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THE EFFECT OF THE SCIENCE TECHNOLOGY SOCIETY AND THE QUANTUM TEACHING MODELS ON LEARNING OUTCOMES OF STUDENTS IN THE NATURAL SCIENCE COURSE IN RELATION WITH THEIR CRITICAL THINKING SKILLS

Research Article

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Abstract

This experimental study aimed to determine: 1) Differences in science learning outcomes between students who were taught via the Science Technology Society and the Quantum Teaching models; 2) Differences in science learning outcomes among students who have high, medium, and low critical thinking skills; 3) Relationship between these learning models and the critical thinking skills in terms of science learning outcomes. The participants of the study comprised 300 students from fifth grade of the private primary school in the Surakarta region. Out of the 300, 150 studentswere in the experimental group and 150 were in the control group. For the data collection two-way analysis of variance followed by the Scheffe test were administered. The result of the study showed that 1.) The level of science learning outcomes of the students who were taught via the Quantum Teaching model were higher than those taught via the Science Technology Society model. 2) There were differences in the level of science learning outcomes among the students who have high, medium, and low critical thinking skills. 3) There was no relationship between the learning models and the ability to think critically for improving science learning outcomes.

Keywords: learning outcomes, science, learning models, the Science Technology Society Model, the Quantum Teaching Model, critical thinking skills

1. Introduction

Education is one of the most important components in the formation and development of human resources in the face of progress and changing times. With the progress of the times that continue to advance rapidly, inevitably will require a quality generation. Quality humans are people who can compete in a good sense, by forming a critical mindset, steady, creative, and innovative reasoning.

Education, especially science has a very important role to overcome these problems. The quality of education can be known and measured from student learning outcomes that are manifested in the values obtained by students. The value of learning outcomes is one indicator that can affect the quality of human resources. But unfortunately, the development of Indonesian human resources can be said to be still quite low. The low quality of Indonesia's human resource development is evidenced by the results of research conducted by several world research institutions. The results of the Education for All (EFA) Global Monitoring Report 2010 survey released by UNESCO assesses that the Indonesian Education Development Index (EDI) is ranked 65 out of 128 countries with an education development index of 0.947 with the secondary education development index category (EFA, 2010). In 2011, Indonesia's ranking dropped to 69 from 127 countries surveyed with an educational development index of 0.934 (EFA, 2011). According to Setiadi (2014), other data are shown from the Human Development Index (HDI), Indonesia on March 14, 2013, the United Nations Development Program (UNDP) version ranked 121 out of 185 countries.

Furthermore, the survey was carried out by the OECD (Organization for Economic Co-operation and Development), the results of the OECD survey were based on the results of tests in participating countries which showed the relationship between education and economic growth. The analysis used by the OECD is based on the results of mathematics and science tests. They use broader global standards using the PISA test. The PISA test is an international study of the reading, math and science achievements of 15-year-old school students. OECD research results in 2012, showed that Indonesia has the ability of science or science ranked 64 out of 65 countries that participated in the test, with a score of 382 whereas the average score obtained by the OECD was 501. This shows that Indonesia is far below the average flat. The latest test results in 2015, Indonesia ranked 69 out of 76 participating countries (OECD: 2015). These conditions are very alarming and need special attention to handling.

Another fact, the results of science learning achieved in the fifth grade of the primary school in Surakarta so far are still not optimal. This raises questions about the quality of science learning carried out so far. The low absorptive capacity of students in natural science shows that there is still a large gap between the demands of the curriculum and the level of student ability in terms of learning science.

Many factors affect student learning outcomes. Sabri (2010) states the factors that influence the process and student learning outcomes are broadly divided into two parts, namely internal and external factors. Teaching and learning activities undertaken by teachers in elementary schools so far are still conventional. The teacher lectures more than involving students directly. The teacher is still a center of learning for students (teacher center), the dependence on the teacher is still quite large influence. The activeness of students in learning is still not visible, the child tends to sit in a chair and take notes on the teacher's explanation. The teacher has not used innovative and creative learning models. In learning activities, the material delivered to students is in the form of a learning guide sheet. The study guide contains a summary of the subject matter taken from the student handbook and other textbooks. The teacher conveys the material by explaining and the student listens and completes the guide. The training is given by the teacher before an evaluation is held. The exercise is done by students and then discussed together.

