Lensa : Jurnal Kependidikan Fisika
Penerbit: Program Studi Pendidikan Fisika IKIP Mataram
e-mail: lensafisika@gmail.com
url: https://e-journal.undikma.ac.id/index.php/Lensa

June 2023. Vol. 11, No. 1
e-ISSN: 2686-0937
p-ISSN: 2338-4417
pp. 1-7

Implementing the Quantum Learning Model to Enhance Students' Physics Learning Outcomes

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Received: March 2023, Accepted: May 2023, Published: June 2023

Abstract

The students' mastery of the subject matter has been identified to not reach the attainment indicator. The low learning outcomes of the students are suspected to be a result of the predominantly lecture-based teaching method, leading to passive engagement in the learning process. This research aims to describe the improvement in students' physics learning outcomes on the topic of quantities and units using the quantum learning model. The study employed a classroom action research conducted in two cycles, including planning, implementation, observation, evaluation, and reflection stages. Twenty-seven students were involved as subjects in this research. The data on students' learning outcomes were collected using a 20-item multiple-choice test, and the evaluation of the learning process was conducted by two observers using observation sheets. The research results indicate that the students' classical mastery in the first cycle was 63.16% and increased to 85% in the second cycle. This study concludes that the implementation of the quantum learning model can enhance the physics learning outcomes of the students at MTs Nahdlatul Mujahidin NW Jempong on the topic of quantities and units.

Keywords: quantum learning model; learning outcomes; quantities and unit

How to cite: Azmi, I., Prayogi, S., & Asy'ari, M. (2023). Implementing the Quantum Learning Model to Enhance Students' Physics Learning Outcomes. *Lensa: Jurnal Kependidikan Fisika, 11*(1), 1-7. doi:https://doi.org/10.33394/j-lkf.v11i1.8558

INTRODUCTION

Physics holds great relevance in students' learning at the secondary school level (Perdana et al., 2019). Physics teaching materials enable students to comprehend natural phenomena and the fundamental properties of the universe, such as motion, force, energy, and matter (Puspitasari et al., 2019). Through this understanding, students can relate physics theories to their daily experiences. Additionally, physics learning helps develop analytical and critical thinking skills, as it involves applying mathematical and logical principles to problem-solving (Prayogi & Asy'ari, 2013). Students are also engaged in science experiments, particularly in physics, which aid in developing experimental skills and understanding scientific methods (Asy'ari et al., 2019; Humayrah et al., 2022). Furthermore, physics serves as the foundation for many other disciplines, such as chemistry, biology, and engineering, making it important and relevant to study for gaining insights into the universe and fostering valuable life skills (Ekayanti et al., 2022).

Unfortunately, many students encounter difficulties in learning physics (Januarti et al., 2023; Sukaisih et al., 2020). In line with these findings, other research results show that physics teachers often utilize class time to discuss tasks, introduce new topics, and assign tasks to students (Sarriyani et al., 2023). Physics is a conceptual subject, demanding teachers' ability to employ appropriate methods according to students' mental development (Hidayana et al., 2022; Iskandar et al., 2021). Therefore, a learning method that can assist students in achieving the learning objectives and indicators is required (Kurniawati et al., 2022). These issues are consistent with the initial observation findings at MTs. Nahdatul Mujahidin NW Jempong, which revealed that physics lessons were perceived as relatively challenging and boring, directly correlating with the low learning outcomes obtained.

The quantum learning model is one of the teaching approaches that can address these research problems. The quantum learning model focuses on teaching and problem-solving skills, followed by the reinforcement of these skills (Sandiyanti & M, 2018). The use of the quantum learning model can enhance students' engagement in learning physics, allowing them to derive maximum benefits from the learning process and outcomes (Cahyaningrum et al., 2019). The quantum learning model has advantages in training listening, accuracy, role distribution, and encouraging students to express the mistakes of others verbally (Baroroh et al., 2017; Khotimah et al., 2018). Based on these views, it can be concluded that the quantum learning model is an instructional approach that instills a positive attitude within students, convincing them that every individual possesses unlimited thinking potential in the learning process.

