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[Research Article]

CLASSROOM ACTION RESEARCH: EFFORTS TO IMPROVE LEARNING OUTCOMES BY APPLYING DIFFERENTIATED LEARNING-BASED INQUIRY LEARNING MODELS

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ABSTRACT

Based on the results of the preliminary study it is known that learning activities still use conventional learning and pay little attention to student learning characteristics. This certainly affects student learning outcomes. This study aims to improve student learning outcomes by applying an inquiry learning model based on differentiation learning strategies. This type of research is Classroom Action Research (CAR). The subjects of this study were 31 students of class XI MIPA 1 with an age range of 16-17 years. Data collection techniques used are observation and tests. The results of the study stated that classical completeness in cycle I was 29% and increased in cycle II which obtained mastery of 87%. Therefore, it can be concluded that the inquiry learning model based on differentiation learning strategies can improve student learning outcomes. The research results have implications in providing an overview for improving the quality of learning, especially within the scope of learning in the classroom.

Keywords: Classroom Action Research, Learning Physics, Inquiry Learning Model, Differentiated Learning Strategies

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1. INTRODUCTION

Physics is a scientific discipline that discusses various things in life (Charli et al., 2019; Rumiati et al., 2021). The discussion of physics includes objects that are microscopic and macroscopic. Physics is a part of science that aims to study and provide a quantitative understanding of various natural processes and their application in life (Charli et al., 2019; Rumiati et al., 2021). Physics is a scientific study that can be found at the school level in physics subjects. However, learning physics is seen as a difficult subject (Lestari et al., 2022; Sari et al., 2022). This is because many formulas are learned and some calculations are considered complicated.

Physics lessons are a learning process that tries to solve problems by observing and depicting the human mind (Lesmono et al., 2021). Physics lessons should not only be taught theoretically but practically taught (Istinganah et al., 2021; Febriana & Sasmita, 2022). However, in reality, learning physics is still dominated by conventional learning activities. This can happen due to several things, such as limited tools, limited time, and other limitations. This of course can have an impact on low student learning outcomes. In addition, learning physics has not considered the characteristics of student learning. Characteristic-oriented learning is very important to maximize student learning potential (Derici & Susanti, 2023; Juwanaa & Savitri, 2023).

Based on the results of the preliminary studies that have been conducted, information is obtained that student learning outcomes are still very low. This is evidenced by the results of students' classical completeness in the previous material which only reached 35% with a Minimum Completeness Criteria (KKM) score of 75. This percentage can be said to be far from the expected criteria, where a class can be said to have completed learning classically if it reaches a percentage of 75% of all students. Therefore, based on these problems, it is necessary to pursue learning based on theory and practice by taking into account the characteristics of students to improve learning outcomes. One effort that can be done is to use an inquiry learning model based on differentiation learning strategies.

The inquiry learning model focuses on student-centered learning. This model facilitates student learning activities so that they are more active in the learning process and the teacher acts as a learning facilitator (Irpan & Bhakti, 2020; Khoury, 2022). In this study the inquiry model applied is the guided inquiry learning model. In the guided inquiry learning model, the teacher acts as a facilitator who provides guidance, support, and resources to students. However, students in this case still play an active role in the learning process. This learning model plays a role in developing the ability to think, communicate, and the ability to work together in groups. The guided inquiry learning model can improve student learning outcomes with discovery-based learning independently (Shabrina & Diani, 2019; Pramesti et al., 2020).

Differentiated learning is a learning strategy that facilitates, serves, and recognizes the diversity of students in learning according to learning readiness, learning achievement, interests, and student learning preferences (Puspitasari & Walujo, 2020; Handiyani & Muhtar, 2022; Khasanah & Alfiandra, 2023). Differentiated learning strategies are divided into 4 aspects, namely content or content aspects, process aspects, product aspects, and learning environment aspects. Given the limitations that teachers have in facilitating all aspects of differentiated learning, the differentiated learning strategy used is focused on the process aspect. The selection of only one aspect is intended so that differentiation learning can be focused with more optimal results.