Merta et al., (2013) state that learning in primary and secondary schools is still largely dominated by expository learning, that is, teachers explain and students listen. In the learning process, it is very rare for a teacher to give a problem that is scientifically solved by students. Anas (2012) revealed that in learning teachers still tend to use the direct learning model because it is considered more practical and easier to achieve learning objectives. This results in more teacher-centered learning.

The results of research by Merta et al., (2013) revealed that some factors of low learning outcomes or grades shown from the learning process in the classroom are still dominated by the teacher. This is done by the teacher because he pursues the target subject matter set by the curriculum. The use of student-centered learning models is still not utilized. Learning activities that do not involve the active role of students make children get bored quickly and less stimulate their thinking abilities. This causes students not to understand what is explained by the teacher. Children tend to master the material with a role model, not mastering the concept of the real subject matter. When the question is only slightly changed in shape, students find it difficult to answer. This shows the students' understanding of the material is low, it will have an impact on the difficulty in solving problems so that student learning outcomes are not optimal. The ability to think of students tends to be monotonous or memorizing, it is difficult to think broadly or critically when getting different forms of questions even though the concept of the material is the same the child has difficulty answering. For the types of problems that require open answers or problem solving, students tend to find them difficult to solve.

The teacher as the holder of control in learning activities is very influential. Ruseffendi (2005) states that one way that can be done to improve the quality of learning is by increasing the role of the teacher because the teacher is a factor that can influence student success. Based on this, then in order to improve the quality of science learning, teachers should try to make the learning process involve the active role of students. Teachers can change the learning model: Many types of learning models are centered or demanding on student activity (student center). The learning models that can be used include the learning model of the Science Technology Society (STS) and the Quantum Teaching Learning Model.

Poedjiadi (2010) states that the uniqueness of the STS learning model is in the introduction, which is raised issues or problems in the community that can be explored from students. Permendiknas No. 22 of 2006 concerning Content Standards for Primary and Secondary Education Units states that in general, the learning objectives of primary school science are emphasizing mutual learning (science, environment, technology, and society) directed at learning experiences to design and create works through the application of science concepts and competence in scientific work wisely.

Based on the Permendiknas, the Science Technology Society learning model is very suitable for use in elementary schools. The teacher in this learning model is a mediator and student facilitator. The teacher brings each student to participate in learning activities. Students who learn by learning the Science Technology Society model will gain independent and meaningful learning skills. The teacher raises issues or problems in the community that can be explored from students, where the problem is related to the subject matter. Students do not get answers directly, but students must try themselves through various approaches and methods to find answers to the problems in

question. The strength of the Science Technology Society learning model is that it is contextual learning that departs from problems surrounding students related to science and technology and their effects on society. The STM model demands the role of students to be active, think critically, and creatively in responding to any changes that occur in the surrounding environment.

Tsai (2010) revealed that the application of the STS model was able to change students' views into constructivist thinking in accepting lessons. The constructivist mindset is very important in shaping students' understanding of the material being taught. Students who are taught using the STS model show improved attitudes and creativity of High School students Lee (2007). Akcay (2010) states the use of STS learning models in learning the Nature of Science (NOS) material makes a real difference in understanding and changing attitudes compared to students who are taught using textbooks. Agustini et al (2013) state that the application of the STS learning model greatly affects students in problem-solving skills. Tsai, Lee, Akcay, and Agustini's research needs to be followed up because it is only limited to the influence of the STSM learning model on changes in attitudes, thinking patterns, creativity, and student skills. Student learning outcomes need to be the main concern because it shows the ability of students in mastering a subject matter that is indicated in their grades in elementary school.

Another student-centered learning model is the Quantum Teaching Learning Model. Quantum Teaching Learning Model is a directed learning model that is made lively and fun in teaching and learning activities. Syaefudin (2009) states Quantum Teaching Learning as one of the learning models that concerns the skills of teachers in designing, developing, and managing learning systems so as to create an atmosphere of effective learning, exciting, and life skills. Wena (2008) explains the Quantum Teaching Learning model is a way to facilitate the learning process that combines elements of art and directed achievement, for various subjects. The principles of the Quantum Teaching Learning model create the best learning environment for students. A learning environment that can lead to positive thoughts and attitudes. In learning activities, teachers involve students actively in their learning activities

Sunandar (2012) states the strengths of the Quantum Teaching Learning model include that this learning model is student-centered, learning feels fun, provides freedom of expression, and can foster student enthusiasm. A positive atmosphere is fun built in this learning model. All efforts that students have made in each phase of learning get teacher appreciation. Students are made to feel happy and comfortable during learning activities. This will make it easy for students to capture and understand the material being taught. Acat and Yusuf (2014) state that the Quantum Teaching Learning model influences student achievement, retention, and attitude. Science learning in elementary school aims to provide information that the implementation of science learning is not only through the transfer of knowledge from the teacher to students, but is able to foster the ability to think, work and be scientific and through the application of science concepts. Thus, Science Learning should be carried out in scientific inquiry (scientific inquiry) to foster the ability to think, work and be scientific and communicate it as an important aspect of life skills (Permendiknas 22/2006).

