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The Effect of the Quantum Teaching Model on the Science Process Skills of Class V Elementary School Students

Dwi Pratiwi Meisari [1], Syarifuddin Kune [2], Hartono Bancong [3]
Universitas Muhammadiyah Makassar, Indonesia

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ABSTRACT (10 PT)

This research is a quasi-experimental study with the form of nonequivalent control group design which was conducted to determine the effect of the quantum teaching learning model on the science process skills of fifth grade elementary school students with the concept of heat transfer. The number of samples was 34, with the experimental class applying the quantum teaching model namely fifth grade students at SDN 216 Dualimpoe 17 people, and the control class applying direct learning coming from fifth grade students at SDN 54 Dualimpoe totaling 17 people. The results of the descriptive analysis of experimental class students obtained an average KPS posttest score of 68.12 with an n-gain score of 0.54 in the medium category. While the control class got an average KPS posttest of 48.29 and an n-gain score of 0.21 in the low category. For the results of inferential analysis after passing the prerequisite test, the hypothesis test using the t-test obtained a sig value. is 0.000 <0.05 and the t value is 15.802> 2.1199 t table so it can be concluded that there is an effect of the quantum teaching model on science process skills for elementary school students on the concept of heat transfer.

Corresponding Author:

Dwi Pratiwi Meisari
Universitas Muhammadiyah Makassar, Indonesia
Email: dwi1592@guru.sd.belajar.id

1. INTRODUCTION

Science has become an important part of every individual. Keeping up with the times that are increasingly advanced, requires us to continue to move and develop the potential that exists within ourselves. Knowledge is achieved through education, both formal and formal, at every existing level. National education aims to educate life, produce fully developed human beings who are faithful, pious, and have noble character.

In essence, the implementation of learning is carried out interactively, challenging, motivating, and fun for students. This is because it is expected that students want to participate actively to develop their creativity and independence according to their talents, interests and potential (Amna Emda, 2017; Hasanah, 2021). Not only from one aspect but covers cognitive, affective, and psychomotor.

At the elementary school level (SD), one of the fields of science that is mandatory to be taught is Natural Sciences (IPA). The National Education Standards Agency defines science as a science that is closely related to the activity of finding out about nature and its surroundings in a structured and systematic way. IPA from the perspective of scientists is defined as a collection of scientific information and methods for testing a hypothesis (Susanti et al., 2019). The nature of science as a process is a method or method used to gain knowledge in the form of scientific facts that are closely related to science process skills (Rahayu & Angg, 2017; Wiratman et al., 2021).

Based on the understanding and purpose of education to develop self-potential, and related to science as a scientific process, it is very important to improve students' science process skills. Not only applied in the educational environment but as self-development of students to solve problems in their lives later. Science Process Skills or KPS as a student experience to strengthen basic skills that are owned, understood, carried out which are all scientific in nature (Asmi et al., 2023). Science process skills play a role in assisting students in

developing mindsets, actively participating, and responsive in the process of building knowledge (Safaruddin et al., 2020).

Although science process skills are very important for students to have, the reality in the field from the results of direct interviews with the homeroom teacher of class V SDN 216 Dualimpoe obtained the fact that students' science process skills are still relatively low. KPS which consists of observing, classifying, predicting, measuring, communicating, and concluding activities has not been mastered by most students. What is most immediately visible is during the learning process of 17 students, only 6 percentages (35.2%) actively ask questions or respond to the teacher, the remaining 11 students with a percentage of 64.8% tend to be passive and only listen. The homeroom teacher also said that the independence and curiosity of students in receiving material was lacking because students still depended on the teacher's instructions directly. Observations were made in the science learning process, the learning atmosphere was less varied, in practice the use of laptops and projectors as an alternative was most often used by teachers with less innovative learning models.

Overcoming problems related to students' science process skills, many solutions and efforts have been made starting from the application of various learning models, teaching strategies, and learning media (Pohan & Dafit, 2021). One of the efforts made if it is adapted to the characteristics and facts that exist in SDN 216 Dualimpoe, the model that can be applied is the quantum teaching model. The quantum teaching model is a learning model with six stages namely grow, experience, name, demonstrate, repeat, and celebrate (Atikah et al., 2019; Ramadhan et al., 2021; Sulistyaningsih, 2018; Wahidurahman et al., 2018; Yuniasih et al., 2018).

