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Quantum Learning to Improve the Fourth Graders' Science Achievement in An Elementary School

Nimas Vindy Armadyaningtyas[1*], Woro Sri Hastuti[2]

[1] Pendidikan Dasar, Fakultas Ilmu Pendidikan dan Psikologi, Universitas Negeri Yogyakarta, Indonesia.

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Corresponding Author:
Nimas Vindy Armadyaningtyas
nimasvindy.2022@student.uny.ac.id

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Abstract: This study aims to increase the science learning achievement. The subjects of this study were 20 students of fourth grade students at Imogiri Elementary School, who used Quantum Learning model. The research design refers to the classroom action research which takes place in two cycles. Data collection through tests, observation and documentation. The data analysis techniques used are qualitative and quantitative descriptive techniques. At the natural syntax of Quantum Learning model, the teacher provides examples of real 3-dimensional models to students and the division into more heterogeneous groups. In the naming activity, the teacher explains the learning material using two languages, namely Indonesian and a foreign language. At the demonstrate syntax the teacher directs students to convey the results of their discussion in turn. The success criteria are if ≥ 75% of the total number of students get a score ≥ 75. This research shows the results of an increase in science learning achievement after using Quantum Learning. In cycle I the average student learning achievement was 73.25 then increased to 83.50 in cycle II. Based on this, it can be concluded that Quantum Learning can improve the science learning achievement of class IV students.

Keywords: Elementary school students; Quantum learning; Science learning achievement

Introduction

Education is increasingly developing as human civilization advances. This directs people to innovate to solve various problems in the world of education. Through education, individuals can improve their logic and way of thinking to face everyday problems. Education is a process of educating which is a process in order to influence students to influence students to be able to adapt themselves as well as possible to their environment, so that it will cause changes in themselves (Manurung et al., 2023). Twenty-first century learning must be able to provide students with provisions for the future (Haryani et al., 2021). In the 21st century, individuals are directed to have skills critical thinking, creativity, collaboration, and communication (Changwong et al., 2018). The issue orientation and principles of educational science are related to deep and meaningful learning problems, collaborative problem solving, adaptive learning, computational thinking, and critical thinking (Tanti et al., 2020).

The quality of education can be seen from the learning process (Akbariah et al., 2023). The learning process should be packaged in an attractive way so that students feel comfortable gaining learning experience. The learning process prioritizes activities that can provide meaning for students. The learning process is not limited to conveying material so that students can master it, but provides conditions so that students strive for a learning process within themselves (Syahdan Lubis, 2021).

A good learning process will lead children to ideal learning. Good learning is learning that provides opportunities and love for students (Aesih, 2023). The learning process is able to motivate children's overall creativity, thereby making students active and learning

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enjoyable (Hadibarata et al., 2019). Students are directed to be active and participative during the learning process, so that learning is student centered and provide meaning for himself (Tegeh et al., 2021). Adi (2021) further explained that student participation in direct learning will foster a scientific attitude and provide an understanding that science is not just learning but knowledge can be applied to various fields in everyday life.

The teacher challenge is to create innovative learning that provides opportunities to develop critical, creative, collaborative and communication competencies (Sujanem et al., 2023). Teacher as educator should use models that suit student needs in order to foster critical thinking skills (Toheri et al., 2019). Strategies that teachers can use to bring out student critical thinking power are: opening learning with appreciation, motivating students to know more deeply, involving acquisition activities, practice and procedural knowledge, having work that supports concrete and documented learning processes, relates to problems and seeks resolutions, allows for unexpected student thinking, provides time for reflection and feedback on the learning that has been implemented (Boronina et al., 2022).

A good teacher is expected to be able to master various learning models and methods and be able to compile innovative learning media so that they can facilitate students in achieving learning goals (Hikmawati et al., 2020). As a step to realize meaningful learning, teachers use various approaches, strategies and methods (Mutanaffisah et al., 2021). A variety of strategies can be applied in various learning, including science learning (Darwata, 2022). It is hoped that variations in strategies in science learning will enable students to explore their learning experiences. Science learning has a fundamental function in developing critical thinking skills (Wangsa et al., 2021). This science education is directed to inquiry to help student deepen their understanding of the natural surrounding (Putri et al., 2023).