In line with the above, students 'critical thinking skills are very important to be developed, especially in this case fostering students' critical thinking skills in understanding and applying science concepts. This is as stated by Ariani et al (2014) and Hasruddin (2015) that the level of students' critical thinking skills is one of the obstacles that also affects the learning outcomes of Natural Sciences. This is as a result of science learning activities that have been centered on the teacher so that the development of students' critical thinking skills is still not optimal. Science education is scientific knowledge (scientific knowledge). Students are expected to learn science, have the ability to think critically and the ability to solve problems related to science. Science learning must be centered on student activities (student-centered). to be more meaningful. Students must be active both physically and mind during science learning takes place. Thus, students are able to have a good sense of science, so that everything related to science has been embedded in their minds (Situmorang, 2011). In line with the opinion of Facione (2015) aspects of critical thinking skills in science learning that need to be developed are the cognitive abilities of students, which lead to the ability to interpret, analyze, evaluate, make conclusions, the ability to explain and self-regulate.

Critical thinking is one of the internal factors possessed by students. Susanto (2013) states that critical thinking is a process of activity that involves thinking about ideas or ideas that are related to a given concept or problem presented. Students must use the brain, study ideas, solve problems, and apply what they learn (Melvin, 2006). By reviewing ideas and solving problems, the process of critical thinking becomes an ability needed in the learning process. Students in learning activities, especially when working on questions require these thinking skills. Diestler (2010) with critical thinking, people are able to understand arguments based on values, understand the inference and are able to interpret, are able to recognize mistakes, are able to use language in an argument, realize and control egocentric and emotional, responsive to different views. The ability to think critically is one factor that cannot be ignored in achieving student learning success.

This research model framework uses the science learning outcomes as the dependent variable, which is a consequence or result of the learning approach. The novelty of this research model, incorporating critical thinking skills that act as moderator variables. The role of critical thinking skills as a moderator indicates that the relationship between learning models with high critical thinking skills will have a higher effect on the learning outcomes of Natural Sciences. Also, this research is the first time to compare the Quantum Teaching learning model with the Science Technology Society (STS) together. So far no one has ever done it, so the results of this study are expected to be able to make new contributions in learning.

This study aims to determine whether or not there are 1) differences in science learning outcomes between students who take learning with the Science Technology Society model and students who take learning with the Quantum Teaching model; 2) the difference in science learning outcomes between students who have high, medium, and low critical thinking skills; 3) relationship between the learning models used with critical thinking skills in improving science learning outcomes of fifth-grade students of the Private Primary Schools in Surakarta Region Academic Year 2017/2018.

2. Research Method

In this experimental study, the participants were 300 5th grade students of private elementary schools in the city of Surakarta in the school year of 2017/2018. The sample of this were obtained through the Area Sampling procedure. The number of participants for the control group and the experimental group were equally 150 each. Retrieval of science learning outcomes data was done by testing techniques, while critical thinking skills data by questionnaire techniques. The data were analyzed via a two-way analysis of variance followed by the Scheffe test. A 2 x 3 factorial design with two-way variance analysis (ANAVA) techniques were administered, too.

3. Results and Discussions

The results of the study can be given with references to related studies as follows:

3.1. The result of the 2 x 3 factorial design with two-way variance analysis (ANOVA)

Table 1. *Factorial Design*

Learning Model (A)	**Critical thinking skills (B)**		
	High (B1)	**Medium (B2)**	**Low (B3)**
STS (A1)	**A1B1**	**A1B2**	**A1B3**
***Quantum Teaching* (A2)**	**A2B1**	**A2B2**	**A2B3**

Note:

A1B1 : Groups of students who have high critical thinking skills who are treated with *Science Technology Society* (STS) learning model

A1B2: Groups of students who have medium critical thinking skills who are treated with *Science Technology Society* (STS) learning model

A1B3: Groups of students who have low critical thinking skills treated with *Science Technology Society* (STS) learning model

A2B1: Group of students who have high critical thinking skills who are treated with the Quantum Teaching (QT) learning model.