Learning strategies with process aspect differentiation are all activities adapted to student learning methods or activities (Amin et al., 2023; Wuryani et al., 2023). In this case, the teacher will divide students into small groups heterogeneously based on student characteristics. Heterogeneous groups are expected to foster collaborative learning between low-ability students and high-ability students. In addition, the division of heterogeneous groups will present a variety of learning processes without isolating one student in learning, because each student will learn with a learning process that fits his characteristics.

Based on previous research, the inquiry learning model can be combined with a differentiated learning strategy (Rahmah et al., 2022). Considering that learning outcomes can be improved by using the inquiry learning model, the combination of this learning model with a differentiated learning strategy is expected to improve student learning outcomes more effectively. The urgency of this research is based on an analysis of the background of the problems that have been described, where student learning outcomes are still not optimal, so special handling is needed to overcome these problems. Therefore, the explicit aim of this research is to improve student learning outcomes by applying an inquiry learning model based on differentiation learning strategies.

2. METHOD

This study uses a quantitative descriptive approach with the type of research used, namely Classroom Action Research (CAR). CAR is a research that focuses on efforts to improve the quality of learning conducted in the classroom (Sa'o et al., 2023; Sugiarni et al., 2021). In this case the research activities were carried out in two learning cycles using the research procedures of Stephan Kemmis and Robin Mc. Taggart, includes planning, action or deed, observation, and reflection (Arikunto et al., 2015). An overview of the intended design model can be seen from Figure 1.

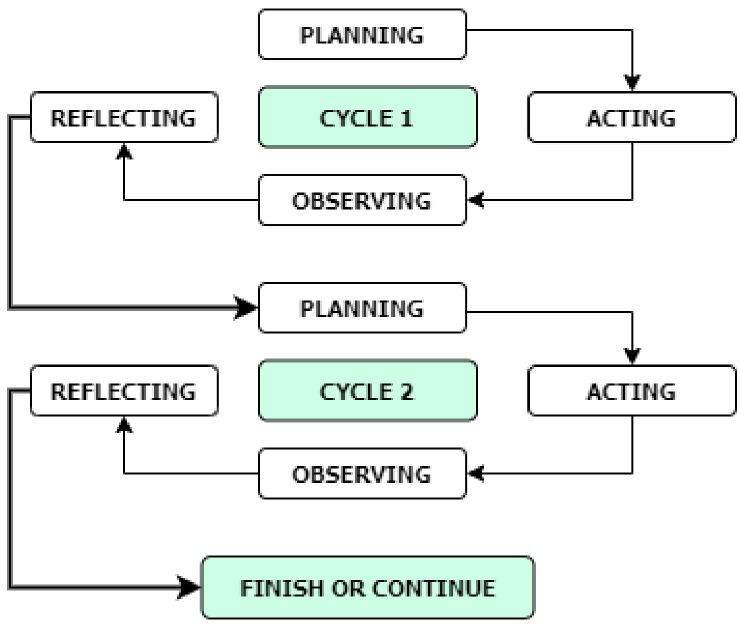

Figure 1. Classroom Action Research Cycle

The main focus of this research is to improve student learning outcomes. Therefore, the research procedure begins with preparing relevant learning plans and research plans such as preparing complete learning tools, test instruments, and observation instruments. After that, the plans that have been prepared will be used in the implementation of learning. In the implementation process, the researcher observed the learning process. This observation activity is needed to find out student learning activities and will later be reflected to get the appropriate results.

This research was conducted at SMA Negeri 3 Cimahi in the 2022/2023 academic year. The subjects of this study were students of class XI MIPA 1 SMA Negeri 3 Cimahi, totaling 31 students with an age range of 16-17 years. Data collection techniques are used in the form of observation and test results of learning. Observation is used to collect information on learning activities before conducting research, while the learning achievement test is intended to determine whether there is an increase in learning outcomes. In this study, students were said to have completed learning individually if they obtained a Minimum Completeness Criteria (KKM) score of ≥ 75. Meanwhile, classical completeness is overall 75% of students passed the KKM.