The quantum teaching model was developed by (Deporter, 2010) which pays attention to the dynamically designed learning environment, use of tools, and learning. The advantage of this model is that students are actively directed to observe everything in their surroundings (Luh et al., 2020b). According to (Deporter, 2010) this model has five principles, namely first, everything speaks, everything has a purpose, experience before giving a name, recognizing every effort, finally, if it is worth learning, it is also worth celebrating. From the explanation above, this research will apply the quantum teaching model and see its effect on the science process skills of elementary school students.

Efforts and solutions to overcome KPS mastery and students' cognitive abilities have been carried out a lot. In the last seven years several studies have been carried out by applying various learning models, including the application of the discovery model (A'yun & Subali2, 2019; Kencana Sari et al., 2019; Khamidah et al., 2019; Rizal, 2019), model *inquiry* (Diana, 2019; Lusidawaty et al., 2020), digital microscope-assisted ethno-STEM model (Priyani & Nawawi, 2020), model *predict, observe, discuss, and explain* PODE (Irfan & Syahrani, 2018) and model *quantum teaching* (Wote et al., 2020; Atikah et al., 2019; Azia, 2022; Gunawan, 2016; Sulistyaningsih, 2018; Wahidurahman et al., 2018; Yuniasih et al., 2018) Of all the studies, this learning model has something in common, namely the provision of direct experience to students.

From the several solutions above and adapted to the characteristics of students and the facts in SDN 216 Dualimpoe, the learning model that is worth trying by teachers is the quantum teaching model developed by Bobby DePorter. The quantum teaching model is learning that pays attention to a solid foundation learning environment, the use of tools, and a dynamic learning design, and the quantum teaching model has the advantage that students are actively stimulated to observe things around them (Luh et al., 2020a; Wahyuning et al., 2017). The principled learning model is bring their world to our world, and deliver our world to their world. It has six stages known as TANDUR namely grow, experience, name, demonstrate, repeat and celebrate (Diantoro et al., 2020; Faj et al., 2018; Subakthi Putri et al., 2020; Supramono, 2016). This model emphasizes that the teacher begins learning by entering the world of students, associating the material to be learned with events, prior knowledge, or feelings that students experience in their daily lives, and ends by celebrating everything that has been learned as a form of positive affirmation.

Based on the exciting research above, most of them have been conducted with older students and has focused on a variety of different outcomes. There is a need for more research on the effect of the quantum teaching model on students' science process skills, particularly with younger students at elementary level in Indonesia. This research will address all of these gaps by investigating the effect of the quantum teaching model on the science process skills and cognitive abilities of the concept of heat transfer in class V elementary school students.

[*Based on the explanation above, the researcher wants to study it through experimental research with the aim of knowing the effect of the quantum teaching model on science process skills and cognitive abilities of the concept of heat transfer in class V elementary school students.]*

2. METHOD

This research is a quasi-experimental, nonequivalent control group design. It consists of two classes, namely the experimental class applying the quantum teaching model and the control class applying direct learning (Sukmawati, Salmia, 2023). The population in this study totaled 108 people, who were fifth grade students at SD Cluster I, Maniangpajo District, for the 2022-2023 school year, Wajo Regency, South Sulawesi.

The number of samples is 34 students with the selection of samples using purposive sampling technique as a consideration is the school's KKM accreditation and grades, then 17 students of class V SDN 216 Dualimpoe are selected as the experimental class and will apply the quantum teaching model while the control class is also 17 students of class V SDN 54 Dualimpoe.

The independent variable in this study is the quantum teaching model while the dependent variable is science process skills (KPS) which consist of observing, predicting, classifying, communicating and concluding. To assess KPS students use activity observation sheets along with LKPD at each meeting. The results of the study were carried out using descriptive statistical analysis, normalized and inferential n-gain tests. By testing the hypothesis using the t test paired samples test which first performs a prerequisite test.