A2B2: Groups of students who have moderate critical thinking skills who are treated with the Quantum Teaching (QT) learning model.

A2B3: Groups of students who have low critical thinking skills who are treated with the Quantum Teaching (QT) learning model.

3.2. The result of the Balance Test

A balance test is a prerequisite for an experiment. The value used is the pretest value of Science of the Final Examination Even Semester fifth grade year of 2016/2017. Before a balance test is performed, the normality test and the homogeneity of the initial ability test are first performed.

Table 2. *Summary of Normality Test*

	Learning Model	*Kolmogorov-Smirnov*			Decision	Conclusion
		Statistic	Df	Sig.		
Pretest	*STS*	0.064	150	0.200	Ho accepted	Normal distribution
	Quantum Teaching	0.063	150	0.075	Ho accepted	Normal distribution

Results of normality test of pretest from the STS and *Quantum Teaching* groups indicate of Sig. > 0.05 thus data of initial ability from two groups came from populations that were normally distributed.

Table 3. Summary of Homogeneity Test

F	df1	df2	Sig.	Decision	Conclusion
0.111	1	298	0.740	Ho accepted	Homogeneous

Results of the homogeneity test showed the initial ability Sig. > 0.05 means that both sample groups come from homogeneous populations.

Table 4. *Results of Independent-Sample T-Test*

		Levene's Test for Equality of Variances		*t-test for Equality of Means*		
		F	Sig.	T	df	Sig. (2-tailed)
Pretest	*Equal variances assumed*	0.111	0.740	-0.136	298	0.892
	Equal variances not assumed			-0.136	298	0.892

Based on the table above shows the value of the t-statistic value of -0.136 with Sig. (2-tailed) > 0.05 so H_0 which states "there is no difference between the average pretest scores of the experimental group and the control group" is accepted. So, it can be concluded that the initial ability of students before being treated equally between the two groups.

3.3. The result of the Assumptions of ANOVA

Data analysis requirements using parametric statistics are data obtained in normal and homogeneous distribution, then before ANOVA test is carried out normality and homogeneity tests. The normality test is done by a *Kolmogorov-Smirnov* test with the results as the following table.

Table 5. *Summary of Normality Test*

Group	*Kolmogorov-Smirnov*			Conclusion
	Statistic	Df	Sig.	
STS model	0.069	150	0.076	Normal distribution
QT model	0.062	150	0.200	Normal distribution
High critical thinking skills	0.079	72	0.200	Normal distribution
Medium critical thinking skills	0.081	111	0.070	Normal distribution
Low critical thinking skills	0.072	117	0.196	Normal distribution
STS; High critical thinking skills	0.119	48	0.088	Normal distribution
STS; Medium critical thinking skills	0.135	39	0.070	Normal distribution
STS; Low critical thinking skills	0.099	63	0.199	Normal distribution
QT; High critical thinking skills	0.109	51	0.184	Normal distribution
QT; Medium critical thinking skills	0.108	60	0.077	Normal distribution
QT; Low critical thinking skills	0.119	39	0.182	Normal distribution

Results of normality test natural science learning outcomes in each group showed a significance level of Kolmogorov-Smirnov > 0.05 so H_0 which states that the data came from populations that were normally distributed was accepted. Thus, it can be

concluded that the natural science learning outcomes data in each group come from populations that are normally distributed.

Homogeneity test using Levene's Test is shown as the following table:

Table 6. *Homogeneity of Variance Results*

F	df1	df2	Sig.	Decision	Conclusion
2.011	5	294	0.077	Ho accepted	Homogeneous

Based on the results of the analysis of data obtained via Levene F-statistics of 2.011 with a significance level of 0.077 which is greater than the cut-off value of 0.05 so H_0 which states that homogeneous population variance is accepted. Thus, it can be concluded that the homogeneous data requirements for hypothesis testing with Two Ways ANOVA have been fulfilled.

3.4. The result of the Hypothesis Testing

Hypothesis testing is done by the Two-Way ANOVA test. After statistical analysis with SPSS Version 16, the results of hypothesis testing such as the following table are obtained.

