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## IMPROVING THE MATHEMATICS ABILITY USING QUANTUM LEARNING METHOD FOR ELEMENTARY STUDENTS

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**Abstract.** The implementation of an appropriate learning model can enhance students' knowledge of fundamental mathematical concepts. The objective of this research is to enhance the ability of elementary school students to calculate the area of a rectangle by employing the quantum learning method. This research was conducted in a classroom setting and consists of seven steps: identifying issues, selecting strategies, compiling learning scenarios, exercising learning scenarios, determining success criteria, implementing scenarios, observing, and reflecting. Observation, interviews, written tests, and documentation were employed to gather the research data. This was followed by quantitative and qualitative analyses of the data. The study's findings suggest that the quantum learning model has the potential to enhance student learning assessment results by facilitating the determination of the area of a rectangle. Additionally, it has been demonstrated to increase student engagement and interest in the learning process. Conversely, educators develop a greater capacity for creativity and proficiency in the teaching of mathematics.

**Keywords:** Mathematics Ability Quantum Learning Method Elementary Students.

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### I. INTRODUCTION

Formal learning typically occurs within structured educational organizations, specifically schools. In educational institutions, students and teachers engage in the learning process. The objective of education is to enhance students' competencies in cognitive, attitudinal, or skill-based areas. The enhancement of students' cognitive ability is evidenced by the final exam results, which have improved compared to the prior evaluation. Progress exams are assessments designed to evaluate the extent of students' knowledge advancement (Hermasari & Yudistyaningrum, 2021). The test findings might be utilized to assess the enhancement in students' learning outcomes or the extent of their information acquisition.

The educational process in schools is intrinsically linked to several interdependent components, including students, teachers, learning materials, and facilities and infrastructure. Mathematics is a subject taught in elementary school (Soedibyo, 2003). The acquisition of mathematical knowledge extends beyond mere counting, formulae, or prevalent conceptual errors. Mathematics is an art that

enhances students' reasoning skills in addressing diverse challenges encountered in numerous facets of daily life (Rohman et al., 2023). If the notion of mathematics is profound and applied with an effective learning model, then the study of mathematics will become more interesting, and students' competencies will enhance.

Teachers are a crucial component in the achievement of learning outcomes. Teachers proficient in several instructional approaches demonstrate strong pedagogical ability. When teachers possess strong pedagogical skills and implement appropriate learning models, engaging and enjoyable educational experiences are fostered, leading to an enhancement of students' abilities. Conversely, if the teacher's pedagogical competency is deficient, resulting in boring instruction, the student's learning outcomes will undoubtedly fall short of expectations. Teachers possessing strong pedagogical ability will inspire students to engage in learning (Anggraeni & Yuliawati, 2016). It is crucial for teachers to enhance their pedagogical competencies, particularly in the mastery of diverse learning paradigms.

The study challenge is how the quantum learning model can enhance the capacity of third-grade children at Jayapura Adventist Elementary School to calculate the area of a rectangle. This study aims to enhance the pedagogical methods employed by teachers to elevate the proficiency of third-grade students at Jayapura Adventist Elementary School in calculating the area of a rectangle.

The main problems faced by researchers during the preliminary data collection at Jayapura Adventist Elementary School were: (1) Teachers employing teacher-centered pedagogies, resulting in minimal student engagement and passive listening; (2) Students exhibiting a lack of enthusiasm for learning due to unengaging content; (3) The application of unstructured learning models, which were merely functional; (4) Textbooks. This led to a disruption in the learning process, preventing the optimal achievement of the established learning objectives. Another factor was the stagnation of students' talents, as seen by their grades failing to meet the school's established standards.

This research is based on the principles of the quantum learning model hypothesis (DePorter, Bobbi, dkk. 2010). This strategy is considered more effective and innovative in enhancing learning outcomes (Eka Permana et al., 2016); (Faj et al., 2018). Subsequently, the application of the TANDUR concept in education according to Astuti et al., (2018); Sianturi (2022); Cahyaningrum and Asyhari (2019) can improve reading skills (Sari et al., 2019); enhance the capacity to resolve mathematical difficulties in daily life (Nugraheni & Marsigit, 2021).

