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Application of Quantum Teaching Model on Environmental Pollution Contents to Train Junior High School Students Creative Thinking Ability

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***Abstract*— This research aims to determine the influence of learning model of Quantum Teaching on environmental pollution material to train students' creative thinking ability of SMP. This research was conducted using pretest-posttest design. Learning devices are tested on 30 junior high school students. Data were analyzed using qualitative and quantitative descriptive methods. Validation result of valid learning device is in the average reliability of 90,57% and reliability of learning implementation is in 80,95%. The test of students' learning outcomes on cognitive competence analyzed using N-Gain has increased (0.88). The students' creative thinking ability at the beginning of learning is 42.67% with creative enough category and at end of learning it shows 70,12% with creative category. Based on the research result, it can be concluded that the Quantum Teaching model on environmental pollution material can be used to train students' creative thinking ability.**

Keywords*— *Science, Quantum Teaching, Creative Thinking

I. INTRODUCTION

Education is a conscious and well-planned effort to create an atmosphere of learning and learning process so that learners actively develop their potential to have spiritual power, self-control, personality, intelligence, noble character, as well as the skills needed by him, society, nation and state (UU RI no 20 pasal 1, 2003). Many educational problems encountered in our country, one of them is the weakness of the learning process. Reference [1] confirmed that the weakness of the learning process in Indonesia is a learning strategy. Learning process is still a teacher-centered learning, meaning the teacher still emphasizes the role as a conveyor of the subject matter. During the learning process, students are less encouraged to develop thinking skills and emphasize more on memorization [2]. Based on the results of PISA (*Program for International Assessment of Student*) data in year 2015, Indonesia is ranked 9th in the bottom of 72 countries. There are three aspects studied by PISA, namely the ability to read, math, and science, following the average of PISA research results in 2012; Reading (397), Mathematics (386) and Science (403). This predicate can reflect how Indonesia's education system is currently running. Referring to PISA data in 2015, Indonesian children are still low in science literacy skills such as identifying scientific problems, using scientific facts, understanding living systems, and understanding the use of scientific equipment.

Students must be trained in thinking skills in the learning process [3]. Further [4] states that learning is centered on the process of thinking or mental processes, not just on the results. The process of thinking or mentality is the creative thinking which is a mental activity to develop or find original ideas, aesthetic, constructive that directly relates to the view of the concept and emphasizes the aspect of intuitive and rational thinking [5]. The 2013 curriculum is designed to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, and affective and able to contribute to the life of society, nation, state and civilization of the world [6]. According to Minister of Education and Culture, Mohammad Nuh (in Kompas 09 December 2013), this creativity is the basic capital to give birth to innovative children, who are able to find alternatives to problems or challenges in the increasingly complicated future.

Reference [7] explains that creative thinking is a thinking process that has characteristics: fluent, flexible, original and elaborative. Creative thinking can be developed in science learning. According to Rogers (in Munandar 2009) emphasizes that the source of creativity is the tendency to self-actualize, manifest the potential, the impulse to develop and mature, the tendency to express and activate all organisms. Creativity can be taught through several approaches, one of them through Quantum Teaching model.

Reference [8] explained that the Quantum Teaching model includes specific guidelines for creating an effective learning environment, designing curriculum, conveying content, and facilitating the learning process. Quantum teaching is excellent for teaching in every subject, including science, so

teaching science with Quantum Teaching is more interesting, challenging, and will motivate students in teaching and learning. Through the Quantum Teaching model, teachers will combine learning features into the form of teaching planning that will improve students' learning outcomes.

Reference [9] affirmed that the learning model of Quantum Teaching has six learning steps known as the TANDUR learning framework, which is the growth of students' learning interest, that is, to create real experiences that can help students learn, i.e provide the keyword so students can name and demonstrate the concepts studied, and give students the opportunity to show that they know or understand the material being studied, repeat that tells the students how to repeat the material, celebrate that is to give recognition for completion, participation, and the achievement of understanding the concept of the material being studied. In addition, reference [9] describes the reasons for using the Quantum Teaching learning model as follows: (1) giving students opportunities to learn as desired through extracting experiences of students; (2) cultivating students' interest in learning; (3) giving students opportunities to learn according to their abilities; (4) providing opportunities for students to be actively involved and creative in the learning process, as well as to interact well with the material, friends, and teachers. This condition is expected to trigger students' creative thinking.