Table 7. *Summary of Hypothesis Testing Results*

Source	*Type III Sum of Squares*	Df	*Mean Square*	F	Sig.
LM	2763.146	1	2763.146	8.483	0.004
CTS	11045.864	2	5522.932	16.955	0.000
LM*CTS	164.064	2	82.032	0.252	0.778
Error	95768.781	294	325.744		
Total	1309656.000	300			

1) Difference Test Results of the Learning Outcomes between Learning with STS model and Quantum Teaching model (A1: A2)

From the calculation of ANOVA (Table 7) obtained F-statistics 8.483 with Sig 0.004 < 0.05 means Ho is rejected and H_1 accepted. This means there is a significant difference in natural science learning outcomes between students who following the learning of the STS model with the Quantum Teaching model. Students who following

the Quantum Teaching model achieve higher learning outcomes than students who following the STS model. The first hypothesis consists of only two factors, namely the STS model and the Scientific model so that there is no need to do a double comparison test but only look at the marginal mean values shown in the following table (Table 8).

Table 8. *Comparison Learning Outcomes of Natural Science Based on Learning Model*

Learning Model	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
STS	60.230	1.502	57.274	63.187
QT	66.407	1.497	63.461	69.353

The average learning outcomes of natural science in students participating in learning with the STS model is 60.230 while the average value of students participating in learning with the Quantum Teaching model is 66,407. Thus, it can be concluded that the Quantum Teaching model is better than the STS model for natural science learning outcomes.

These findings are supported by Bobby DePorter's (2010) theory in which the Quantum Teaching learning model is identical to a symphony and musical performance. It means learning Quantum Teaching, empowering all the potential and existing learning environments, so that the learning process becomes fun and not as something burdensome. This can encourage students' interest in learning and participate actively in the learning process. The findings of this study generally support the results of previous studies conducted by Acat and Yusuf (2014); Juliartha et al (2014) and Ria (2014) that there are significant differences in learning outcomes of students based on learning models, where the learning outcomes of students who take part in learning Quantum Teaching models experience positive changes.

2) Difference Test Results of the Learning Outcomes between Students Who Have High, Medium, and Low Critical Thinking Skills (B1: B2: B3)

From the calculation of ANOVA (Table 8) obtained F-statistics 16.955 with Sig 0.000 < 0.05 means Ho is rejected and H2 accepted, so Ho stated that "there is no difference in natural science learning outcomes between students who have high critical thinking skills, have medium critical thinking skills, and have low critical thinking skills. This means that there are differences in natural science learning outcomes between students who have high critical thinking skills, have medium critical thinking skills, and have low critical thinking skills. From the results of the analysis, it can be concluded that there are differences or effects of critical thinking skills on natural science learning outcomes. Based on the analysis of multiple comparisons with Scheffe, a comparison of natural science learning outcomes of students who have high, medium, and low critical thinking skills is presented as the following table (Table 9).

Table 9. *Comparison of Natural Science Learning Outcomes Based on Critical Thinking Skills*

Critical thinking skills	N	Subset		
		1	2	3
High	102	55,43		
Medium	99		63,07	
Low	99			71,33
		1,000	1,000	1,000

Based on the data in the above table it can be concluded that among students who have high, medium, and low critical thinking skills have different natural science learning outcomes. From the Scheffe test, the value of science learning outcomes of students who have low critical thinking skills is in subset 1 with an average value of 55.43, moderate critical thinking skills in subset 2 with an average value of 63.07 and high critical thinking skills at subset 3 with an average value of 71.33. Thus, it can be concluded that students who have high critical thinking skills have better natural science learning outcomes than students who have medium critical thinking skills. Likewise, students who have medium critical thinking skills have better natural science learning outcomes than students who have low critical thinking skills.

The theory put forward by Chaffee (2012, p. 4) supports the results of this study that critical thinking is a thought process to clarify one's understanding of something so as to produce intelligent decisions. Characteristics of learning that are able to empower students' critical thinking are learning that utilizes the relationship between students, there are questions with the HOTS category giving sufficient time to students to provide reflections on the questions and problems given. The findings of this study generally support the results of previous studies conducted by Marjan (2014); Muhardjito Nurwulandari, and Mufti and Fazriyah (2015) that there are learning outcomes of students who have higher critical thinking skills better than students who have low critical thinking skills.

3) Results of Relationship between Learning Model and Critical Thinking Skills on Learning Outcomes of Natural Science.