Extensive research on quantum learning models has been undertaken by scholars, yielding diverse outcomes. Numerous studies utilizing quantum learning models influence students' reasoning abilities (Astawan & Rati, 2016); quantum learning model to enhance student learning outcomes (Faj et al., 2018); The efficacy of the quantum learning model in facilitating science education (Wote et al., 2020); The effectiveness of the quantum learning model in enhancing creativity and mathematics learning results (SHOLIKAH, 2018); Video-assisted quantum learning to enhance psychomotor learning outcomes (Ramadhani & Ayriza, 2019); and The impact of the planting learning paradigm on students' mathematical comprehension and reasoning skills (Astuti et al., 2018).

This classroom action research aimed to enhance learning through the quantum learning paradigm, enabling grade 3 students at Advent Jayapura Elementary School to improve their proficiency in calculating the area of a rectangle in mathematics

## II. METHODS

### Research Setting and Subject

This research was carried out at Advent Jayapura Elementary School. The courses comprised 17 third-grade students, including 7 males and 10 girls, who failed to achieve the minimal score from a total of 32 students, which consisted of 14 boys and 18 girls, in mathematics. The criterion for student completion is achieving a minimum score of 100%.

### Research Procedure

This research was conducted as classroom action research. The implementation of classroom action research involved seven steps: (1) identifying the problem, (2) selecting an alternative strategy, (3) developing a learning scenario based on the selected strategy, (4) practicing the learning scenario, (5) establishing success criteria, (6) executing the meticulously prepared scenario, (7) observing, and (8) reflecting (Rukminingsih, 2020). This study comprised research stages including design, implementation, observation, and reflection. The interconnection among the four components was perceived as a singular cycle.

The study used a classroom action research methodology based on the Kemmis and McTaggart model, utilizing a self-reflective spiral process that commences with preparation, followed by action and observation, reflection, and re-planning if necessary (Juanda, 2016). The study was executed in two phases, with each phase comprising two meetings. The initial two meetings were designated for the presentation of the information, concluding each session with an evaluative assessment of the students.

#### 1. Planning

The actions undertaken during this planning phase are as follows:

- a. Creating learning scenarios with quantum learning models.
- b. Creating learning devices.
- c. Preparing learning materials.
- d. Compiling assessment materials

#### 2. Implementation

The execution of cycle 1 learning occurred across 2 sessions (4 × 35 minutes). In this study, the researcher functioned as the instructor while the classroom teacher served as the observer. This phase is the implementation step of all established action plans. The learning tactics and situations outlined in the planning must be effectively executed. Throughout the educational activities, the instructor implements learning procedures that correspond to the established learning scenarios.

#### 3. Observation

At this point, the class teacher, in the capacity of a researcher, conducts observations and documents pertinent occurrences during the execution of the cycle. The data collection is conducted utilizing prepared observation and assessment instruments. Monitoring students throughout the educational process through the quantum learning concept.

#### 4. Reflection

Upon the completion of the learning process, the researcher and the class teacher evaluate the execution of the learning in Cycle 1 utilizing the quantum Learning model. Furthermore, they assess students' comprehension throughout the learning process. Provided that all proceeds well, it will progress to the subsequent cycle until all students attain a minimum score of 5.5 and their competencies improve.

### **Data Collection Technique**

Researchers undertake a sequence of activities to acquire valid data. The employed procedures include observation, interviews, written assessments, and documentation.

#### 1. Observation

This observation was directly conducted by the researcher. This was executed to acquire more precise data. Observations occur at pre-learning, initiation, and during the learning process. Observations commence with the compilation of data requirements, which are subsequently integrated into the designated observation format.

#### 2. Interview

Interviews were conducted in person and individually. Previously, suitable inquiries would be formulated to extract the necessary information. Interviews were administered to third-grade students.

#### 3. Written Test

The written test aimed to assess the educational achievements of students. The assessment was administered prior to and during the learning process utilizing the quantum learning model at the conclusion of the cycle.

#### 4. Documentation

Documentation was a data gathering method that encompasses student activity outcomes, including photographs, archives, records of school conditions and history, as well as educational materials utilized during the research.

#### 5. Validity of the Data

All acquired data must be evaluated for its validity. Evaluating the reliability of data by technical triangulation. Technical triangulation involved verifying the credibility of data by cross-referencing it with the same data source using various methodologies. This ensures the data was genuinely valid.

### **Data Analysis Technique**

The employed data analysis strategy was the mixed methods research approach. Mixed methods refer to the integration of quantitative and qualitative research approaches, resulting in the collection of both quantitative and qualitative data. Qualitative data analysis employed the Miles and Huberman analytical framework. Qualitative data analysis was conducted interactively and persistently until saturation is achieved. During the execution of quantitative data analysis, the average initial data was compared to the average data following the completion of the learning cycle. Furthermore, it utilized statistics on the percentage rise in student value.

