (Hidayatul et al., 2020). which stated that the discovery learning learning model allows students to better understand the learning material, students who are taught using the discovery learning learning model are more enthusiastic and gain a good understanding when compared to students who are taught with conventional learning models (Casinillo, 2023). Apart from that, students' progress needs to be observed so that problems can be detected early (Khan et al., 2021). Therefore, it is important to have discussions between students and teachers to find out what the participants want for the learning process to run well. The discovery learning model has helped students improve their physics learning outcomes (Kasmiana et al., 2020); (Paramitha et al., 2023).

The 6 syntaxes in the discovery learning model according to experts include providing stimulus, problem formulation, data collection, data processing, proof and giving conclusions, which means a learning model that focuses more on proof. Based on the results of the research and discussions that have been carried out, it can be seen that the discovery learning model provides an improvement in the physics learning outcomes of students who have high or low interest in learning compared to the Inquiry Based learning model (Akhir et al., 2023); . This means that students' physics learning outcomes can be said to have improved based on the material that has been delivered with the right learning model (Marpanaji et al., 2018); (Ingkavara et al., 2022); (Smiderle et al., 2020).

Conclusion

Based on the research, it can be concluded that firstly, there are differences in physics learning outcomes between students who are taught using the discovery learning model and students who are taught using the inquiry based learning model. Second, there is no interaction effect between the discovery learning learning model and students' learning interest on physics learning outcomes. Third, for students who have a high interest in learning, there are differences in the physics learning outcomes of students who are taught using the discovery learning model and students who are taught using the inquiry based learning model. Then fourthly, for students who have low interest in learning, there are differences in physics learning outcomes for students who are taught using the discovery learning model and the inquiry based learning model.

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Research ideas, research methods, and analyzing data; J.R.; guiding review writing and editing, supervising and validating instruments used in research; M.S.A.; P.P.

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The authors declare no conflict of interest.

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