In science learning, students not only learn about conceots but must understand a orocess of phenomena occurring by observing, demonstrating, experimenting, and exploring and constructing material (Septianita et al., 2023). Science learning is not only about mastering a collection of knowledge in the form of facts, concepts or principles but is also a process of discovery. The discovery process is carried out by directing students to construct concepts through various activities related to the material according to the science learning objectives (Fikriana et al., 2023).

The aim of science learning in elementary schools according to Isnaeni et al. (2021) is to form and develop cognitive, affective, psychomotor and creativity as well as train students to think critically in self-actualizing in understanding natural phenomena in their environment, so that students can face life's challenges increasingly competitive and able to adapt to changes that will occur in the surrounding environment. Based on this, science learning in elementary schools should be able to develop their curiosity and critical thinking power regarding the problems they face, so that comprehensive and meaningful learning achievements will be obtained.

Science learning is essentially based on scientific products, scientific processes and scientific attitudes (Elisa et al., 2023). Understanding the nature of science is not limited to memorizing knowledge and facts, but is an active process in studying nature. Rahmadhani et al. (2021) state that natural science as a product has natural meaning and its phenomena, behavior and characteristics are integrated into natural science concepts, laws and principles. Science as a process is an activity that involves cognitive abilities and leads to scientific activities carried out by scientific experts (Idris et al., 2022). Learning that directs students to work like scientists means that the learning process uses a science process skills approach. Science process skills are the key to student academic achievement (Ertikanto et al., 2018). Elementary school students are expected to have process skills that can be developed in the learning process. Science process skills function to teach students to understand the environment and develop critical thinking skills (Annisa et al., 2021).

Yanti (2021) further stated that this goal has not been fully achieved, because in general science learning has not developed process skills for investigating the natural environment, solving problems and making decisions. Based on this, it was identified that students still had difficulty solving several science problems. This has an impact on low science learning achievement.

Based on data obtained by researchers in class IV at an elementary school, science learning achievement, there are daily science test scores for the last three years, appears to still be low. This data can be seen in the following table.

Table 1. Pure Average Value of Daily Science Test Results for Class IV Elementary School

Year	Averag
2020	67.7
2021	69.9
2022	68.7

Based on the table above, the average science score for the last three years is 68.80. During the observation, the researcher also identified some problems in class IV, there are: most students were not active during learning, some students were not able to express opinions, there were students who dominated group discussions, students had difficulty understand the material through image media, students still make mistakes in answering questions, students have difficulty concluding the material they have learned, learning is not yet student centered, and the average science learning achievement is still low.

DePorter et al. (2015) states that Quantum Learning is an option that makes learning more enjoyable to improve student learning achievement. DePotter further explained that learning by using Quantum Learning will provide benefits, there are: having a positive attitude, increasing motivation, developing skills, increasing self-confidence, and increasing learning achievement. This statement is in line with the opinion of Wulandari et al. (2019) who state that Quantum Learning helps students to more easily understand the material so that it can improve student learning achievement. Widiyono (2021) further stated that Quantum Learning is learning that can increase students' understanding, motivation and activeness. Quantum Learning will make it easier for students to increase understanding and activity so that student learning achievement increases.

Anggara et al. (2021) explain that Quantum Learning is learning that actively involves students, both physically, mentally and emotionally. Learning is carried out by designing, developing and managing the learning system in such a way that learning is effective, enjoyable and exciting, there are carried out in the syntax of foster, natural, named, demonstrate, repeat and celebrate. This step ensures that students experience learning, practice, and ultimately achieve learning success and more meaningful learning.

Based on the description above, the researcher will conduct classroom action research with the title "Quantum Learning to Improve Science Learning Achievement of Grade IV Elementary School Students". Through the application of this learning, students are expected to be able to increase motivation and enthusiasm for learning, so that science learning achievement increases. Based on the above background, the formulation of the problem studied in this research is: how to improve science learning achievement by using Quantum Learning in fourth grade elementary school students? The aim of this research is to determine the increase science learning achievement by using Quantum Learning in fourth grade elementary school students. This research can be useful for expanding insight and scientific knowledge, especially regarding Quantum Learning in improving achievement in the science learning process.

Method

This type of research is class action research which consists of two cycles. According to Arikunto (2019) class action research is a reflection of learning activities in the form of an action, which is deliberately raised and occurs in a class together. The research procedure in Figure 1 refered to the Kemmis and Taggart design which consisted of two cicles for each cycle consists of 4 four aspects, that are planning, implementation, observation and reflection.

