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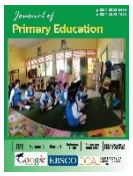

The Effects of Multimedia Assisted *Quantum Learning* Models Towards Science Learning Outcomes in Elementary School Students

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Abstract

The low student learning outcomes usually due to learning process which have not used a variety of models and emphasizesmemorization learning. Media is used to create interesting learning so that students canbe active in learning activities. The objective of this research was to determine the effect of multimedia-assisted quantum learning models on science learning outcomes in elementary school students. This type of research was a Quasi Experimental with pretest-posttest control group design. The samples of this research were 28 students of grade IV students of SDN Ngesrep 02 and 27 students of grade IV of SDN Ngesrep 03. Instruments used in this researchwere observation sheets and tests. Data analysis techniques include normality test, homogeneity test, n-gain score test and t-test. The results show that the average score of learning outcomes in the experimental class was 76.85 and the control class was 73.39. The independent test results state that there are differences between the experimental class and the control class, indicated by $t_{count}>t_{table}$ of the significant value of 0.024 <0.05. It can be concluded that there was a significant influence in learning using multimedia-assisted quantum learning models towards student learning outcomes.

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INTRODUCTION

Science is one of the contents of the lessons in the 2013 curriculum. Science is a collection of systematic theories, its application is generally limited to natural phenomena, created and develop through scientific methods such as observation and experimentation and requires scientific attitudes such as curiosity, openness, honesty, and so on (Trianto, 2010). Achievement of science competencies in elementary schools applies minimum standards that must be achieved nationally. Science lessons require understanding and mastery of concepts rather than memorization.

The results of observations in class in the sciences learning process, teachers have not applied the learning model which support the expected goal. Submitting new knowledge to students emphasizes on learning to memorize. Students learning outcomes have not been maximized was indicated by many students who have not reached yet the minimum completeness criteria. The teacher was not accustomed to using multimedia in delivering the material. So that the attention and activeness of students towards learning were reduced and studentshad difficulties in understanding abstract material and learning outcomes were not as expected, especially on sciences subjects.

The application of innovative learning models can assist the learning process in deliver messages and content. Multimedia-assisted quantum learning models can make students active in learning so as to improve learning outcomes. Maskuriet al. (2016) state that the quantum learning model using the TANDUR framework (***T****umbuhkan*/Grow, ***A****lami*/Natural, ***N****amai*/Name, ***D****emonstrasikan*/Demonstrate, ***U****langi*/Repeat, ***R****ayakan*/Celebrate) can improve the science learning outcomes in elementary school students. `Astuti (2017) states that the quantum learning model is effective in improving student learning activities and student learning outcomes. One of the innovations in this model is by using multimedia.

The use of multimedia in learning was very necessary because it attracted the attention of students. Naz and Akbar (2010) state that it is informed that media or learning aids can help teachers for transfer knowledge in impressive ways, and design learning more effectively. Hanim et al. (2016) suggest that by using multimedia students can see, hear and even interact so that the students' sense of involvement in the use of interactive learning multimedia was more than just using textbooks and pictures alone.

In this study multimedia was a multimedia presentation used hardware in the form of a computer/laptop, LCD, and sound, and powerpoint software that combines all media elements such as text, video, animation, images, graphics, and sound into a single integrated presentation (Munadi, 2013). In the context of learning media, PowerPoint was used to present learning messages. This powerpoint-based media was a medium to assist teachers in supporting the learning process that was displayed in the form of slides with the support of multimedia elements (text, graphics, animation, sound, and video) so that teaching materials were originally abstract can be presented more concretely.Gaol (2014) PowerPoint media was used as an intermediary for the delivery of material, by using PowerPoint media it hoped that learning will be more attractive to students. So that it can increase interest, attention, motivation and student learning outcomes. Based on these problems, the objective of this research was to examine the effect of multimedia-assisted quantum learning models on science learning outcomes in elementary students so that it can be used to improve the learning process and improve student learning outcomes.