Reference [2] in his research states students' response to Quantum Teaching is very good and can improve students' learning outcomes. Furthermore [10] in his research stated Quantum Teaching model as an alternative model can improve understanding of science concept and student's creative thinking skill.

Presenting materials should be tailored to the characteristics of active learning, meaning that any new subject matter needs to be tied to previous knowledge and experiences [11]. The subject matter according to the characteristics of the target school is a school that utilizes the natural surroundings in the learning activities, so that students can find a real example of the environment around the school about the problem of pollution.

One of the problems closest to the students is environmental problem. Environmental issues that are most expressed in the study of natural science (biology) is the problem of environmental pollution. Environmental pollution in general can be distinguished into pollution of water, air, soil, and sound. Environmental pollution material in accordance with the basic competency of science class VII even semester on basic competence 3.9 that describes pollution and its impact to living creatures, should be presented to the students because they are the successor of the nation and part of the community members through learning in the classroom. Students will be faced with a variety of environmental pollution problems. At the time of environmental pollution materials given, students will be challenged with these problems so that with the ability to think creatively, they will be able to create solutions to address these environmental problems.

Based on the background described above, it will be conducted research on the application of Quantum Teaching model on environmental pollution material to train the ability of creative thinking of junior high school students.

II. RESEARCH METHOD

This study aims to determine the effect of learning model of Quantum Teaching on environmental pollution material to train junior high school students' creative thinking ability. The method used in this research is quasi experiment with one group pretest-posttest design that is experiment research conducted on one group which is called experiment group without any comparison group or control group. This study was conducted in Second Semester of Junior High School. The students tested are totalling 30 determined from the class VII.

The research instruments used for data collection in this research were non-test and test instruments. Research instruments (Pretest, Posttest, and creative thinking) are multiple choice questions with four choices of answers and descriptions; whereas non-test instruments are Syllabus, Learning Implementation Plan (RPP), and students' worksheets on creative thinking ability. Prior to the research, it is necessary to test and analyze the test instrument that aims to determine the quality of a test instrument. Qualified instruments can be reviewed from several things such as validity test, reliability test, difficulty index test, and distinguishing power test.

Analysis of the students' creative thinking ability test is conducted by calculating the number of answers of each question on each unit of test. Creative thinking skill score is obtained by summing the scores obtained from each unit of the test. The summed score is then parsed on the score of each student. The greater percentage of each unit test result will be analyzed descriptively-qualitatively. Students are said to be creative when the results of creativity test scores ≥ 61, 2% (Khanafiyah, 2010). The percentage of scoring can be calculated using the following formula:

Percent of Acquisition Score = (Acquisition Score/Maximum Score) x 100 %

The creativity criteria of the students from the percentage of the acquisition score are categorized as follows:

TABLE I. CRITERIA FOR STUDENT CREATIVITY

Average Score Interval	Category
81,6% - 100%	Very Creative
61,2% - 81,5%	Creative
40,8% - 61,1%	Fairly Creative
20,4% - 40,7%	Less Creative
0,00% - 20,3%	Not Creative

Source: Khanafiyah, 2010

Level of learning effectiveness using Quantum Teaching learning model is analyzed to normalized gain score formulated as follows:

$$(g) = \frac{S_{post} - S_{pre}}{100 - S_{pre}}$$

Information:

(g) = Improving academic skills learning outcomes

S_{pre} = Average pretest or initial skill

S_{post} = Average posttest or final skill

III. DISCUSSIOIN

A. Validity of Learning Instruments

The valid validation value of three validators is 4.37 with very good category with 92% instrument reliability so that RPP can be used and reliable. LKS used by researchers include environmental pollution material oriented model Quantum Teaching. The average value of validation of 4.28 is very good category with 96% reliability of the instrument so that LKS can be used and reliable.