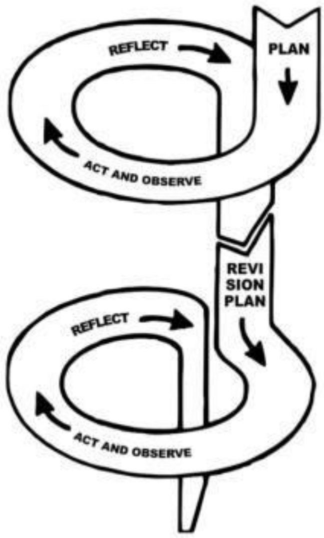

Figure 1. Kemmis and Mc Taggart action research (1988) implementation

The subjects of this study were students of four graders Imogiri Elementary School. Students of four graders amounted 20 students consisting of 11 female and 9 male students. Research used 2 research cycles covering four syntaxes in carrying out action research.

The data collection techniques in this research are tests, observation and documentation, while the data collection instruments are test sheets and observation sheets. The data collection instruments used were teacher activity observation sheets in teaching, observation sheets of student activities in learning, learning tools (syllabus, lesson implementation plans, and student worksheets).

This research uses qualitative and quantitative descriptive data analysis techniques. Qualitative data is obtained from the results of observations made when carrying out actions. Quantitative data is used to calculate and analyze daily test results in the form of numbers. The criteria for the success of the action in this research is characterized by an increase in the science learning achievement of fourth grade elementary school students through using learning activities Quantum Learning. The indicator of success in this research is if ≥

75% of the total number of students get a score of ≥ 75 which is the minimum completeness criteria score.

Result and Discussion

Researchers conducted observations before the action in August 2023 and found several problems such as students not being active during learning, most students not being active in expressing opinions, some students dominating during group discussions, most students still making mistakes in answering questions, some students having difficulty concluding the material, the learning has not yet taken effect student centered and the average grade IV science learning achievement is still low. In the pre-cycle, the average observation result for fourth grade elementary school students' science learning achievement was 66.84.

Action planning in cycle I are compiling teaching modules Quantum Learning, discuss with the relevant class IV teacher teach module with syntax Quantum Learning, prepare student worksheets, prepare teaching materials and learning media, create questions as evaluation material, prepare research instruments in the form of observation sheets, prepare documentation tools to record and take pictures of the science learning process in class, prepare the equipment needed when learning.

The actions in cycle I are carried out by the teacher by carrying out the learning process according to the teaching module used Quantum Learning. The actions in cycle I were carried out in 4 meetings on green plant material. There is the meeting schedule for cycle I.

Table 2. Schedule for Cycle I

Meeting	Date
First	Sept 26 2023
Second	Sept 27 2023
Third	Sept 30 2023
Fourth	Oct 2 2023

Each meeting lasts for two class hours and consists of three syntaxes, there are initial activities, core activities, and closing by applying Quantum Learning. Time allocation for initial activities is ± 10 minutes, core activities ± 65 minutes, and final activities ± 15 minutes.

The third syntax in the first cycle of class action research is observation. Observation activities are carried out simultaneously with cycle 1 learning activities. These observation activities observe the activities of students and teachers during the learning process. Researchers observed the process of implementing learning carried out by teachers during the learning process with Quantum Learning. Apart from that, researchers also observed learning activities carried out by students.

The results of the researcher's observations are that the teacher has implemented the Quantum Learning learning syntaxes in sequence, but there are several syntaxes that are missing optimal in implementation. In each learning process the teacher directs students to ask questions. Apart from that, the teacher also directs students to work together through group discussion activities and demonstrations. At the end of the lesson the teacher also gives students the opportunity to express their opinion and appreciate the students' learning efforts.

Observation activities were also carried out on students. The results of observations made by researchers show that the majority of students are able to participate in learning well. Students can take part in learning using the Quantum Learning model syntaxes, although there are several syntaxes that have not run optimally, there are the natural, named and demonstrate syntax. This causes teachers to have to provide more guidance to students who experience difficulties at that syntax.

The results of student observations during the learning process by applying Quantum Learning were also carried out by observing the results of daily tests on green plant material in the plant structure sub-chapter. These results were obtained based on daily test scores carried out after 4 meetings in cycle I.