METHOD

The research design used as an experimental model with a quantitative model in the form of Quasi-Experimental Design. The sample of this research was the fourth-grade students of SDN Ngesrep 02, Kota Semarang, which totaling of 28 students as the control class and that ofthe SDN Ngesrep 03, Kota Semarang

which totaling of 27 students as the experimental class. Instruments used in this researchwere observation sheets and tests. The observation sheet was used to determine the initial conditions of students and teachers before the study was conducted. The test used a written test to measure the level of understanding of students in the form of learning outcome data before and after students get learning using a multimedia-assisted quantum learning model. Data analysis techniques included prerequisite tests and final analysis tests. The prerequisite tests were analyzed with the normality and homogeneity tests, while the final analysis test was through the n-gain score test and the t-test. Homogeneity test used to find out the both samples have the same initial state before being treated. Normality test used to find out whether the data was normal or not. The n-gain test used to determine the increase of student learning outcomes and the t-test used to determine the effectiveness in terms of improving learning outcomes between classes using multimedia-assisted quantum learning models and classes without using the quantum learning model.

RESULTS AND DISCUSSION

The study experimental class was intervenedwith multimedia-assisted quantum learning, and the control class only intervenedwith quantum learning as the comparison in science learning by the topic of light. Preliminary data in the form of student learning outcomes have taken before the learning model applied to either the experimental class or the control class which used as a prerequisite test in research. The pretest learning outcomes of the control class and the experimental class were shown in Table 1.

Table 1. Pretest learning outcomes of the control class and the experimental class

Class	N	Average
Control	28	67.86
Experiment	27	67.96

Table 1 showed that the average pretest in the control class was 67.86 and the experimental class was 67.96. It sewed that the average results of the experimental class and the control class were not far adrift. The pretest results in Table 1 was used as a basis for the prerequisite tests including tests of normality and homogeneity tests. Data normality test was used to find out that the experimental class and the control class distributed normally. The results of the pretest normality test presented in Table 2.

Table 2. The result of Pretest normality

	Control	Experiment
N	28	27
Kolmogorov-Smirnov Z	.826	.864
Asymp. Sig. (2-tailed)	.503	.444

Data was normally distributeif the significance value (sig.) was more than 0.05. Based on Table 2 in the control class of 28 students obtain a significance of 0.503 while the experimental class with a total of 27 students obtain a significance of 0.444. Because of the significance in the experimental class and control class were above 0.05; so it can be concluded that the pretest value data in the experimental class and the control class were normally distributed.

A homogeneity test was carried out to investigate whether or not homogeneity is met in the variance between groups. The testing criteria is by looking at the significance value (sig.). If the significance value is> 0.05, then homogeneous data can be interpreted. The results of the homogeneity test is presented in Table 3.

Table 3. Test Results of Homogeneity in Pretest Values

Levene Statistic	df1	df2	Sig.
.010	1	53	.923

In Table 3 it known that the Test of Homogeneity of Variances table obtained a pretest significance value of 0.923. Since 0.923> 0.05 so it can be concluded that the pretest data

of the experimental class and homogeneous control. After the prerequisite tests fulfilled, proceed with the final analysis test.

The data used in the final analysis was posttest learning outcomes data which data have taken after the treatment was given. The average results of the control class and the experimental class posttest can be seen in Table 4.

Table 4. Posttest average results of the control class and experimental class

Class	N	Average
Control	28	73.39
Experiment	27	76.85

Before analyzing the effect of multimedia-assisted quantum learning models on student learning outcomes, normality and homogeneity tests conducted on the posttest results. The results of the posttest normality test presented in Table 5.

Table 5. Results of posttest normality test

	Control	Experiment
N	28	27
Kolmogorov-Smirnov Z	.957	1.096
Asymp. Sig. (2-tailed)	.319	.181

Based on Table 5, the significance of the experimental class data was 0.181 and the control class was 0.319. Because of the significance in the experimental class and control class was above 0.05; so it concluded that the posttest value data in the experimental class and the control class were normally distributed. While the result homogeneity test can be seen in Table 6.

Table 6. Results of Homogeneity Test of Posttest Value

Levene Statistic	df1	df2	Sig.
1.041	1	53	.312

In Table 6 it known that the Test of Homogeneity of Variances table obtained a significance value of 0.312. Because 0.312> 0.05, it can be concluded that the posttest data of the experimental and homogeneous control classes.

