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Application of Quantum Learning in Improving Science Learning Outcomes on Water Cycle Materials

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ABSTRAK

The purpose of this study was to overcome learning problems in grade 5 SD Islami Daarunnadwah, especially those related to learning the basic science of water recycling. The type of this research is Classroom Action Research where the research subjects are fifth-grade students of SD Islami Daarunnadwah who found 21 students. The results of the Classroom research showed an increase in learning outcomes which was shown in each cycle 1 and 2, where in cycle 1 the value of learning completeness reached a percentage of 71.43 percent and in cycle 2 it had achieved an achievement with a percentage of 100%. From the observations from observers, it also shows that the application of the quantum learning model to science learning in cycle 1 shows the number 31 which is included in the good category while in cycle 2 shows the number 37 in the good category. In this way, the application of the quantum learning model in science subjects with water cycle material has improved the learning outcomes of 5th grade students of SD Islami Daarunnadwah.

Keywords:

Learning outcomes, quantum learning, water cycle.

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INTRODUCTION

Achieving optimal understanding in every subject is crucial, one of which is in science subject (IPA). Rahmawati et.al (2021) explained that science becomes meaningful when knowledge is constructed through students' own understanding and discovery, supported by appropriate facilities and guidance from teachers (Gizaw & Sota, 2023; Rahmawati et al., 2021; Suryanti et al., 2020). This approach positions students as active participants in the learning process, enabling them to engage deeply with the material and better grasp scientific concepts. The primary goal of science subject, as stated by Depdikbud (1997), is for students to

comprehend basic scientific concepts, apply scientific methods, and adopt a scientific attitude (Artaga, 2021; Kusuma et al., 2025; Pantiwati et al., 2017). This empowers students to solve problems effectively while fostering an awareness of the greatness and power of the Creator behind the natural world.

In line with this, KTSP curriculum outlines that the objectives of science subject are "to develop knowledge and understanding of science concepts that are useful and applicable in everyday life, to increase awareness to participate in maintaining, protecting, and preserving the natural environment, and to foster appreciation for nature and its allegiance as one of God's creations" (Faisal & Martin, 2019). Based on the learning objectives from various curricula, it is evident that students are expected to gain a strong understanding of scientific concepts and approaches, which is essential for achieving optimal learning outcomes. To reach these goals, science must be taught using appropriate methods that actively engage students in the learning process. As stated by BSNP, science subject (IPA) is not merely a collection of facts, concepts, or principles to be memorized, but also a systematic process of discovering and understanding nature (Anharuddin & Fatonah, 2023; Gultom et al., 2022; Syamsudin, 2023). Therefore, science learning should emphasize inquiry, exploration, and critical thinking, enabling students to experience science as both content and process.

The role of students as "junior scientists" in the science learning process highlights the importance of using a basic science process skills approach (Lotrecchiano et al., 2016; Parrella et al., 2022; Vickery et al., 2023). This is particularly relevant in elementary education, where students' cognitive abilities are still developing and cannot be equated with those of adult scientists. Therefore, it is essential to provide students with opportunities to practice science process skills that are appropriate to their stage of cognitive development. These skills include activities such as observing, which involves using the senses to identify and record the characteristics of objects and phenomena; and predicting, which refers not to random guessing, but to forming expectations based on prior knowledge, observations, and logical conclusions. According to Piaget's theory of cognitive development, as cited in Desmita (2011), elementary school students are in the concrete operational stage, which means they learn best through hands-on experiences and direct interaction with tangible objects (Hayat et al., 2024; Rohmah et al., 2022). This implies that science instruction at this level should prioritize activities that allow students to engage directly with their environment—observing changes, forming hypotheses, conducting simple experiments, and drawing conclusions (Andriani et al., 2025; Morris, 2025). Through this approach, students can develop a foundational understanding of scientific concepts while also cultivating critical thinking and inquiry-based learning habits.