Previous research has provided ample evidence of the implications of the quantum learning model in improving learning outcomes, motivation, and learning activities of students. Puspaningrum et al. (2015), who identified the improvement of students' multirepresentation abilities through the implementation of the quantum learning model with experimental methods, found a significant increase in multirepresentation skills and physics learning outcomes with a medium level of improvement in pressure and solid substance topics. In line with these findings, Lokaria and Noviyanti (2018), in their research to examine the influence of the quantum learning model on students' science learning outcomes, also stated that the quantum learning model significantly impacted the improvement of students' learning outcomes. Other studies have reported similar results, where the quantum learning model significantly affects students' conceptual understanding and learning motivation in elementary school (Rodiyana, 2018).

These empirical studies have demonstrated the positive impact of using the quantum learning model in science education, particularly in physics. The results of these findings logically provide a basis for using the quantum learning model as a solution to address the current research problem. This study aims to enhance the physics learning outcomes of students at MTs Nahdlatul Mujahidin NW Jempong on the topic of quantities and units through the implementation of the quantum learning model. The novelty of this research lies in the different physics teaching materials used, namely the topic of quantities and units, which were not employed in previous studies. Additionally, the generalizability limitations of previous research conclusions to different research locations also contribute to the novelty of this study.

METHOD

This study is a Classroom Action Research (CAR) focusing on the systematic observation of intentionally designed activities occurring within a classroom. The activities involved in this research include planning, implementation, observation, and reflection stages (Prayogi & Asy'ari, 2013). The research consists of two cycles, and the phases within each cycle are illustrated in Figure 1.

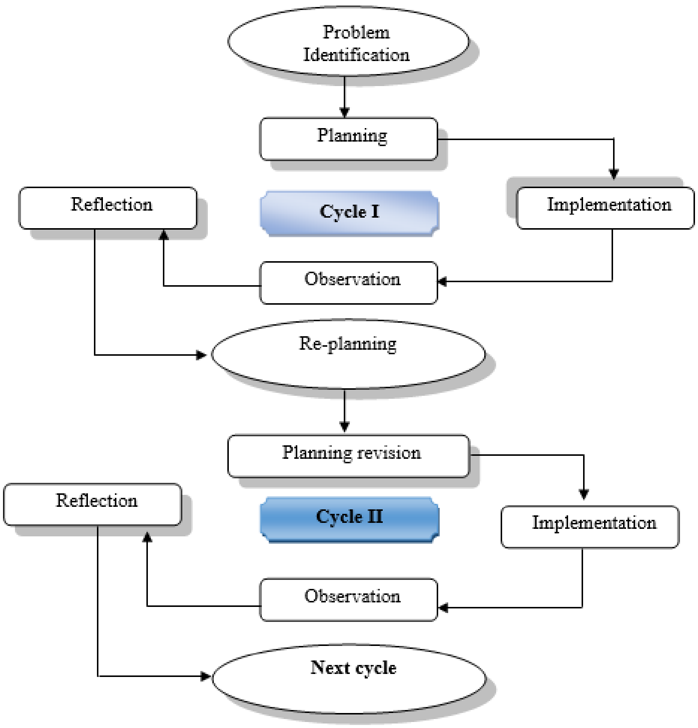

Figure 1. Flowchart of the Action Implementation in Classroom Action Research

This research was conducted at MTs Nahdlatul Mujahidin NW Jempong and involved 27 seventh-grade students as research subjects. The students' learning outcomes on the topic of quantities and units were measured using a 20-item multiple-choice test, while the learning process was observed by two observers using an observation sheet on the implementation of the learning activities. Furthermore, the observers were tasked with providing recommendations for improvements based on the evaluation of any learning barriers that emerged. The research data related to students' learning outcomes were analyzed descriptively and quantitatively using the Classical Mastery Criterion (KK) equation (Sukaisih & Muhali, 2014). The research is considered successful if the classical mastery indicator of students is >85% with a minimum test score of 73.