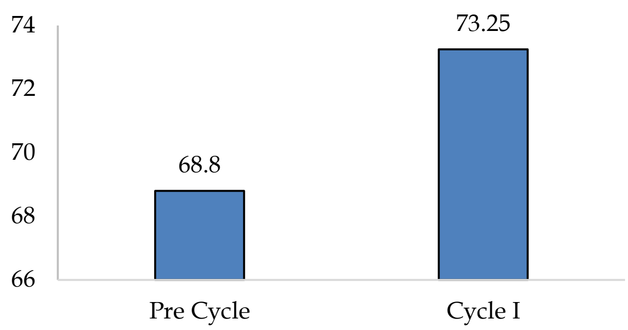

Figure 2. Observation result of student science achievement in cycle 1

Science learning achievement of class IV students in cycle I, there was 1 student or 5% who got a score of 90-100, 8 students or 40% who got a score of 80-89.9, a total of 6 students or 30% got a score of 70-79.9, there were 4 students or 20% who got a score of 60-69.9 and 1 student or 5% got a score of 50-59.9. The class average reached 73.25. This shows that the science learning achievement of class IV students has increased from pre-cycle, although it is still relatively low. The highest score is 90 and the lowest score is 55. Students who got a score below the minimum completeness criteria were 11 students.

Based on the results of observations in cycle I, reflection was obtained as a basic material for making improvements in the next cycle. Achievements at the foster syntax, teacher has been able to foster students learning motivation well. This can be seen from the level of student activity when answering questions from the teacher. There are no obstacles or improvements in this syntax. In the natural syntax, most students are able to complete assignments, although still with teacher guidance.

The natural syntax is not yet fully effective. This is caused by the division of groups being less heterogeneous and the teacher not providing a real model as an example of the final product being made. The improvement plan to be carried out is students are given real examples (products) by the teacher. Apart from that, the group division was carried out in a more heterogeneous manner.

At the named syntax, some students still need teacher assistance in giving names because of foreign language vocabulary. The obstacles in this syntax are, students are still confused about giving names to each aspect of the model because of the foreign language vocabulary. The improvement plan to be carried out is teachers provide explanations in two languages (foreign language and Indonesian) so that students understand the material more easily.

At the demonstrate syntax, some students are confident in conveying the results of their group discussions, even though they are still appointed and directed by the teacher. Some students are still reluctant to convey the results of group discussions. The improvement plans to be carried out are teachers direct all group members to take turns presenting the results of their group discussions.

At the repeat syntax students can repeat the material studied well and fluently. Students can summarize learning material well. There are no obstacles or improvements at this syntax.

At the syntax of celebrating students have received appreciation from teachers. This appreciation takes the form of praise, applause, thumbs up or gifts from the teacher. There are no obstacles or improvements at this syntax.

Based on the observation data, it can be seen that the results of cycle I show that the natural, named and demonstration syntaxes still require improvement. The foster, repeat and celebrate syntaxes have shown a good process. The class average in cycle I was 73.75, indicating that science learning achievement had not reached the expected success criteria.

Action planning in cycle II are compiling teaching modules Quantum Learning, discuss with the relevant class IV teacher teach module with syntax Quantum Learning, prepare student worksheets, pepare teaching materials and learning media, create questions as evaluation material, prepare research instruments in the form of observation sheets, prepare documentation tools to record and take pictures of the science learning process in class and prepare the equipment needed when learning.

Planning for learning activities in cycle II related to improving Quantum Learning is as follows: first, in the natural syntax, the teacher directs students to create a 3 dimensional model and the group division is carried out more heterogeneously. Second, at the named syntax, the teacher explains using two languages, Indonesian and English. Thirth, at the demonstrate syntax, the teacher directs all group members to take turns presenting the results of their discussion.

The actions in cycle II are carried out by the teacher by carrying out the learning process in accordance with the teaching module that uses Quantum Learning. The actions in cycle II were carried out over 4 meetings, the material is about photosynthesis.

Table 3. Schedule for Cycle II

Meeting	Date
First	Oct 24 2023
Second	Oct 7 2023
Third	Oct 8 2023
Fourth	Oct 11 2023

Observation activities were carried out together with cycle II learning activities. This observation activity observes the activities of teachers and students during the learning process.

Researchers observed the implementation of learning carried out by teachers while implementing Quantum Learning. The teacher has carried out the syntax of Quantum Learning sequentially and corrected deficiencies in cycle I. These improvements include giving examples of real models to students, grouping students more heterogeneously and directing students to express their opinions in turns.