Table 1. Research Design

Group	*Pretest*	*Treatment*	*Posttes*
Experiment	O_1	X_{QT}	O_2
Control	O_3	-	O_4

Information :
O1 = experimental class pretest
O2 = posttest experimental class
O3 = control class pretest
O4 = posttest control class
XQT = treatment with the quantum teaching model

3. RESULTS AND DISCUSSION

Results

Meetings held in each class related to the concept of heat transfer. At the first meeting the material and experimental activities carried out related to conductors and insulators. The material for the second meeting relates to heat transfer by conduction with experimental activities comparing margarine that melts faster between margarine on a wooden spoon and on an iron spoon. The third meeting was about convection heat transfer by observing the cooking process of green beans. Finally, in the fourth meeting, the material for heat transfer by radiation was with a practicum comparing wet wipes placed in the school field with those placed in the classroom. From these four meetings and the posttest, they were then observed and given an assessment related to the science process skills possessed by each student in each class.

The following is a comparison of the KPS posttest results from the experimental class of fifth grade students at SDN 216 Dualimpoe and the control class of fifth grade students at SDN 54 Dualimpoe can be seen in table 3.

Table 3. Descriptive Statistics of Experimental and Control Class PPPs

Variable	Posttest KPS	
	Experiment Class	Control Class
N	17	17
Range	19	22
Min Value	59	40
Maximum Value	78	62
Sum	1158	821
Mean	68.12	48.29
Standard Deviation	5.721	6.469

The frequency distribution of KPS results from the two research classes is in table 4.

Table 4. Frequency Distribution of Experiment Class and Control Class KPS Results

Interval	Category	Frequency		Percentage (%)	
		Experiment Class	Control Class	Experiment Class	Control Class
84 - 100	Very Skilled	-	-	0	0
68 - 83	Skilled	9	-	53	0
52 – 67	Skilled Enough	8	5	47	30
36 – 51	Less Skilled	-	12	0	70
20 - 35	Very less	-	-	0	0

[The results of the descriptive analysis show that the average KPS score for the experimental class that applies the quantum teaching model is 68.12, which is higher than the average KPS for the control class, which is only 48.29.]

From the Table 4, the results show that the average KPS score for the experimental class that applied the quantum teaching model is 68.12, which is higher than the average KPS score for the control class, which is only 48.29. The category obtained from the average KPS score of the experimental class is in the skilled category, while the average KPS in the control class is included in the less skilled category. It suggests that the quantum teaching model may be effective in improving students' science process skills. However, the difference in KPS scores between the two groups is not statistically significant. It is because the sample size is too small. And it is more difficult to detect the statistically significant differences between two small groups.

In addition to the results above, an n-gain test was also carried out to find out the significant difference in the average between the KPS of the experimental class and the control class. In the research that was conducted in four meetings, the normalized n-gain scores obtained from each class were described in table 5.

Table 5. Comparison of N-Gain KPS Scores for Experiment Class and Control Class

Period	N-Gain Score / Categorization	
	Experiment Class	Control Class
Meeting 1	0.34 / Currently	0,12 / Low
Meeting 2	0.53 / Currently	0,21 / Low
Meeting 3	0.58 / Currently	0,22 / Low
Meeting 4	0.72 / Tall	0,31 / Currently
Meeting 5	0.54 / Currently	0,21 / Low

For more details, the above data is illustrated through the graph below:

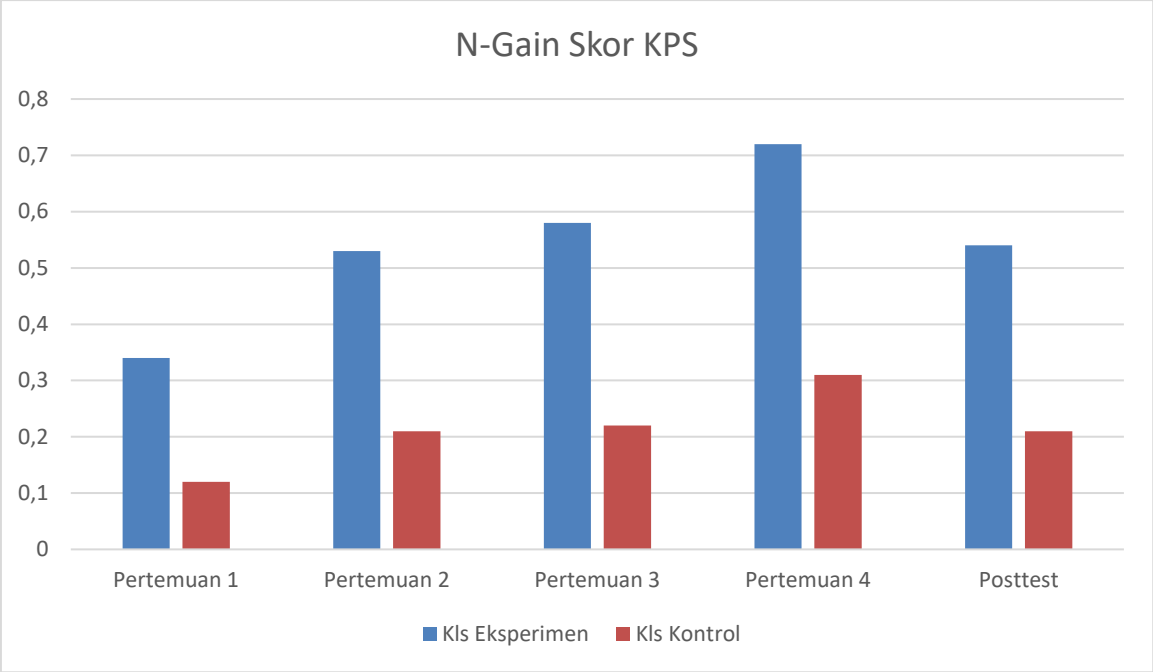

Figure 1. Comparison of N-Gain KPS Scores

From the results of the n-gain test it is clear that the experimental class that applied the quantum teaching model for four meetings had a higher n-gain score than the control class. In the first meeting, n-gain, the score of the experimental class was 0.34, which was included in the medium category, and the control class was only 0.12, which was in the low category. The second meeting of the experimental class obtained 0.53 medium category while the control class 0.21 low category. The third meeting of the n-gain experimental class scored 0.58 in the medium category and 0.22 in the low category for the control class. For the fourth meeting, the experimental class got 0.72 and was in the high category, while the control class was in the moderate category with an acquisition of 0.31.

The results of the descriptive statistical analysis have been presented, then an inferential statistical analysis was carried out by conducting a hypothesis test (paired samples test) which previously had to pass prerequisite tests in the form of normality tests and homogeneity tests.

The results of the normality test for science process skills for the control pretest have a significance value of 0.057 > 0.05, it can be stated that the data is normally distributed, as well as for the control posttest, the significance value is 0.200 > 0.05, it can be concluded that this data is also normally distributed. Furthermore, the normality test for the experimental class, the significance value for the pretest was 0.112 > 0.05 including normal distribution, as well as the posttest significance value 0.169 > 0.05 which can be concluded that the KPS data for the experimental class were also normally distributed. Furthermore, the second prerequisite test is the homogeneity test for the science process skills variable, a significance value of 0.745 > 0.05 is obtained, so it is concluded that the KPS data variant is homogeneous

After the normality test and homogeneity test were carried out and it was stated that the samples were normally distributed and homogeneous, the hypothesis test with the t-test (paired samples test) could be carried out. Based on the results of the paired samples test, it is known that the sig. is 0.000 <0.05 and the t value is 15.802> 2.1199 t table so that it can be concluded that there is an effect of the quantum teaching model on the science process skills of the heat transfer concept of class V elementary school students.

Discussion

The quantum teaching model which has six stages is able to accommodate students' science process skills. Each material and experiment carried out is adjusted to the KPS that you want to measure and implement based on the stages of the quantum teaching model. The first stage is the growing stage. Before entering the core material, the teacher first opens the lesson by raising an opening topic that is related to the core material. Such as displaying pictures or objects and asking students their initial opinion. At this stage observing, predicting and communicating activities have begun to appear.

The second stage in this model is the natural stage, students are given the opportunity to do their own experiments by following the instructions on the worksheets that are distributed. At this stage observing, classifying, and communicating activities can appear. For example, in one meeting, when students were shown some household appliances and ordered to group them into groups of conductors, insulators and conductors.

