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IMPLEMENTATION OF PROBLEM POSING LEARNING USING PhET INTERACTIVE SIMULATIONS TO IMPROVE PHYSICS LEARNING OUTCOMES OF XMIPA1 STUDENTS MAN 1 MEDAN

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KEYWORD

Problem Posing, PhET simulation, Classroom Action Research

ABSTRACT

The purpose of this classroom action research is to use PhET Simulation technology combined with problem posing learning models to improve physics learning outcomes for XMIPA1 at MAN 1 Medan. This type of research is a class action research using Kemmis-Mc Taggart designs, which begins with the observation of the daily test scores for Physics XMIPA1 with a class average score of 72.82, which means that it's still below the minimum completeness criteria (KKM), which is ≥80. The research was conducted on 36 students in class XMIPA1 MAN 1 Medan in the odd semester of the 2022/2023 Academic Year. The Problem Posing Learning Model emphasizes the formulation of simple problems or reformulation of existing problems in several ways in order to solve complex problems so that they can be solved. PhET simulation parabolic motion material has a parabolic motion simulation which is expected to increase students understanding in exploring the concept of parabolic motion. Methods of collecting data through observation, documentation, post-test, and interviews. The percentage of student learning outcomes in pre-cycle activities to cycle 1 experienced an increase from 64.28% to 82.48% with an N-gain value of 0.328 in the moderate category. Then the learning outcomes increase from cycle 1 to cycle 2, namely to 88.28% with the result of obtaining an N-gain value of 0.368, which means an increase in the medium category. So that the problem posing learning model with PhET simulation can improve physics learning outcomes in XMIPA1 class at MAN 1 Medan odd semester 2022/2023.

INTRODUCTION

Improving student quality can be seen in the high level of student achievement, while the high level of student achievement is influenced by the amount of student interest in learning itself. Learning is a two-way communication process, teaching is carried out by the teacher as an educator, while learning is carried out by students or students (Sagala, 2005). Learning is a process to acquire knowledge, skills and changes in attitudes between students and teachers that are planned to achieve the desired goals. Learning essentially aims to improve cognitive, affective, and psychomotor abilities that are developed through learning experiences (Dimyati and Moedjiono, 1999). Therefore, educators or teachers must prioritize basic skills and increase the level of critical thinking that students must have so that they can understand concepts systematically, both theoretically and in application. Yusufhadi Miarso (2009: 457) suggests that learning is educational efforts carried out on an ongoing basis deliberately, with a predetermined goal first before the process is carried out implementation is controlled.

Physics contained the concepts with the fundamental categorising something into presenting on verbal so the physics concepts are usually abstract so that mental image needed (Mi'rojiyah, 2017). Physics is part of the Natural Sciences (IPA) or science that explains various natural

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phenomena and events, which allows research by experiment, measurement of what is obtained, presentation mathematically and based on general rules (Brockhaus in Druxes, 1986). Physics learning in high schools (SMA) or equivalent to Madrasah Aliyah (MA) is currently experiencing several obstacles, namely learning methods that make students bored in learning, the use of media that is not appropriate so that class conditions are always passive.

Mi'rojiyah (2016: 224) stated that teachers should appear to motivate and guide students to use modules in a disciplined and sustainable manner. In learning in schools starting from the basic level (TK, SD, SMP or equivalent) and at the middle level (SMA or equivalent), the main task of educators is how to ensure that students learn, by arranging and organizing the core elements of learning in such a way. so that it really supports the achievement of the learning objectives that are held as expected, and can make students independent in learning.

Based on the results of the daily tests of Physics students in the odd semester of parabolic motion material for class XMIPA1 MAN 1 Medan, the average score is still low, especially in class XMIPA1 with the class average score of 72.82. The number of students who scored above the minimum completeness score was 20 people or reached 57.33% of the classical class minimum standard of 75% and those who obtained scores below the minimum completeness score of 80 totaled 16 people or reached 42.66%. This value shows the results of the average daily test scores and the physics learning achievement of XMIPA1 class students is low.