The learning outcome of the control class student before the treatment shows an average value of 67.86 so the average class did not fulfil the Minimum Criteria of Mastery Learning (KKM) and included in the medium criteria for the level of mastery learning. After receiving treatment by using the quantum learning model, student learning outcomes show an average value of 73.39, the average class had fulfilled the KKM and it included in the medium criteria for the level of mastery learning. In line with the research of Amalana et al. (2013) informed that the quantum learning model influences student learning outcomes. In addition, Imaduddin (2013) informed that the use of quantum learning approaches can affect student learning outcomes.

Student learning outcomes before and after treatment in the control class can be seen in

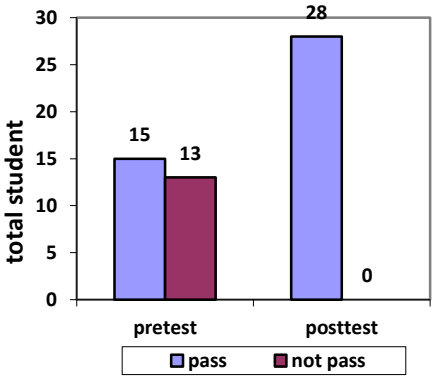


Figure 1. Student learning outcomes before and after treatment in the control class.

The learning outcomes of the experimental class students before treatment showed an average value of 67.96 so that the average class did not fulfil the KKM and included in the medium criteria for the level of mastery learning. After being treated by using a quantum learning model assisted with multimedia, student learning outcomes showed an average value of 76.85, so that the average class fulfil the KKM and it included in the high criteria for the level of mastery learning. Student

learning outcomes before and after treatment in the experimental class can be seen in Figure 2:

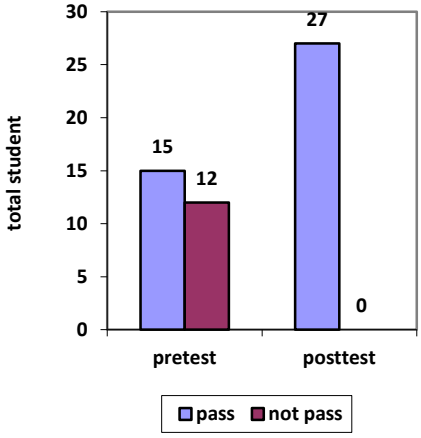


Figure 2. Student learning outcomes before and after treatment in the experimental class

This line same as research conducted by Kanadli (2015) that the quantum learning model can improve long-term learning skills that resulted in increasing academic achievement. This reinforced by Khairaniet al.(2016) that the learning outcomes of students in the classroom use the TANDUR type quantum learning model increasing seen from the average test scores of student learning outcomes. Research Putra et al. (2019) that it informed that the learning outcomes of students who follow the quantum learning model are in the high category. This was in accordance with the opinion of Acat (2014) that the quantum learning model influences students' academic achievement, retention, and attitude mark positively.

The results of students' answers to the control class before using the quantum learning model regarding light and its properties showed that students did not understand that the rainbow was the result of refraction and decomposition of white light into seven colors. It was evident from the results of students' answers that the rainbow is an example of light reflection and can only mention three colors in the rainbow, namely red, yellow and green.

The use of the quantum learning model at the "namai" stage, students form groups and work on worksheets. This stage related to the "demonstrasikan" stage, namely doing a practicum about light and its properties. The results of the answers from one of the groups can be seen in Figure 3.