The learning result test developed in this research is a learning result test consisting of 5 items of multiple choice and 7 items of description. Validate the test of learning outcomes and test students' creative thinking ability, providing valid judgment so that it is worth using.

B. Observation of the Implementation of Learning

The average implementation of RPP class VII students of 3.79 is very good category with reliability 80.95%. Observational instruments observed include: 1) introduction obtaining an average rating of 3.56; 2) core activities earned an average grade of 3.82; 3) the cover obtains an average rating of 4.00 so that it conforms to the learning summary; 5) time management earns an average grade of 3.67; And 3) the observation of the classroom atmosphere scores an average of 3.92 so that it fits in with the enthusiasm of students and teachers.

Based on observations made by two observers, the results of the implementation of learning states that all learning stages performed with the category of each aspect is good, i.e. in the range of score 3.5-4.0.

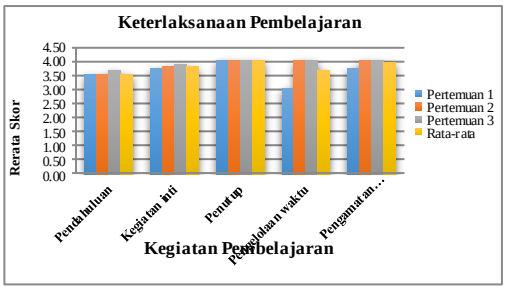

Fig. 1. Diagram of the Implementation of Science Lesson

C. Student Learning Outcomes

Student learning outcomes are measured from a complete indicator consisting of 12 indicators and 12 instructional objectives outlined in 12-item test questions covering five multiple choices and seven descriptions. The test of the students' learning result is done twice as much as the pretest test to know the students' initial ability before being given the treatment and the final test (posttest) to know the students' concept understanding after being given treatment using the learning device of science oriented Quantum Teaching on the contamination material environment. Completeness of learning outcomes can be known based on the value of pretest and posttest. The determination of the value of the competence of knowledge is poured in the form of numbers and letters, namely 4.00-1.00 for the equivalent of the letters A to D. Learning completeness for knowledge competence is set with a minimum score of 2.67 (B-) [12]

Results of pretest with the object of research as many as 30 students, nothing is complete. This is because students have not found the concept of the material being studied. All students achieve mastery at the time of posttest implementation because in accordance with the syntax model Quantum Teaching **Namai** meaning that students have found the concept of the material studied the environmental pollution and teachers have done question and answer at the end of learning. Based on the posttest result, the class is said to be thorou

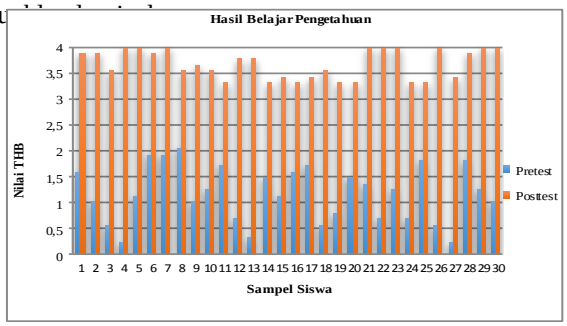

Fig. 2. The Test Chart of Learning Outcomes

Increased competence of students' knowledge, this can be seen from the average pretest value of 1.17 (D) and posttest 3.68 (A-). The average test result of this learning increases because of the influence of the learning given. This is consistent with the sensitivity index of each item that was developed obtained an average of 0.56. The item has a sensitivity to the effects of the learning given and the improvement of students' learning outcomes after the treatment is the effect of the learning of science oriented Quantum Teaching. Forms of mastery of student on concepts can be seen from the answers they provide, then the results of these learning tests are analyzed using a normalized Gain Score.