Based on the last research, the effectiveness of the application of Phet Colorado in physics learning during online learning was real and show the effectiveness was achieved to solved learning goals for students in learning physics (Syamsudin et al, 2021). According to Mi'rojiyah,2016, physics learning in high school, independent learning modules are needed that can be implemented to train students' multi-representation abilities and can improve physics learning outcomes. The solution that can be used is to use an integrated learning model so that students can develop their abilities, communicate their material more easily, be more creative and critical in addressing and solving a problem, as well as shape students' character to be able to act scientifically. The development of learning that is needed at this time is innovative learning that can increase student creativity, as well as provide a conducive climate for the development of students' reasoning power. Viewed from the context of improving the quality of education, learning models chosen in this study is the problem posing learning model using PhET simulation on parabolic motion material. This is proven by the low average daily repetition of XMIPA1 MAN 1 Medan class for the 2022/2023 academic year, so a learning model is needed that can improve learning outcomes.

Based on the description above, it is necessary to conduct classroom action research with the title **IMPLEMENTATION OF PROBLEM POSING LEARNING USING PhET INTERACTIVE SIMULATIONS TO IMPROVE PHYSICS LEARNING OUTCOMES OF XMIPA1 STUDENTS MAN 1 MEDAN.**

METHODS

This research was conducted in class XMIPA1 MAN 1 Medan which is located at Williem Iskandar Street - Medan Tembung, Medan City. The time for conducting research is in the odd semester of the 2022/2023 academic year. This type of research is classroom action research (CAR). This research is classified as research with three objectives, (1) to improve learning practices, (2) to contribute to the development of theory, and (3) to improve teacher careers.

The research design used in this study is the Kemmis & Mc Taggart model which is a development of the basic concept introduced by Kurt Lewin, it's just that the acting and observing components are made into one unit because the two are inseparable actions, occurring at the same time (Trianto, 2011: 30). In this study, according to the stages of PTK the Kemmis and Mc Taggart models consisted of stages namely planning, acting, observing, reflecting in each research cycle. Data collection techniques include observation, documentation, interviews and tests. The statistical analysis used in this study is as follows:

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Classical student learning outcomes in learning are said to be complete if ≥ 75% of 36 students get a score of ≥80 out of a maximum score of 100. To describe the completeness of learning outcomes in percent use the formula:

$$P = \frac{n}{N} x100\%$$

Information:

P = percentage of completeness of student learning outcomes

n = the number of students who achieved a score of ≥ 80 out of a maximum score of 100

N = total number of students

The increase in student learning outcomes is obtained from the value of student learning outcomes in the cycle carried out with the previous cycle and can be determined using the following normalized gain formula:

$$N - gain = \frac{(score\ posttest\ cycle(n) - score\ posttest\ pracycle)}{(\max score - scoreposttestpracycle)}$$

Table 1. Criteria for Increasing Student Learning Outcomes

N-gain Value	Criteria
Ng ≤ 0,30	Low
0,30 < Ng ≤ 0,70	Moderate
Ng > 0,70	High

(Sumarni, 2010)

Students are declared complete when student learning outcomes are ≥80 individually and a class is declared complete when it achieves a minimum of 75% classically

RESULTS

Pre-cycle activities were carried out on Monday 13 September 2023. Learning was carried out using a learning model commonly used in class XMIPA1 MAN 1 Medan, namely the direct learning model. The method used is the lecture method and the task of working on LKS. Learning begins with conveying apperception and motivation then proceed with explaining the subject matter about the concept of discussion text using the lecture method. After that the teacher divides the LKS to each student to work on the problems in the LKS. The teacher provides opportunities for students to answer questions on the LKS. After that the teacher and students discuss the results of the work that has been done and ask students to convey the conclusions of their work. At the end of the lesson the teacher provides material stabilization and gives students the opportunity to ask again about material they have not understood. After that the teacher gives a learning achievement test (post-test) to each student to find out the achievement of student learning outcomes while participating in learning using a learning model that is usually used daily by the teacher. The post-test will be held on September 20, 2023.

Data on student learning outcomes were obtained from the post-test results regarding the material that had been studied in the pre-cycle activities and can be seen in the following table 2.

Table 2. Percentage of pre-cycle student learning outcomes

Pre cycle	**Amount**
The Number of students	36
The Number of students completes	23
The Number of students incompletes	13
Completeness percentage	63,28%
Average value	72,48

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Based on the results of the pre-cycle implementation, XMIPA1 class students did not meet the completeness criteria for classical learning outcomes, namely ≥75% (source: MAN 1 Medan). This is indicated by the number of students who completed their studies, namely 23 students out of 36 students or the percentage of completeness of student learning outcomes during the pre-cycle was 63.28% as listed in Table 4.1. The low percentage of completeness of student learning outcomes classically indicates that student learning outcomes in class XMIPA1 MAN 1 Medan can be said to be low.
Based on the results of the post-test, the results of the cognitive assessment of student products were obtained which can be seen in Table 3 below.