### **Achievement Indicators**

The achievement indicator of this study is for third-grade students at Jayapura Adventist Elementary School to enhance their proficiency in calculating the area of a rectangle, as demonstrated by results that meet or above the standard benchmark

## **III. FINDINGS AND DISCUSSION**

### **Cycle 1**

Cycle 1 involved the discussion and exploration of the nomenclature and characteristics of planar shapes, as well as

the representation of rectangular models. The test questions were drawing a rectangle and labeling it, identifying the names of the rectangle's sides, naming the corners of the rectangle, stating the number of sides, and comparing the length and width of opposite sides. The application of learning employs the quantum learning model, comprising stages such as apperception, exploration, explanation with questions and answers, and the development of learning implementation based on the TANDUR principle. The findings from cycle 1 indicated that students achieved a 100% proficiency in drawing flat shapes. Only 52.94% were successful in writing the names of new angles. The success percentage for identifying the names of the sides of planar objects, specifying the number of sides, and comparing opposite sides was 94.12%. The assessment results indicated that 0% of students scored below the standard score, 50.88% achieved a score of 60, 58.82% attained a score of 80, and 35.29% received a score of 100.

During the evaluation of material regarding sides, students initiate the activity by examining items and rectangular planar shapes. Students subsequently execute tasks as per the directives outlined in the Student Worksheet provided by the instructor. The data indicates that students have mastered six aspects: the nomenclature of plane shapes, identification of the sides of plane shapes, measurement of the length of the sides of rectangular plane shapes, measurement of the width of the sides of rectangular plane shapes, comparison of the opposite sides of rectangular plane shapes, and identification of the sides of rectangular plane shapes, including the long and short sides when the image is rotated. Initially, hardly 23.5% of students comprehended the designation of the planar shape. Students that mastered the content after utilizing the quantum learning paradigm achieved a 100% proficiency rate. In the content depicting the lateral aspect of the plane figure, students achieved a 100% proficiency rate, an increase from the prior 35.2%. The material demonstrating the elongated side of the rectangular plane shape was grasped at 100%, an increase from the previous 20% proficiency. Similarly, the material displaying the broad side of the rectangular plane shape increased to 100%, up from 25%. The comparison of the opposing sides of a rectangular plane yielded a result of 94.12%, while the nomenclature of the sides indicated the long and short dimensions when the image is rotated by 100%. The proficiency in the six materials shown a notable enhancement, culminating in an average final achievement of 94.12% following the implementation of the quantum learning model.

Student engagement in the learning process influences the extent of knowledge acquisition. Their engagement in learning manifests as passion, the audacity to inquire, and a commitment to participation. The maximum score is 4.00, with an average of 3.18 indicating a favorable assessment for students eager to learn, an average of 3.53 reflecting a positive evaluation for students who actively inquire during lessons, and an average of 3.24 denoting a commendable rating for students' commitment to participation in learning. Alongside student attitudes, engagement in learning

activities or skills significantly influences overall learning outcomes. Consequently, student engagement and competencies are also assessed. The noticed aspects include a willingness to learn, the ability to make observations, and the capacity to work in front of the class. The observation results indicated an average value of 3.41, reflecting a favorable scale for student learning readiness; an average of 2.88, denoting a sufficient scale for student observations; and an average of 2.71, representing a sufficient scale for student presentations in front of the class.

The proficiency of teachers in implementing the quantum learning paradigm must also be considered, as it will influence the outcomes. Consequently, observations were conducted regarding the execution of instruction by teachers, focusing on aspects such as teacher preparedness to initiate learning activities, classroom management proficiency, time management skills, capacity to provide apperception, material delivery effectiveness, questioning techniques, discussion facilitation abilities, application of TANDUR, and capability to conclude learning sessions. The observations indicated that the learning process had a success rate of 95%. This signifies that teachers have proficiently executed the quantum learning paradigm in their instructional practices. The comprehensive reflection from cycle 1 utilizing the quantum learning model on mastering the identification and description of rectangular flat shapes has been accomplished. The student's score of 100% demonstrates compliance with the school's standard score threshold. Proactive students and teachers who excel at learning. This is a prerequisite for advancing to the subsequent cycle. This also demonstrates that there were no substantial issues in the execution of learning during cycle 1. The deficiencies in cycle 1 will be rectified in cycle 2 following a reflective analysis.