The type of data in this study consists of qualitative data and quantitative data. The qualitative data in question is data from observation and discussion analysis, while the quantitative data is a statistical calculation in determining the increase in learning outcomes. The data analysis technique used is descriptive statistics and inferential statistics in the form of the Wilcoxon test using IBM SPSS Statistics Version 22.

3. RESULT AND DISCUSSION

Learning activities in this study focused on discussing the wave properties of light. The learning objectives used refer to cognitive level indicators of Anderson & Krathwohl's Revised Bloom's Taxonomy, which include C3, C4, and C5. This research was conducted in 2 learning cycles and aims to improve student learning outcomes.

At the beginning of learning, researchers formed study groups heterogeneously based on the level of student ability. The formation of the group is based on the results of the diagnostic tests that have been obtained previously. The formation of heterogeneous groups is expected to facilitate students in learning and make them peer tutors in the learning process.

To find out the increase in learning outcomes from each cycle, researchers tried to explore the interrelationships between research variables. In this case, the researcher used the data normality test as a prerequisite test to test the relationship between variables. Because there were 31 students, the data normality test used was the Kolmogorov-Smirnov normality test with a significance level of 0.05. The normality test results can be seen in Table 1.

Table 1. Data Normality Test Results

	Kolmogorov-Smirnov		
	Statistic	**Df**	**Sig.**
Cycle I	0,132	31	0,184
Cycle II	0,210	31	0,001

In this test, data is said to be normally distributed if its significance value is > 0.05. Based on Table 1 it is known that cycle I has data that is normally distributed, while cycle II has data that is not normally distributed. Therefore, to determine the effect of the inquiry learning model based on differentiation learning on learning outcomes, it is necessary to carry out the Wilcoxon non-parametric test. The Wilcoxon test results can be seen in Table 2.

Table 2. Wilcoxon Test Results (Test Statistics[a])

	Cycle I – Cycle II
Z	−4,038[b]
Asymp. Sig. (2-tailed)	0,000

Based on Table 2, it is known that the significance value of the research data is 0.000 and is smaller than the significance level of 0.05. Therefore, it can be interpreted that there is an influence of the inquiry learning model based on differentiation learning on student learning outcomes.

In line with the results of the Wilcoxon test that has been carried out, the inquiry learning model based on differentiation learning can indeed be integrated into a lesson (Rahmah et al., 2022). This has a positive impact when used in improving student learning outcomes because based on previous research the inquiry learning model can improve student learning outcomes (Saragih et al., 2022; Sudiartha, 2022) and differentiated learning also influences the optimization of student learning outcomes (Herwina, 2021; Suwartiningsih, 2021).

After knowing the relationship between the inquiry learning model based on differentiated learning on learning outcomes, researchers want to describe the increase in learning outcomes in each cycle. To find out the increase, the researcher processed the learning outcomes data using descriptive statistics.

3.1 Pre-Cycle

The activities carried out by researchers in the pre-cycle were conducting preliminary studies. Preliminary studies conducted included analyzing the results of daily physics tests in the previous discussion and observing learning in class. Based on the results of observations made, learning activities in the pre-cycle use teacher-centered learning. In this case, students do not construct their knowledge independently. Learners learn passively by receiving knowledge directly from the teacher as the main learning resource. In addition, the dominant learning indicators are oriented toward the Lower Order Thinking Skills (LOTS) indicator. LOTS indicators include indicators C1, C2, and C3 (Erniyanti et al., 2020; Utomo, 2023). Analysis of student learning outcomes in the pre-cycle is shown in Table 3.

Table 3. Pre-Cycle Classic Mastery

KKM	Status	Numbers	Percentage (%)
≥ 75	Complete	11	35%
< 75	Not Complete	20	65%

Based on Table 3, pre-cycle classical completeness only gets a proportion of 35%. In this case, it is known that of the 31 students, 11 people completed the KKM (Minimum Completeness Criteria), and 20 people who had not completed the KKM. Mastery of the classics is of course still very low. This can be caused by several factors, one of which is caused by learning activities that make the teacher the main source of learning. This ultimately causes student dependency on learning.