From the calculation of ANOVA (Table 7) obtained F-statistics 0,252 with Sig 0.778 > 0.05 means Ho accepted and H3 rejected, it can be concluded that H_0 which states "there is no relationship effect between learning model (STS and Quantum Teaching) with critical thinking skills (high, medium, and low) on natural science learning outcomes" accepted. Because there is no relationship between the learning model and critical thinking skills, the comparison of learning approaches between STS and

Quantum Teaching for each category of critical thinking skills follows their marginal comparison. From the fact that there is no such relationship, so the characteristic differences between the STS and Quantum Teaching approaches for each category of critical thinking skills are the same. The mean marginal value can be seen in the following table (Table 10).

Table 10. *Comparison of Natural Science Learning Outcomes Based on Learning Approaches and Critical Thinking Skills*

Learning Model	Critical thinking skills	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
STS	High	69.208	2.605	64.081	74.335
	Medium	58.974	2.890	53.287	64.662
	Low	52.508	2.274	48.033	56.983
Quantum Teaching	High	73.333	2.527	68.359	78.307
	Medium	65.733	2.330	61.148	70.319
	Low	60.154	2.890	54.466	65.842

Judging from the marginal mean, the average value of students who take learning with the STS model is always higher than the average value of students who take learning with the Quantum Teaching model, both at high, medium, and low levels of interest in learning. Because there is no relationship, this also applies to students with high critical thinking skills, who get better natural science learning outcomes than students with medium critical thinking skills. Likewise, students with medium critical thinking skills, who get better natural science learning outcomes than students with low critical thinking skills

Based on the findings of this study, it can be proven from the average marginal results (Learning Model*Critical Thinking Skills) that (1) students with high critical thinking skills who follow STS learning model of natural science learning outcomes are better than those of medium and low critical thinking skills. (2) Likewise, students with high critical thinking skills who follow the learning model of Quantum Teaching science learning outcomes are also better than medium and low critical thinking skills. (3) the learning models of both STS and Quantum Teaching interacted with critical thinking skills (High, Medium, and Low) did not show any difference in the learning outcomes of Natural Sciences.

According to Ghozali (2005), moderator variables are variables that strengthen or weaken the relationship between two variables. In this study, critical thinking skills that act as moderator variables cannot strengthen the relationship of learning models with science learning outcomes. The relationship between the STS*CTS-High of learning

outcomes is always better than CTS-Medium and CTS-Low. Likewise, the relationship of the Quantum Teaching *CTS-High of learning outcomes is always better than the CTS-Medium and CTS-Low. That is, in each learning model, students who have high, medium, or low critical thinking skills, are equally good at improving science learning outcomes.

Factors causing no relationship can be caused by other moderating factors, both student factors (interests, motivation, learning styles, etc.) and factors outside students (learning media, teaching materials, etc.). According to Mulyanto et al. (2018), a possible factor causing the absence of this relationship is the presence of other factors that interact with the learning model of student learning outcomes, for example learning styles. For example, the results of the research Solihatin (2011), Liyusri and Situmorang (2013), and Marpaung and Napitupulu (2014) show the relationship of influence between learning models with learning styles on student learning outcomes.

The findings of this study support the results of previous studies conducted by Erwin, Tellu, and Kundera (2015) that there is no relationship between learning models and students' critical thinking skills towards learning outcomes in Biology lessons at SMA Negeri 4 Palu. The findings of this study support the results of previous studies conducted by Widyatiningtyas et al. (2015) that there was no significant relationship between the learning model and the initial ability of mathematics to the ability to think critically mathematics in high school students in Bandung. The findings of this study support the results of previous studies conducted by Tijayanti and Marzuki (2014) that there is no significant relationship between learning methods and types of intelligence on the development of critical thinking skills of students at SMA Negeri 1 Suela, East Lombok.

4. Conclusion

Consequently, it can be concluded that there are differences in natural science learning outcomes of the students between those who are taught via the Science Technology Society Model and those taught via the Quantum Teaching model. The science learning outcomes of students who take classes with the Quantum Teaching model are better in terms of critical thinking skills than those who follow learning with the Science Technology Society Model. In addition, there are differences in science learning outcomes of the students among those who have high, medium, and low critical thinking skills. Natural science learning outcomes of the students who have high critical thinking skills are better than the science learning outcomes of the students who have medium critical thinking skills. Likewise, students who have medium critical thinking skills are better than science learning outcomes of students who have low critical thinking skills. And there is no relationship between the learning model with the ability to think critically in improving science learning outcomes. In short, teachers should prefer the Quantum Teaching Model to use in the classroom implementations and should provide students with activities to help them develop their critical thinking skills.

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