The third stage is the name. After the students carry out the experiment, at the naming stage the students and the teacher collaborate and confirm the concepts or knowledge they get from the experiments that have been carried out. Next stage four is demonstration, students present the results and answers they got from the experiment, the KPS that appears most at this stage is communication.

The fifth stage is repeat, this stage is a reinforcement for the activities that have been carried out, be it facts, concepts, principles, and theories obtained previously. Teachers and students reflect back on all the knowledge gained. The last stage is celebrating, after learning, there needs to be the slightest appreciation and positive affirmation, either by clapping, singing together, or by giving other gifts.

Meetings held in each class related to the concept of heat transfer. At the first meeting the material and experimental activities carried out related to conductors and insulators. The material for the second meeting relates to heat transfer by conduction with experimental activities comparing margarine that melts faster between margarine on a wooden spoon and on an iron spoon. The third meeting was about convection heat transfer by observing the cooking process of green beans. Finally, in the fourth meeting, the material for heat transfer by radiation was with a practicum comparing wet wipes placed in the school field with those placed in the classroom. From these four meetings and the posttest, they were then observed and given an assessment related to the science process skills possessed by each student in each class.

The results of the descriptive statistical analysis and the n-gain test showed a significant increase in KPS from the experimental class by applying the quantum teaching model as evidenced from the first meeting the n-gain score for the experimental KPS was in the medium category to the fourth meeting which was in the high category, and the posttest was in the high category currently. While the control class did not show a significant increase until the posttest was still in the low category.

While the results of hypothesis testing with paired sample test sig. is 0.000 <0.05 and the t value is 15.802> 2.1199 t table, from this value it can be stated that the quantum teaching model has a significant effect on the science process skills of elementary school students. The results of this study are also in accordance with previous research conducted by (Cahyaningrum et al., 2019; Fatimah et al., 2022), research entitled Application of the Quantum Teaching Model in Improving Science Process Skills in Grade IV. This is a research conducted in three cycles and obtained the results of applying the quantum teaching model to improve learning and science process skills in fourth grade elementary school students.

4. CONCLUSION

Based on the data analysis and discussion that has been described, it can be concluded that the science process skills (KPS) of the experimental class that apply the quantum teaching model are included in the skilled category, and the n-gain score is included in the moderate category. Meanwhile, for the control class, which was taught using the direct learning model, the process skills were in the less skilled category, and the n-gain score was in the low category. Thus there is a significant influence of the quantum teaching model on the science process skills of fifth grade elementary school students. It is better for future studies to use larger sample sizes to show more significant improvement in implement the quantum teaching model. In addition, future studies should also investigate whether the quantum teaching model is more effective for certain subgroups of students.

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BIOGRAPHIES OF AUTHORS

	**Dwi Pratiwi Meisari**, born in Ujung Pandang on 31 May 1997, 2016-2020 continued her undergraduate studies at the UNM Primary School Teacher Education Department, then in 2021 continued to the Masters level at the Masters in Basic Education, Muhammadiyah University of Makassar. During his master's degree, he took a specialization in Natural Sciences as the topic raised in his final assignment to complete her studies. Dwi can be contacted via email dwi1592@guru.sd.belajar.id
	**Syarifuddin Kune**, is a lecturer at the Postgraduate Program at Muhammadiyah University of Makassar, he is also Head Lector at the Physics Study Program at Muhammadiyah University of Makassar. Born on May 5, 1955, his interest in science and the environment is proven by the level of education he chose. took his undergraduate education at IKIP Ujung Pandang, continued his master's degree at Hasanuddin University, Makassar, majoring in Environment, and also completed his doctoral degree at Hasanuddin University, Makassar, majoring in Agricultural Sciences. He can be contacted via email Syarifkune@gmail.com
	**Hartono Bancong**, he is a lecturer in the Physics Education Study Program, as well as the HR Productivity Development Division, Planning, Supervision and IT Agency 2021-2024. He completed his bachelor's degree in Physics Education, Makassar State University, graduating in 2011. In the same year, he continued his Master's degree in Physics Education, Makassar State University, completing in 2013. He continued his PhD in Physics Education at Seoul National University, South Korea, graduating in 2020. He can be contacted via email Hartonobancong@unismuh.ac.id