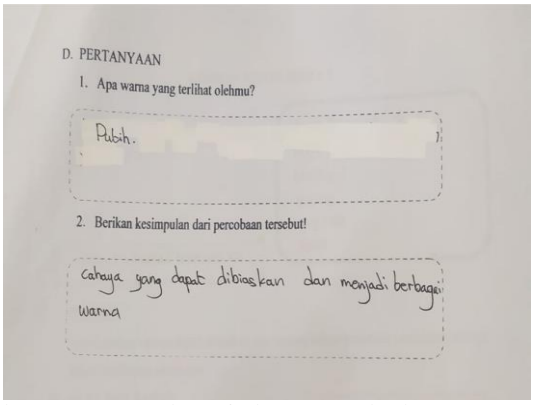


Figure 3. Results of the control class group's answers

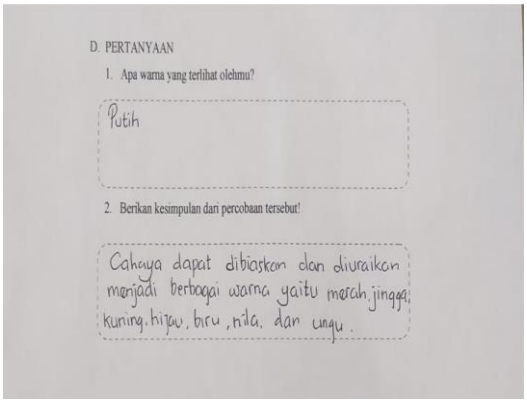
Figure 3 showed the results of the students' answers in the control class regarding light and the nature showed that students have not been able to write answers according to the questions, it was proven that students did not understand if white light will experience refraction and decomposition into various colors, namely red, orange, yellow, green, blue, indigo, and purple. The meaning students not able yet to explain the results of existing information into the questions.

In the control class there were differences in the results of students' answers before and after using the quantum learning model. It indicated by the better learning outcomes in the control class after using the quantum learning model than before using the quantum learning model.

Whereas the results of students' answers in the experimental class before using the multimedia-assisted quantum learning model regarding light and its properties showed that students did not understand that a rainbow was the result of refraction and decomposition of white light into seven colors. This was evident from the results of the students' answers that the rainbow was an example of light refraction and can only mention four colors in the rainbow, namely red, yellow, green and blue.

In the experimental class, the use of a multimedia-assisted quantum learning model at the "namai" stage, students form groups and work on worksheets. The worksheet displayed via slides. This stage related to the "demonstrasikan" stage, namely doing a practicum about light and its properties.

The results of the answers from one of the groups can be seen in Figure 4.


D. PERTANYAAN

1. Apa warna yang terlihat olehmu?

Putih

2. Berikan kesimpulan dari percobaan tersebut!

Cahaya dapat dibiaskan dan diuraikan menjadi berbagai warna yaitu merah,jingga, kuning,hijau, biru, nila, dan ungu.

Figure 4. Results of the experimental class group

Figure 4 showed the results of the answers in the experimental class that students be able to write answers according to the questions, namely explaining that white light will experience refraction and decomposition into various colors, namely red, orange, yellow, green, blue, indigo, and purple. Students can explain the results of the information that already exists in the questions.

In the experimental class there were differences in the results of students' answers before and after using the multimedia-assisted quantum learning model. It was indicated by the learning outcomes after using the multimedia-assisted quantum learning model better than before using the multimedia-assisted quantum learning model.

Based on the discussion above, in the control class and the experimental class, both before and after using the model, there were differences in learning outcomes. Thus it can be concluded that the experimental class better than the control class.

To analyze the improvement in learning outcomes by using multimedia-assisted quantum learning models N-gain the score test was employed. The N-gain score test performed on the control class and the experimental class by calculating the increase in the average value of pretest to posttest. The results of the N-gain score test were displayedin Table 7.

Table 7. The Results of Gain Score Test

Class	N-gain	Category
Control	0.159	Low
Experiment	0.259	Low

Based on Table 7 it can be seen that the N-gain results in the control class showed 0.159 with the low category and the N-gain from the experimental class showed 0.259 with the low category. Even though both of them were in a low category, the experimental class showed higher improvement scores than the control class, it can be concluded that the use of multimedia-assisted quantum learning models gave a greater increase than the quantum learning model.

These results were in line byAfniyati et al. (2018) that the application of interactive multimedia-assisted quantum learning models gave a positive response to learning that affects student learning outcomes. Huda et al. (2018) in their research that it informed that there was a significant influence on the use of quantum learning models on the learning achievement of elementary school students. To prove the hypothesis then proceed with the t-test.