Students who are used to depending on the material provided by the teacher will become passive in learning. This makes it difficult for them to develop their potential to construct their knowledge independently. Teacher-centered learning makes students less independent in learning so students find it difficult to develop their knowledge and are not creative in thinking (Putra et al., 2021). Therefore, improvement efforts by implementing student-centered learning are carried out in the next cycle.

3.2 Cycle I

Unlike the pre-cycle learning activities, learning in this research cycle uses the guided inquiry learning model. One feature of this model is that it focuses on learner-centered learning processes (Maharani et al., 2020; Pratiwi et al., 2021; Lantowa et al., 2022). In addition, learning indicators are developed at a higher level. This learning activity is intended so that students are more active in constructing their knowledge independently and can learn at the level of learning that should be obtained (not only learning at a low level). The results of classical completeness in cycle I can be seen in Table 4.

Table 4. Cycle I Classical Mastery

KKM	Status	Numbers	Percentage (%)
≥ 75	Complete	9	29%
< 75	Not Complete	22	71%

Based on Table 4, the percentage of the classical cycle I completeness was 29%, where 9 students completed the KKM (Minimum Completeness Criteria) and 22 students did not complete the KKM. Classical completeness is smaller than the acquisition of completeness in the pre-cycle. The decrease in classical completeness in the first cycle occurred because the learning design that the researchers used was different from the pre-cycle learning. Therefore, learning in this study is still not optimal because students are not used to learning with the treatment that researchers use.

Learning outcomes in cycle I were still relatively low and even experienced a decrease in the percentage of classical completeness when compared to pre-cycle learning. This can be explained because the majority of students experience problems in determining research variables, formulating research hypotheses, and determining experimental steps. This makes students not understand what they have to do in the learning process. As a result, most students experience a decrease in learning outcomes when compared to previous learning outcomes.

3.3 Cycle II

Based on various things that have not been optimal in learning in cycle I, researchers are trying to improve and develop learning activities that will be carried out in cycle II. In this case, the researcher provides intensive guidance related to ongoing learning. However, the provision of guidance still pays attention to the principle of students as learning centers. In addition, the researchers also developed Student Worksheets (LKPD) given in cycle II to make it easier to understand by including the meaning of the dependent variable, control variable, and independent variable. Researchers also provide trigger questions so that students get an idea of the learning process. Classical completeness in cycle II is shown in Table 5.

Table 5. Cycle II Classical Mastery

KKM	Status	Numbers	Percentage (%)
≥ 75	Complete	27	87%
< 75	Not Complete	4	13%
	Total	**31**	**100%**

Based on Table 5, 27 students have completed the KKM (Minimum Completeness Criteria) and the remaining 4 students have not completed the KKM. The percentage of complete learning outcomes in cycle II reached 87%. The completeness has exceeded the minimum expected completeness of 75%.

In the implementation of cycle II, the researcher facilitated the application of a differentiated learning strategy, in the form of opportunities for collaboration between students with high learning abilities and students with low abilities. During learning activities, researchers provide opportunities for each student to share their understanding so that each group member understands the material being studied. This is proven to foster a collaborative attitude and improve student learning outcomes.

Learning in cycle II is more optimal than learning in the previous cycle. In this case, students are getting used to the learning provided by the teacher. Students begin to understand what they have to do to solve learning problems. Students are more active in learning activities. Students can share their understanding of concepts with other students during discussion activities. In addition, during the presentation activities, students were very enthusiastic in presenting the results of the experiments they carried out. Some students also actively ask questions during the presentation.

Based on the activities that have been carried out, various data were obtained from the previous presentation. The results of the completeness of each cycle are very diverse where there is a decrease and increase in classical completeness. To be able to see a comparison of classical completeness from the pre-cycle, cycle I, and cycle II can be seen in Figure 2.