Based on the researcher's observations in Grade 5 at SD Islami Darunnadwah, it was found that students' science learning outcomes had not reached a satisfactory level. The average score obtained was 72.4, which is still below the Minimum Mastery Criterion (KKM) set by the school, namely 75. This underachievement reflects deeper issues within the learning process. One of the key factors contributing to low learning outcomes is the teacher-centered approach commonly used in classrooms (Garrett, 2008). In such settings, learning activities are predominantly dominated by the teacher, with little to no initiative from the students. Students are treated more as passive recipients of information, expected only to memorize and reproduce the material delivered by the teacher. This condition results in limited student engagement, where classroom activities are restricted to listening, note-taking, and answering questions, rather than promoting deeper understanding or active participation. As a consequence, students struggle to develop critical thinking and problem-solving skills, which are essential for mastering scientific concepts (Muawiyah, 2024; Tanty et al., 2022). Therefore, there is a clear

need to shift towards more student-centered learning models, such as *quantum learning*, which actively involve students in constructing their own understanding and making the learning process more meaningful and effective.

Teachers must be able to stimulate students to independently discover the knowledge, skills, and attitudes they need, rather than simply transferring information (Gholam, 2019; Munna & Kalam, 2021). One key innovation in this regard is the use of innovative learning models that empower students to become active participants in their own learning process. Teachers are expected to continuously implement and adapt new approaches in classroom instruction, creating learning experiences that encourage student exploration, inquiry, and reflection (Beena Rosy C.G, 2024). By doing so, students are given the opportunity to construct their own understanding, rather than relying solely on teacher explanations. Such learning models support the development of critical thinking, creativity, and problem-solving skills, which are essential for mastering complex concepts, especially in subjects like science. When students are actively involved in the learning process—through discussion, experimentation, or collaborative work—their engagement and retention of material significantly improve. Therefore, increasing student participation and ownership of learning is a crucial step toward improving overall learning outcomes and fostering long-term academic success.

One of science learning models that is currently widely applied is the quantum learning model. Quantum Learning is a comprehensive set of learning strategies and philosophies designed to create an optimal learning experience for individuals of all ages and backgrounds. According to DePorter et al. (2006), this model provides structured guidance for creating effective learning environments, designing instructional materials, delivering content, and facilitating the learning process in ways that enhance both engagement and comprehension (Handrianto et al., 2021). Its approach is grounded in brain-based learning principles and emphasizes meaningful student involvement. A key strength of the quantum learning model lies in its ability to stimulate students' interest and motivation through a structured design framework known as TANDUR, an acronym for *Tumbuhkan* (Grow), *Alami* (Experience), *Namai* (Name), *Demonstrasikan* (Demonstrate), *Ulangi* (Repeat), and *Rayakan* (Celebrate) (Afniyati et al., 2018). This framework encourages active participation, repetition, and emotional engagement—key factors in long-term retention and meaningful learning. By combining cognitive, emotional, and social aspects of learning, quantum learning supports a more holistic and student-centered educational process.

The purpose of this study is to implement the quantum learning model to improve learning outcomes on the topic of the water cycle in Grade 5 at SD Islami Daarunnadwah. Through the application of this model, it is expected that various forms of student learning activity will emerge, promoting active engagement and meaningful participation. In essence, this model aims to foster effective educational interaction, where the teacher serves as a facilitator and motivator, and students take an active role as learners. For such interaction to be effective, the learning process must emphasize student-centered activities, with students becoming more active than the teacher in the classroom. By applying the quantum learning model, science learning is designed to be more enjoyable, interactive, and student-driven, thereby enhancing the overall quality of elementary science education. Moreover, this approach supports the effective implementation of the current curriculum by encouraging active, creative, effective, and joyful learning (commonly known in Indonesia as *PAKEM*). Ultimately, quantum learning is expected to increase students' understanding of scientific concepts and contribute to the creation of a more dynamic and responsive classroom environment.