## Cycle 2

In cycle 2, the subject matter pertains to the calculation of a rectangle's area. Two ways are employed to calculate the area of a rectangle: utilizing a unit square and applying a standard formula. In practice question 1, students determine the area of a rectangle utilizing a unit square. Data about student success and achievement from the implementation of the learning indicated a minimum threshold of 100% for question number 1, 88.24% for question number 2, and 94.12% for questions number 3, 4, and 5.

In question 2, the formula is employed to calculate the area of a rectangle. The student's score data from this activity is as follows: 82.35% for questions 1 and 2, 76.47% for question 3, 88.24% for question 4, and 82.35% for question 5. The percentage of student accomplishment scores in the range of 0 - 55 is 0%, in the range of 56 - 69 is 0%, in the range of 70 - 89 is 29.41%, and in the range of 90 - 100 is represented by 12 students. An evaluation of students' attitudes and psychomotor skills was conducted in the learning process. This also facilitates the attainment of overall scores and the effective implementation of the quantum learning paradigm. Observations of student attitudes yielded assessment results: student enthusiasm in

learning was rated at 4.00, student willingness to ask questions was rated at 4.00, student engagement in learning was rated at 4.00, and group cooperation received a score of 3.82. The students' attitudes are generally positive.

The measurement of student activity yielded an average learning readiness value of 3.88. The average value of group work was 4.00. The average courage to present in front of the class was 3.88.

## Discussion

The use of the quantum learning paradigm in Cycle I yielded favorable outcomes, assisting students in recognizing the names and elements of flat shapes, specifically rectangles. Researchers conducted activities that involved inquiring about students' interests, facilitating student observations, presenting and labeling shapes, elucidating their components, reiterating explanations, and acknowledging students' achievements. This educational activity was conducted due to the first observation that students were unfamiliar with the names and characteristics of two-dimensional shapes (rectangles). The class teacher employed monotonous methods, positioning himself as the focal point, which resulted in student disengagement and boredom. Consequently, the concept of rectangles was not effectively internalized, remaining confined to the students' superficial understanding.

Researchers' implementation of the quantum learning model in cycle I instruction can enhance students' proficiency in mastering the names and constituents of rectangles. The findings from classroom action study undertaken by researchers indicate that the quantum learning model is appropriate for classroom instruction with diverse student populations, aiming at enhancing their capabilities. The study results demonstrate a considerable enhancement in learning outcomes. In the second cycle of learning, the subject covered was the calculation of a rectangle's area. Two approaches are employed to determine the area of a rectangle: non-standard and standard. The area of a rectangle can be determined non-traditionally by calculating the unit square. This is executed to furnish students with a foundational understanding of region. The conventional method for calculating the area of a rectangle is by employing the formula  $\text{Area} = \text{Length} \times \text{Width}$ .

The processes in the learning process are largely analogous to those in cycle 1. The teacher first outlines the learning objectives and thereafter invites students to provide their feedback. This exercise operates efficiently, with students competing to articulate their experiences pertinent to the subject matter. The subsequent task involves students collaborating with their group members to utilize the Student Worksheet for calculating the area of a rectangle using a unit square box. In this activity, students exhibit considerable enthusiasm, resulting in significant improvements in their attitudes, skills, and learning outcomes, all of which meet the minimal standard value. Quantum learning can enhance students' capabilities and educational results (Sujatmika, 2018); (Nuraeni & Ariska, 2020), student reasoning (Astawan & Rati, 2016), improve student learning activities

(Jayantika, 2018), and students' critical thinking skills (Irwani, 2018).

The quantum learning paradigm not only enhances learning assessment outcomes and demonstrates improved student comprehension but also fosters student engagement and interest in learning. Generally, most students are significantly engaged in learning, conducting observations, and presenting their findings. Students have considerable enthusiasm for engaging in learning, and their attention is commendable. This is evident in their preparedness prior to studying and their earnestness and excitement throughout participation in the educational process. The students' courage and abilities have improved relative to prior assessments. Quantum learning enhances student engagement in the learning process and elevates their interest in acquiring knowledge (K Yuniar, A Rakhmawati, B Setiawan, 2019). The TANDUR type quantum learning model significantly impacts the comprehension of concepts and the development of motor skills concerning learning styles (Setyosari & Hanief, 2020).

The quantum learning model positively influences teachers' instructional skills. Teachers enhance their creativity and proficiency in instruction. This results in an enhancement of students' competencies in learning, particularly in mathematics with the calculation of a rectangle's area. The implementation of the quantum learning model enhances teachers' self-confidence and communication skills (Afacan & Gürel, 2019)

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