RESULT AND DISCUSSION

Students' Physics Learning Outcomes

The evaluation results of Cycle I in Table 1 indicate that out of 27 students, 19 students participated in the evaluation test, and there are still students who scored below 73, resulting in a classical mastery of 63.16% in Cycle I. Based on these findings, the achieved classical mastery has not yet reached the minimum criterion of >85% for all seventh-grade students at MTs Nahdatul Mujahidin NW Jempong who took part in the evaluation test.

Table 1. Cycle I Learning Evaluation Results

Cycle I Learning Evaluation Results	
Total number of students	27
Number of students participating in the evaluation test	19
Highest score	100
Lowest score	40
Number of students who achieved mastery	12
Average score	71.58
Classical mastery	63.16%

As the achieved classical mastery in Cycle I is still below the set indicator, it is necessary to proceed to the next cycle. The failure to reach the minimum proficiency standard is also attributed to deficiencies in the implementation of the learning process in Cycle I. Based on the observations and evaluations conducted in Cycle I, several shortcomings were identified, such as students' lack of motivation, as evidenced by their lack of focus during the learning process and reduced attention to the teacher's explanations. Additionally, students tended to be hesitant in participating actively in solving the practice problems given by the teacher in front of the class. The deficiencies and the steps for improvement, as reflections for implementation in Cycle II, are briefly presented in Table 2. These improvements aim to address the shortcomings and make the learning process more effective, resulting in better outcomes in Cycle II.

Table 2. Deficiencies and Improvement Steps in Cycle I

Deficiencies	Improvement Steps
➢ Students pay insufficient attention to the teacher's explanations.	➢ Motivate students by providing contextual questions related to the material in Cycle II.
➢ Students are hesitant to step forward and solve the example problems given by the teacher.	➢ Offer rewards to groups or individual students who can solve the example problems provided by the teacher.

Furthermore, based on the evaluation results of Cycle II as shown in Table 3, it can be observed that the class's average score is 76.67 out of a total of 20 students who participated in the evaluation test in Cycle II. The classical mastery achieved in Cycle II is 85%, indicating that the indicator of ≥85% classical mastery has been met. This achievement is attributed to the improvements made in Cycle II, considering the reflections from Cycle I. In Cycle II, students were more focused and motivated in their learning, actively engaging in solving practice problems and scientific activities in the classroom.

Table 1. Cycle II Learning Evaluation Results

Cycle II Learning Evaluation Results	
Total number of students	27
Number of students participating in the evaluation test	20
Highest score	86.7
Lowest score	66.7
Number of students who achieved mastery	17
Average score	76.67
Classical mastery	85%

The improvement in physics learning outcomes for seventh-grade students at MTs Nahdlatul Mujahidin NW Jempong on the topic of quantities and units using the quantum learning model was found to be 21.85%. In a simplified manner, the comparison of students' learning outcomes in Cycle I and Cycle II is presented in Figure 2.