METHODS

The type of research employed in this study is Classroom Action Research (CAR), a form of reflective inquiry aimed at improving and enhancing teaching and learning practices in the classroom through deliberate and systematic actions. This research model emphasizes professional development through cycles of planning, action, observation, and reflection. In this study, the research was conducted collaboratively between the researcher and the classroom teacher, where the researcher served as an observer and the teacher carried out the instructional activities. This collaboration allowed for more comprehensive observation and implementation of the learning intervention. The CAR was conducted at SD Islami Daarunnadwah, located in Limo District, Depok City, over a period of three months, from April to June. The setting and timeframe were chosen to allow sufficient opportunity for planning, implementing, and evaluating the application of the quantum learning model to improve student learning outcomes, particularly in the science topic of the water cycle.

The subjects of this research were 21 fifth-grade students at SD Islami Daarunnadwah, consisting of 12 female and 9 male students. This CAR adopted the model developed by Kemmis and McTaggart (1988), which is widely known as the spiral model (Aliyyah et al., 2020). This model emphasizes a continuous cycle of planning, action, observation, and reflection. After each cycle is completed, particularly after the reflection phase, the findings are used to revise and improve the planning for the next cycle. This iterative process enables researchers and practitioners to make data-informed adjustments to enhance teaching practices and learning outcomes in a systematic and sustainable manner.

The data collection phase in this study employed two primary methods: quantitative and qualitative. Quantitative data were obtained through tests administered at the end of each cycle to measure student learning outcomes, as well as assessment sheets used to evaluate both teacher and student activities during the learning process. Meanwhile, qualitative data were gathered through observations, focusing on student engagement and the teacher's ability to implement the quantum learning model effectively. In addition, data on teacher perceptions and responses to the use of quantum learning were collected through interviews, providing insights into the practicality and impact of the model from the teacher's perspective.

The success indicator for this CAR research was that 100% of students would achieve a score above 75, or at least show an increase in the number of students reaching the minimum mastery level. This benchmark is based on the Teaching and Learning Completion Standards (SKBM) established by SD Islami Daarunnadwah for the science subject (IPA). Achieving this standard would indicate that the implementation of the quantum learning model had effectively improved student learning outcomes in accordance with the school's academic expectations.

RESULTS AND DISCUSSION

Pre-Cycle

Based on the findings from preliminary interviews, SD Islami Daarunnadwah continues to use the traditional lecture method for teaching fifth-grade science. This approach led to low student engagement and interest during lessons, which significantly affected their learning outcomes. The pre-cycle assessment showed that most students scored below the minimum completeness criteria (KKM). The class average was 72.4, with only 28.57% of students meeting the learning standards, while 71.43% did not.

Cycle I

In Cycle I, the teacher applied the quantum learning model to enhance students' understanding of the material. By connecting the lessons to real-world situations, the otherwise complex science topics became more accessible. This approach increased students' enthusiasm for participating in the lessons and actively seeking answers during experiments. This aligns with DePorter et al. (2000), who describe quantum learning as an innovative approach that fosters student learning by creating a dynamic classroom environment and integrating all aspects of the learning experience through interactive engagement (Sujatmika et al., 2018).

Table 1. Cycle I Learning Outcomes

KKM	Number of students	Percentage (%)	Average
Qualified	15	71,43%	78,6
Unqualified	6	28,57%	

The table above showed an increase in the average grade from the pre-cycle to Cycle I, rising from 72.4 to 78.6. The highest score was 95, while the lowest was 60. The percentage of students meeting the Minimum Competency Criteria (KKM) in Cycle I increased significantly, from 28.57% to 71.43%. Regarding science learning completion in Cycle I, 15 students achieved completion, while 6 did not.

The observers' notes also provided several evaluations and suggestions for improvement in the next cycle. These included: 1) students were still confused and adjusting to the quantum learning approach; 2) the classroom atmosphere was less conducive due to excessive singing; 3) students remained shy and hesitant to demonstrate their observations. Based on these critiques and recommendations, the researcher identified the key issues to guide the improvement of the classroom action plan for the next cycle.

Cycle II

The actions implemented in Cycle II continued to employ the quantum learning model. Learning outcomes showed further improvement compared to Cycle I, as evidenced by an increase in the class average score to 84.43. Additionally, the percentage of students meeting the Minimum Competency Criteria (KKM) reached the target indicator of 100%.