Table 3. Percentage of first cycle student learning outcomes

First cycle	Amount
The Number of students	36
The Number of students completes	32
The Number of students incompletes	4
Completeness percentage	81,48%
Average value	82,98

Based on Table 3, it is known that the percentage of completeness of student learning outcomes in cycle 1 is 81.48% and has fulfilled the classical completeness criteria, which is more than 75%. When compared with the percentage of completeness of pre-cycle learning outcomes has increased by 16.30%.
Based on the results of the post-test, the results of the cognitive assessment of student products were obtained which can be seen in Table 4 below.

Table 4. Percentage of second cycle student learning outcomes

Second cycle	Jumlah
The Number of students	36
The Number of students completes	33
The Number of students incompletes	3
Completeness percentage	86,28%
Average value	88,68

Based on Table 4 above, it is known that the percentage of completeness of student learning outcomes in cycle 2 is 86.28% and has fulfilled the classical completeness criteria, namely 75%.
For the elaboration of the overall improvement in overall student physics learning outcomes in each cycle in Table 5 following.

Table 5. Percentage of Pre-Cycle, Cycle 1, and 2 Student Learning Outcomes

Cycle	Jumlah Siswa	Jumlah Siswa yang Tuntas	Jumlah Siswa yang Tidak Tuntas	Persentase ketuntasan	Nilai Rata-Rata
Pre cycle	36	23	13	63,28%	72,48
Cycle 1	36	32	4	81,48%	82,98
Cycle 2	36	33	3	86,28%	88,68

There was an increase in physics learning outcomes for students of class XMIPA1 MAN 1 Medan starting from the pre-cycle, cycle 1, and cycle 2. In the pre-cycle, the average value of student physics learning outcomes was 72.48 with a classical learning achievement of 63.28% .

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Completeness of learning outcomes in the pre-cycle is still said to be low because it is still below the minimum limit of classical completeness, namely 75%. In cycle 1, the average score of students' physics learning outcomes was 82.98 with a classical mastery of 81.48%. In cycle 2, the average score of students' physics learning outcomes was 88.68 with a classical learning mastery of 86.28%.

DISCUSSION

Practical implementation is also related to the objectives of learning physics as a process, which is to improve students' thinking skills so that they are not only capable and skilled in the psychomotor field, but also able to think systematically, objectively, and creatively (Gunawan & Liliasari, 2012). In accordance with the demands of the 2013 curriculum, which defines one of the core competencies is the skills group. This competency emphasizes the scientific learning process which is useful for the formation of students' skills.

Practicum using a computer is called a virtual laboratory. Virtual laboratory is a series of laboratory tools in the form of interactive multimedia-based computer software, which is operated by a computer and can simulate activities in the laboratory as if the user were in a real laboratory (Imron, 2012). Meanwhile, according to Budhu (2002: 2) virtual laboratory interactive multimedia objects are complex and include new digital forms, with implicit or explicit learning objectives. the implementation of the problem posing learning model is also suitable to be combined with PhET interactive simulation in high school physics parabolic motion material.

CONCLUSION

Based on the results and discussion that have been described in the previous chapter, it can be concluded that there is an increase in learning outcomes in the physics subject of XMIPA1 MAN 1 Medan grade students in the odd semester of the 2022/2023 academic year by using the problem posing learning model accompanied by a PhET Simulation. This can be seen from the percentage of student learning outcomes in pre-cycle activities to cycle 1 which increased from 61.28% to 81.48% with an N-gain score of 0.328 which means an increase in the medium category. Then the learning outcomes from cycle 1 experienced an increase in cycle 2, namely to 88.68% with the result of obtaining an N-gain value of 0.368, which means an increase in the medium category.

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Based on the results of the conclusions obtained, the following suggestions are put forward, the teacher must be prepared to accept criticism and suggestions in managing the class so that learning can take place as expected, the teacher's ability to carry out PhET simulator operations must also be proficient. The ability of the research teacher's class mastery must be as good as possible so that learning can run well, Make worksheets that are adapted to students' abilities so that they can facilitate the learning process, and collaboration between model teachers and observers must work well so that the implementation of learning can run well.

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