Independent Sample t-test conducted to know the effectiveness of learning outcomes improvement. The results of the independent sample t-test were presented in Table 8.

Table 8. The Results of The Independent Sample t-test

Independent Samples t-Test								
		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
		T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Learning outcomes	Equal variances assumed	-2.316	53	.024	-.09910	.04279	-.18492	-.01328
	Equal variances not assumed	-2.317	52.998	.024	-.09910	.04276	-.18487	-.01333

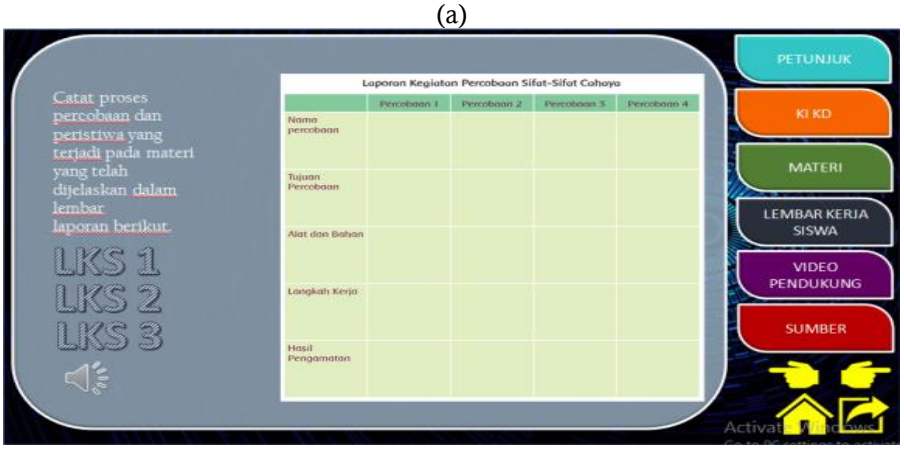
In hypothesis testing, there were several provisions that must be used as guidelines. These provisions were if $t_{count}<t_{table}$ or significance value> 0.05, then H_0 was accepted, and if $t_{count}>t_{table}$ or significance value <0.05, then H_0 was rejected. In this study, significance value of 0.05 was used. Based on Table 8, the significance value of 0.024 <0.05, so that $H_0$was rejected. So there was an average difference between the N-gain of the control class and the N-gain of the experimental class.

Based on descriptive N-gain values, it can be concluded that the N-gain of the experimental class was higher than the N-gain of the control class. This means an improvement in student grades before being given a method and after being given a quantum learning method with the help of multimedia was better than the improvement student grades before being given a method and after being given a quantum learning method without the help of multimedia. The influence of multimedia-assisted quantum learning models towards student learning outcomes can be obtained by the significance value of 0.024 <0.05. So, the quantum learning method with the help of multimedia was more effective in improving student learning outcomes compared to the quantum learning method without the multimedia-assisted.

The science learning of light topic and its nature by using the principles, strategies, and steps of quantum learning through the term *TANDUR (Tumbuhkan, Alami, Namai, Demonstrasikan, Ulangi, and Rayakan)*. With this technique, students are very enthusiastic about following the learning so that they can improve their learning outcomes. Ratnasari et al. (2018) in the implementation of the quantum model there are activities of reading, explaining, demonstration, training, discussion, group work, and repetition.

The quantum learning model assisted with powerpoint multimedia makes student more interested in learning activities that will affect their learning outcomes. The results of Rahmi et al. (2014) research showed that the developed science learning multimedia gave a positive response to students. The display of multimedia powerpoint can be seen in Figure 5. (a) and (b)

(a)



(b)