Based on the results N-Gain obtained an average value of 0.88 with high Gain category. This shows that the ability of mastering the concept of students who have followed the science learning oriented Quantum Teaching to train students' creative thinking ability to improve. Mastery of student concepts at the time of learning included into the syntax model Quantum Teaching Namai meaning that teachers expect students to find the concept of the material he studied. In addition to knowing the mastery of student concepts, the analysis of N-Gain can also indicate differences in student learning outcomes between before and after treatment. This can be seen from the improvement of student learning

outcomes. The average pretest that was originally 29.24 increased to 92.00. Reference [13] states that a high normalized Gain Score shows a level of effectiveness. Completeness of the overall indicator is said to be complete because it reaches 93.61%, so the class can be said classically.

Improvement in the mastery of student concepts, shows the implementation of learning devices running well. It is based on the development of tools and learning instruments with good validation will become worthy of use for learning activities and measure student learning outcomes. Learning activities using learning tools Quantum Teaching-oriented IPA will affect students' responses to learning, students will tend to be active, happy, and interested when their learning is meaningful and beneficial to them, so students will be motivated in learning which will further affect their learning outcomes. This is in accordance with Quantum Teaching syntax ie; Grow means that students are motivated to learn; **Experience** which means students play an active role, happy, and interested in the learning process; **Demonstrate** which means students are able to work together in groups and demonstrate group work in front of other groups.

D. The Ability of Student Creative Thinking

The ability to think creatively in this study was measured by providing a test of creative thinking skills adopted on verbal tests developed by [14] and [15]. This research is to know the existence of improvement of ability of creative thinking of student hence this test is given at the time before learning and after learning. The tests developed included five sub-unit tests including; The beginning of words, composing words, the same traits, the extraordinary use, and what akibantya, which will represent each indicator of the creative thinking skill that is fluency, flexibility, originality, and elaboration).

The verbal test developed in this study is associated with environmental pollution according to the topic being taught. The selection of verbal tests refers to Guilford's intellectual theory that states that creative thinking is also called divergent thinking, which is the ability of students in providing various alternative answers.

The results of this creative thinking ability test are calculated based on the number of relevant student responses and an increase. This is in accordance [13], students are said to be able to think creatively if there is an increase in the results of tests before being given treatment (pretest) and after treatment (posttest). The number of relevant answers given by the students has increased, it can be assumed that the students experience an increase in creative thinking skills due to learning by using the model Quantum Teaching. This shows that Quantum Teaching is able to help students to practice creative thinking skills.

The ability of creative thinking or divergent thinking can be interpreted as the ability to find the number of relevant answers to a problem (based on available information) with an emphasis on quantity, usability, and diversity of answers [14]. Furthermore, the more likely answers are given to a problem, the more creative one becomes. But the answer given should be relevant to the problem. So, not only the number of answers that can be given but also the quality of the answers given there should be relevance of answers to the problems posed.

Preparation of the test before learning gets an average of 42.67% with the creative enough category. This is because students are still adapting to new learning, thus allowing to influence students' ability to do the test. The answer to unit 2 is the word composing test, the students have difficulty in compiling words of the given word.

The result of the test of creative thinking ability is tested by qualitative descriptive. The average yield at the time of pretest of 42.67% with the category quite creative. Most students have not been able to issue creative ideas, this is because students have never been taught using the model of learning Quantum Teaching in the classroom. The average posttest is 70.12% with creative category. This happens because the students have begun to be independent, fluent in expressing creative ideas, and able to make work steps in the design of creative ideas they design. This increase is due to the application of Quantum Teaching models trained to students to stimulate students' creative thinking skills during the learning process. This can be seen in the student response result of 100% which states that learning Quantum Teaching is new for the students. Reference [16], Quantum Teaching learning model is the conversion of various interactions in and around learning activities. These interactions change the students' natural abilities and talents into good and evolving that will benefit the students and others.

IV. CONCLUSION

Based on the above description, it can be concluded that Quantum Teaching model can be applied to environmental pollution material can be used to train students' creative thinking ability of SMP.

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