Table 2. Cycle II Learning Outcomes

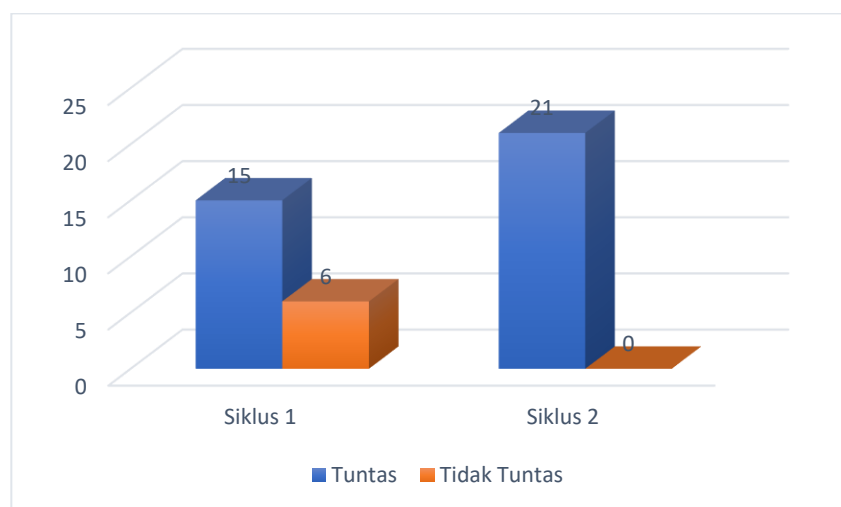
KKM	Number of students	Percentage (%)	Average
Qualified	100	100%	84,43
Unqualified	0	0	

The implementation of the quantum learning model in Cycle II proved to be more effective than in Cycle I. This improvement can be attributed to the teacher's more intensive guidance, supervision, and use of rewards, which helped motivate students to participate more actively in the learning process. Student engagement and performance showed a noticeable increase compared to Cycle I. This aligns with the view of Djamarah & Zain (2002), who stated that recognizing students' achievements and providing rewards are forms of motivation that help sustain students' interest in the learning material (Alhamro & Usman, 2025). The data

obtained in Cycle II indicated that the research objectives have been successfully met, and therefore, continuation to the next cycle is unnecessary.

The research findings indicated that the implementation of the quantum learning model in Cycle I led to an improvement in learning outcomes. The number of students who did not meet the minimum competency criteria decreased from 15 students (71.43%) to 6 students (28.57%). Following the more optimized application of the model in Cycle II, all students successfully achieved learning completion, reaching 100%.

Picture 1. Histogram Diagram of the Development of Students' Learning Outcomes from Cycle I to Cycle II



Based on the data, it can be concluded that the implementation of the quantum learning model in teaching the water cycle concept in science successfully improved the learning outcomes of fifth-grade students at SD Islami Daarunnadwah during the 2021/2022 academic year.

CONCLUSION

The implementation of the quantum learning model using the TANDUR method in the fifth-grade science subject on the water cycle at SD Islami Daarunnadwah was carried out through two cycles of classroom action research. In each cycle, from Cycle I to Cycle II, student learning outcomes showed a significant improvement. This improvement can be attributed to the effectiveness of the quantum learning model in actively engaging students, thereby creating a more conducive and supportive classroom environment. As a result, science learning outcomes for fifth-grade students at SD Islami Daarunnadwah improved noticeably.

At the pre-cycle, the science learning outcomes of fifth-grade students was relatively low. The average class score was only 72.4, with a learning completion rate of just 28.57%. In Cycle I, the implementation of the quantum learning model combined with varied teaching methods led to an improvement—the average class score rose to 78.6, and the completion rate increased to 71.43%. In Cycle II, enhancements made to the application of quantum learning included increased teacher encouragement, group guidance, active student participation through questioning and feedback, reinforcement strategies, and the use of heterogeneous groupings. As a result, student achievement in science improved even further, with the average class score reaching 84.43 and the learning completion rate achieving 100%.

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