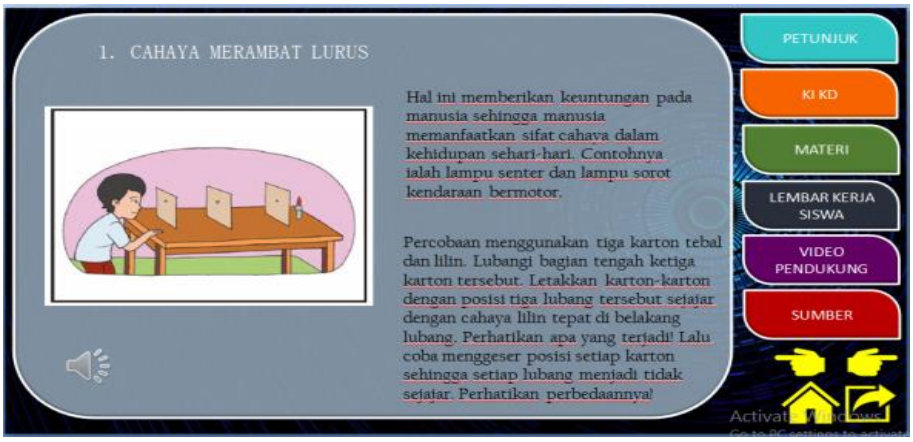


Figure 5. (a) Display of multimedia powerpoint at the "*Alami*" stage
(b) Display of multimedia powerpoint at the "*Namai*" stage

The group using the multimedia-assisted quantum learning model at the "Tumbuhkan" stage presented with a video about the topic so that students can relate the material to their previous knowledge. Nurlita(2020) in her research found that the quantum learning model was effective in increasing students' critical thinking skills. The outline of this activity wasto provide meaning that was quickly and easily understand by students. According to Gunawan et al. (2016) multimedia developed to be a learning aid in the classroom both by teachers and students.

In the "Alami" stage, students carry out activities to observe, ask and explore. This activity was carried out by observing the pictures displayed through the slides and questions and answers regarding the learning material. In exploration activities carried out by looking for information from various sources assisted by multimedia. A study conducted by Kassim (2013), which have examined the relationship between learning styles, creative thinking abilities, and multimedia learning materials obtained results that indicate high visual abilities obtained after using multimedia.

Students at the stage of "Namai" was formed into several groups to discuss the pieces of work of students (LKS). According to Widodo et al (2013) , discussion allowed students to exchange ideas and understand the answers that have been found . Master guiding and serving pieces of work the students were through slides in multimedia

Activity learning on stage "Demonstrasikan" students perform experiments or lab associated with the material so that students really associate the experience and do it

so that learning was more meaningful. Arifin et al. (2016) student learning outcomes that used the quantum learning model accompanied by experimental methods were better than learning outcomes that did not use the quantum learning model accompanied by methods so that it was affected the student learning outcomes.

At the "Ulangi" stage the teacher performs repetitions with the help of multimedia in the form of pictures , videos, and animations. Students can present the results of these experiments with confidence. Ningrum et al. (2015) that it informed that quantum models with practicum methods influence the ability of students' multi-representation.

At the stage of "Rayakan" activities that do is given praise, sing together, and the provision of rewards in the form of applause. The teacher gives awards to the best students or groups in the hope that it can increase student motivation.

Multimedia-assisted quantum learning applications provide many learning experiences through the "TANDUR" syntax. Students gain experience learning the fun and the students easily understand the topic light and nature. The multimedia-assisted quantum learning model in this study used multimedia powerpoint which combines all media elements such as text, video, images and sound in each stage of the quantum learning syntax. A similar study was conducted by Afniyati et al (2018) but used interactive multimedia.

This study found that the use of multimedia-assisted quantum learning models affected student learning outcomes. The quantum learning model encourages all students to be actively involved in learning. Besides that, multimedia made it easy for students to learn and attract students' attention to follow learning. The application of the quantum learning model with multimedia was very suitable and recommended for use in learning, especially for science subjects at the elementary school level, so it was not only limited to the level of secondary education as in previous studies to improve learning activities that have an impact on increasing student learning outcomes. Further research needed to find out how much correlation in the use of quantum learning models towards multimedia and learning activities such as what was shown an increase in learning activities.

CONCLUSION

The conclusion of this study was the use of multimedia-assisted quantum learning models has an effect on the learning outcomes of elementary school science students. The quantum learning method with the help of multimedia was more effective in improving student learning outcomes compared to the quantum learning method without the help of multimedia.

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