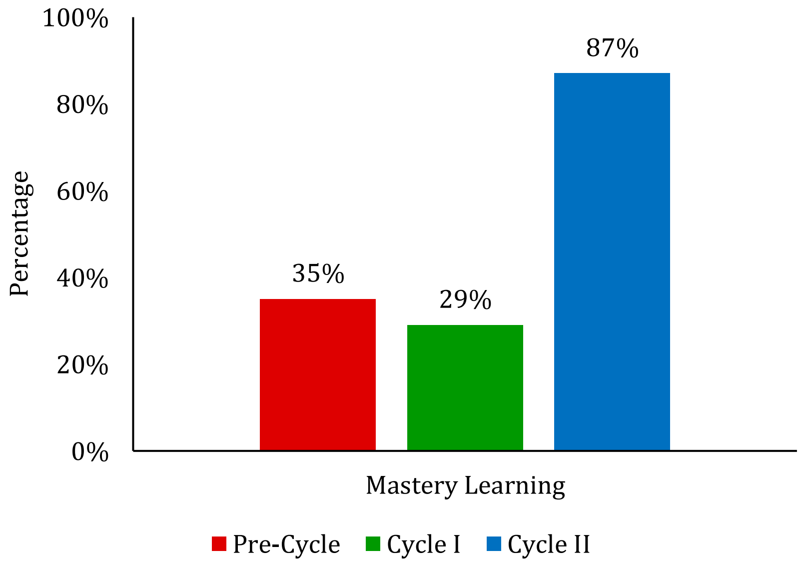

Figure 2. Classic Mastery Comparison

Based on Figure 2, it is known that students' classical mastery decreased in cycle I when compared to classical mastery in the pre-cycle. However, students' classical completeness finally experienced a significant increase in cycle II. The increase in cycle II is inseparable from the various improvements and developments that have been made based on the learning outcomes in the previous cycle.

The results of the learning analysis in cycle II showed that most students understood the learning tasks they had to do. This makes students more optimal in solving a given problem. The results of classical completeness in cycle II were quite high at

87%. However, on the other hand, this shows that there are still some students who experience problems in carrying out the learning process. In cycle II it is known that there are still 4 students who have not completed the KKM. This can be explained that the learning activities in this study focused on group learning. However, in a class, there must be students who prefer independent learning.

As a follow-up effort for further research, teachers can further optimize learning by differentiating aspects of the process. In this case, the teacher can provide special guidance for students who do not really like group learning so that they can still get the expected learning outcomes. Even so, the teacher still has to get used to learning in groups with these students. This is so that they can foster social sensitivity by learning collaboratively.

Inquiry learning models based on differentiation learning strategies can improve student learning outcomes. This is because the characteristics of the inquiry learning model allow students to construct their knowledge independently. This is important to gain an understanding of meaningful learning (Naibaho, 2021). In addition, learning activities in each cycle pay attention to various supporting aspects, such as various learning processes. The basis for grouping students also considers the level of student learning ability, so that in a class there are no superior groups or support groups. This makes each group have the same rights and obligations in achieving the expected learning objectives. Heterogeneous groupings can make students collaborate and create peer tutors in learning activities (Suyatinah, 2020; Suryani, 2022). Heterogeneous groups allow each student to achieve the expected learning goals (Nurhidayat et al., 2023).

4. CONCLUSION

Based on the results of the research that has been described, it can be concluded that the inquiry learning model based on the differentiation approach can improve student learning outcomes. This increase is marked by an increase in the percentage of classical completeness in each learning cycle. The percentage of classical completeness in cycle I was 29% and increased in cycle II which obtained a classical completeness percentage of 87%. Given that the learning activities in this study were dominated by group learning activities, the researchers suggested that further research could facilitate students who prefer independent learning. In addition, teachers need to adopt student-centered learning habits so that they can have more meaningful learning experiences. The results of this study have implications for illustrating that the inquiry learning model can be combined with a differentiated learning strategy to improve the quality of learning.

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