Observation activities in cycle II for students showed an improvement from cycle I. This can be seen in the number of students who were active in answering questions from the teacher more than in cycle I. Apart from that, students were also more independent in carrying out assignments given by the teacher. Students who seemed passive during group discussions began to be confident in expressing their opinions and participating in the group. The results of student observations during the learning process with Quantum Learning were carried out by researchers by observing the results of daily tests in the photosynthesis sub-chapter. These results were obtained from the average value of learning outcomes in cycle II which consisted of 4 meetings.

Science learning achievement of class IV students in cycle I, there were 3 students or 15% who got a score of 90-100, 12 students or 60% who got a score of 80-89.9, and 5 students or 25% got a score of 70-79.9. The class average reached 83.50. This shows that the science learning achievement of class IV students has increased from cycle I. The number of students who achieved the minimum completeness criteria was 19 people.

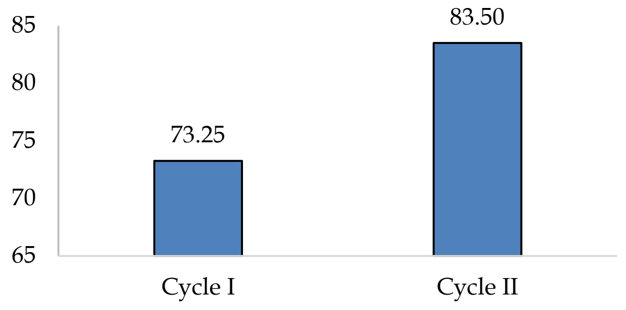

Figure 3. Observation result of student science achievement in cycle II

At the reflection syntax, researchers and teachers discussed the results of observations in cycle II. In the foster syntax, teacher has been able to foster students' learning motivation well. This can be seen from the level of student activity when answering questions from the teacher. There are no obstacles in the foster syntax.

The natural syntax has shown improvement. This can be seen from the 18 students who were able to complete the assignment. Meanwhile, 2 students still need teacher assistance in completing assignments. The named syntax shows changes from cycle I. All students are able to name each aspect of the model or experiment that has been created. There are no obstacles in the named syntax. At the demonstrate syntax, 19 students were brave and confident in conveying the results of the discussion. There was 1 student who was still reluctant to convey the results of the discussion. Teacher motivate students to develop their self-confidence.

At the repeat syntax, students can repeat the material studied well and fluently. Students can convey the essence of learning. There are no obstacles at this syntax. Not different from cycle I, in cycle II students received appreciation from the teacher. Students receive appreciation from teachers in the form of praise, applause, thumbs up and prizes. This makes the learning atmosphere enjoyable.

Discussion

This research was carried out in two cycles. The research design used in this research is a research model developed by Kemmis and McTaggart. The research model consists of four components, there are planning, action, observation and reflection (Ali et al., 2023). The planning syntax for cycle I has been carried out well. Researchers prepared all the necessary learning tools, there are teaching modules, student worksheets, learning media and evaluation questions.

The action and observation step have also been carried out well. The activity carried out at the beginning of learning is giving appreciation by the teacher, followed by the foster syntax. In cycle I and II, foster syntax has gone well. Students are directed to conduct questions and answers using image media during the appreciation session. This is in accordance with the statement by De Potter (2015) which states that learning activities are carried out by connecting the material being studied with events resulting from observations experienced by students.

The second activity is natural syntax. Students are directed to conduct group discussions in making models and experiments related to learning on green plant material. In cycle I, the teacher's role was still dominant because many students still had difficulty understanding 2 dimensional model material, especially parts of plant body structures that were not directly visible. Apart from that, there are some students who are still passive. This is because the division of groups is not heterogeneous. Improvements made in cycle II were the teacher providing real examples or models to students. One of the real models used by teachers is a photosynthesis model based on cardboard and used paper. This gives students direct or real experience of working on projects based on the material being taught. This action is in accordance with the Quantum Learning steps according to Rainis (2019) which states that the learning process will be more meaningful and enjoyable if students experience the material being studied directly. Furthur more Alika et al. (2021) tell that the function of learning media can be a means of supporting student learning.