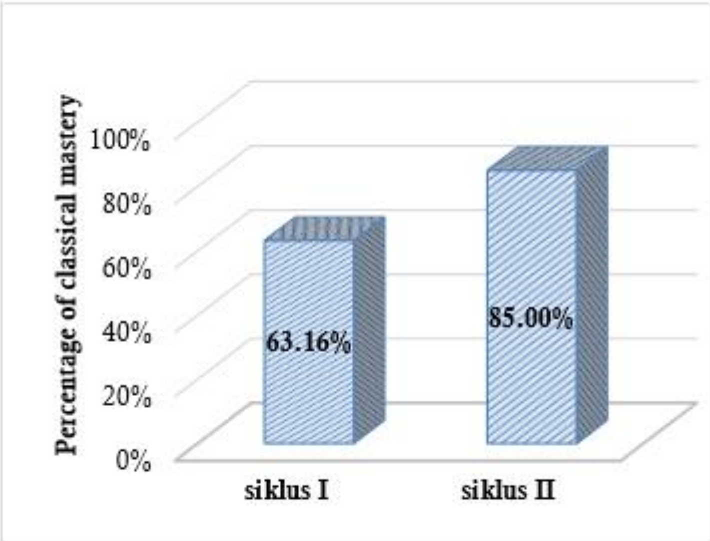

Figure 2. Improvement in Students' Classical Mastery

Discussion

This classroom action research was conducted in two cycles, each consisting of four stages: (1) planning, (2) action implementation, (3) observation and evaluation, and (4) reflection. In Cycle I, the students' physics learning outcomes had an average score of 71.58 with a classical mastery percentage of 63.16%, while in Cycle II, there was an improvement in the learning outcomes with an average score of 76.67 and a classical mastery percentage of 85.00%. The implementation of the quantum learning model in this research has empirically demonstrated its effectiveness in enhancing students' physics learning outcomes on the topic of quantities and units. Furthermore, the results of this study can serve as an alternative viable learning model to improve students' learning outcomes. The success of this research can be attributed to the characteristics of the quantum learning model that promote skilled, communicative, and confidence-building learning environments (Noperlis & Neviyarni, 2022), which is highly relevant to the research problem described earlier.

Learning is a holistic process that encompasses cognitive, emotional, and social aspects in learning based on the quantum learning model (Ningrum et al., 2015), making it suitable for the holistic nature of physics. Such characteristics encourage students to perceive the connections between various physics concepts and understand physics phenomena comprehensively. In line with this view, Faj et al. (2018) state that the quantum learning model emphasizes creativity and exploratory freedom in learning to discover more innovative and engaging ways to understand physics. Additionally, Kalsum et al. (2021) explain that the quantum learning model encourages cooperative learning, where students can help and support each other in grasping difficult concepts. Similarly, Wigati (2016) highlights that the quantum learning model is known for providing enjoyable learning experiences, guided by five main principles: every student can speak, has objectives, prioritizes experiences, acknowledges effort, and celebrates outcomes.

These characteristics have positive impacts on students' learning outcomes in terms of products, skills, and affective aspects. The research findings of Kalsum et al. (2021) show that the quantum learning model significantly influenced students' physics learning outcomes compared to direct instructional methods, although the specific teaching materials used in that study were not described. Furthermore, the results of Faj et al.'s (2018) study demonstrate that the use of the quantum learning model with practical activities had a positive impact on students' learning outcomes in the topic of work and energy. This was evidenced by an effect size of 0.3, indicating a medium-sized effect. These findings are supported by Prahara E. P et al. (2021), who found that the quantum learning model significantly influenced students' learning activities. On the other hand, the impact of the quantum learning model was found to be not significant or even negatively valued (standard gain -0.002) in enhancing students' self-efficacy in physics (Aprilia et al., 2020). Consistent with this research, the model was also found not to have a significant impact on students' physics learning outcomes, possibly due to students' lack of conceptual and mathematical understanding (Prahara E. P. et al., 2021).

CONCLUSION

Based on the findings, it can be concluded that the implementation of the quantum learning model improves the learning outcomes of seventh-grade students at MTs Nahdatul Mujahidin NW Jempong on the topic of quantities and units. This conclusion is based on the research findings, which show that the percentage of students' classical mastery in learning outcomes increased from 63.16% in Cycle I to 85% in Cycle II, indicating an improvement of 21.85%.

RECOMMENDATION

The implementation of the Quantum Learning model can be considered as one of the efforts to improve students' physics learning outcomes, taking into account the use of interactive learning media to promote communicative and engaging learning experiences. Additionally, this study was limited to the topic of quantities and units, indicating the need for further research with more varied teaching materials to examine the impact of the quantum learning model on enhancing students' physics learning outcomes in secondary schools.

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