When discussing, students appear to be more independent, so the teacher is no longer dominant in guiding them. Apart from that, teachers also divide groups more heterogeneously. The teacher evens out students with different abilities, so that students help each other and work together to complete group assignments. Rohayati et al. (2023) stated that an important aspect that teachers must pay attention to in implementing science learning is actively involving students to develop their critical thinking skills. Furthur more Sugiharto et al. (2022) tell that collaboration skills become essential for students to master because these skills become provisions for students to face global competation and improve social aspects. In addition to having science process skills, learners must also master collaboration skills.

The third activity is naming. At this step, students are directed to discuss naming each aspect of the model that has been created. In cycle I, the problem faced was that students often made mistakes in giving names because there were foreign terms and students were still confused about naming the names and functions of plant body structures. Improvements made in cycle II were that the teacher provided explanations in two languages, Indonesian and a foreign language. This is in accordance with the opinion of Indrayani et al. (2019) who state that at the named syntax, students are directed to develop abilities in constructing and making connections between concepts from the material discussed.

The fourth activity is a demonstrate. In cycle I, students still did not have the courage when directed by the teacher to demonstrate the model that had been created. Students seem less confident in presenting the results of their discussions in front of the class. In cycle II, the improvement made was that the teacher directed students to take turns demonstrating and conveying the results of their group discussions. This activity makes passive students become active and brave in expressing their opinions. This is in accordance with the opinion of (Sari et al., 2018) who state that by demonstrating in turn, students become more confident in actualizing all their potential. The learning process by applying the demonstration method emphasizes students learning (Prananda et al., 2023). Furthermore, research by (Nurlaela et al., 2021) states that the advantage of Quantum Learning is that it makes students more active and confident in the learning process because it gives students the opportunity to show their abilities in the demonstration phase. This activity can make it easier for teachers to control the level of students' understanding of the learning material.

The fifth activity is repeat. In cycles I and II, students were able to remember and repeat the material presented by the teacher. This can be seen when actively answering questions from the teacher regarding the day's learning. This is in line with the opinion of De Potter (2015) who states that Quantum Learning is tips, instructions or strategies that can sharpen students' understanding and memory and make learning a happy and useful process.

The sixth activity is celebrate. In cycles I and II, this activity was carried out by the teacher well. Students are given appreciation in the form of praise, thumbs up, stickers, stationery or stars for successfully studying the material. This is the same as one of the principles of Quantum Learning, there is recognizing every effort by appreciating students' efforts, no matter how small. Sumartini (2023) states that Quantum Learning is learning that rewards students for their effort, perseverance and success in learning the material.

Based on the actions that have been taken, the data shows that student test results have improved. This is shown by the students' daily test results 73.25 in cycle I to 83.50 in cycle II. This explanation shows that Quantum Learning can improve the learning achievement of fifth grade elementary school students. The application of Quantum Learning requires students to be more active in groups, have the courage to express their opinions and be able to independently complete assignments given by the teacher so that student learning achievement increases. The increase in student learning achievement can be seen from the results of students' daily tests per cycle. This is in line with the opinion of De Potter (2015) who explains that Quantum Learning will provide benefits, there are: having a positive attitude, increasing motivation, developing skills, increasing self-confidence and increasing learning achievement. Based on this, it can be concluded that Quantum Learning can improve the learning achievements of fifth grade elementary school students.

Conclusion

Quantum Learning can improve the science learning achievement of fifth grade elementary school students. Teacher teach students using Quantum Learning steps, there are foster, natural, named, demonstrate, repeat and celebrate. At the natural syntax, the teacher provides examples of real 3-dimensional models to students and the division into more heterogeneous groups. In the naming activity, the teacher explains the learning material using two languages, namely Indonesian and a foreign language. This is done so that students do not get confused in naming each aspect of the model and explaining the function of the designated aspect. Next, at the demonstrate syntax the teacher directs students to convey the results of their discussion in turn. This activity is to direct all students to be active and participative. The science learning achievement of fifth grade elementary school students has increased after using Quantum Learning. In cycle I the average science learning achievement was 73.25. In cycle II his achievement increased to 83.50. In cycle I, 75% of the students had above average science learning achievements, while in cycle II the number increased to 95% of the total students.

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Author Contributions

Conceptualization, N.V.A, W.S.H.; methodology, N.V.A.; validation, H.; formal analysis, N.V.A.; investigation, N. V. A.;

resources, N.V.A.; data curation, N.V.A.: writing—original draft preparation, N.V.A.; writing—review and editing, W.S.H. and N. V. A.: visualization, N.V.A.All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The author declares no conflict of interest.

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