

**SEMI GUIDED INQUIRY LEARNING MODEL WITH DEMONSTRATION-EXPERIMENTS
METHOD TO TRAIN ELEVENTH GRADE STUDENT'S CREATIVITY ON REACTION
RATES MATTER**

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Abstract

The implementation of this research which used quasi experimental with One group pretest posttest design was aimed to describe the students creative thinking skills to the implementation of semi guided inquiry learning model with demonstration-experiments method on reaction rates matter. From all of students in the MIA of the 11th grade in SMAN 1 Sidoarjo on the odd semester 2016-2017 academic year was obtained the MIA 4 of the eleventh grade as a sample. The method used in this research were observation and test. The instrument used in this research were students activity observation sheet, and the creative thinking skills test. The results showed that the students creative thinking skills has been practice proven by posttest score of students creative thinking skills have reached the determined score ≥ 3 . Students latest creative thinking skills obtained a total of 2 students or by 6,25% scored 3 (B), a total of 17 students or by 53,12% scored 3,20-3,50 (B+), a total of 11 students or by 34,38% scored 3,60-3,80 (A-), and a total of 2 students or by 6,25% scored 4 (A).

Keywords: semi guided inquiry, demonstration, experiment , creativity, creative thinking skill.

INTRODUCTION

High Science creativity indicated by the way of addressing a problem differently, analyzing problem, persuade others and capable of taking the risk to develop an idea by the students [1]. Science education in the 21 century needed science creativity. Indonesia needs creative and skilled human resources to produce innovative work in science. An efficient and productive educational process can generate a creative and skilled human resources in science because education is a major factor determining the quality of human resources.

The principal goal of education is to create men who are capable of doing things, not simply of repeating what other generations have done. Men who are creative, inventive, and discoverer is a main goal of education. The second goal of education is to form minds which can be critical, can verify, and not accept everything they are offered. The great danger today is of slogans, collective opinions, ready made trends of thoughts. We have to be able to resist individually, to criticize, to distinguish between what is proven and what is not [2]. Those purpose was supported by the Curriculum 2013. The Curriculum 2013 was designed to harmonize achieved knowledge and skills of learners in which curriculum 2013 is designed with a characteristic namely develop a balance between

the development of spiritual and social attitudes, curiosity, creativity, cooperation with intellectual and psychomotor ability [3].

The results of the pre-study questionnaire, conducted at SMAN 1 Sidoarjo, showed that 56.9% of students can developed elaboration category of creativity. Students that can showed flexibility category were 58.6%, those are 64% of students can developed originality, and 62.4% of students can developed fluency category of creativity. Students creativity average in elaboration character were 2.28 with predicate C+, Students flexibility average were in 2.34 with predicate C+, Students originality were 2.56 with predicate B-, and students fluency were 2.50 with predicate C+. From those data, the creativity of eleventh grades students need to be trained in order to have a high creativity to make an innovation that could be useful in the future.

In terms of technology in the 21st century, rates of reaction is an important issue. Every chemical reaction in the industry need to be set in optimum conditions so that the product is produced in an efficient time. Therefore, it is important to study the factors that affect the rate of reaction creatively. Creativity is used a wide range of idea creation techniques (such as brainstorming), create new and worthwhile ideas (both incremental and radical concepts), and elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative

efforts [4]. It is required a good learning process that motivated student to train the creativity of students in understanding the reaction rate in order to be able to create new innovations in the application of reaction rates in the future.

Inquiry learning model is suitable model to train students creativity in reaction rates, it is in line with the opinion of Arends [5] which states Inquiry learning model is one of the learning models which used to educate the students how to think. Inquiry learning model can develop thinking and reasoning skills, develop metacognitive skills and develop positive attitudes toward inquiry and appreciation for the tentativeness of knowledge. The core principles of inquiry-based science education such as student activities, meaningful contents, developing critical thinking and motivating towards science correspond to the basic components of creativity. Inquiry-based science education involves basic processes that give rise to creativity [6].

The use of appropriate learning models also need to be supported by the use of appropriate methods such as the method of demonstration and experimentation. Demonstration and experimental method used to reinforce students understanding of the phenomena, where students and teachers will simultaneously carry out an analysis of the phenomenon. Involve students actively in the learning will make the learning process will be much more understandable by students compared to the students who merely just listen to the teachers notes. In addition Ajoke&Nna [7] revealed that in order to achieve self-confidence as well as in terms of creativity and the ability of the process, the students better be actively involved in learning process though experiments or demonstration of students and teachers.

Based on the description above, this research raised a topic that is in accordance with the conditions encountered, which is: "Semi Guided Inquiry Learning Model with Demonstration-Experiments Method to Train Eleventh Grade Student's Creativity on Reaction Rates Matter".

METHOD

The type of this research is descriptive quantitative of quasi experimental type. The sample of this research is 32 students in XI MIA 4 class of SMAN 1 Sidoarjo. The research design is one group pretest-posttest design [8].

$$O_1 \times O_2$$

O_1 =Creativite thinking skills pretest score in reactions rate subject matter
 X =The implementation of semi guided inquiry learning model with demonstration-experiments method on reaction rates subject matter
 O_2 =Creativite thinking skills posttest score in reactions rate subject matter.

Learning instruments used in this research are: (1) Syllaby; (2) Lesson Plan; and (3) Student Worksheet. Whereas the research instruments used are: (1) Students activity observation sheet, and (2) Creativite thinking skills test. The method which used in collecting data in this research is observation and test method. Technique used to analysis the data is quantitative descriptive analysis. The research procedure consisted of three stages of the implementation of the learning activities including preparation phase, implementation of learning activities, and data analysis stage.

Students activity observation sheet are analyzed using the percentage of students who participating in learning process as follows:

$$\% \text{ Student Activities} = \frac{\Sigma \text{frequency of appears activity}}{\Sigma \text{total frequency}} \times 100\%$$

The studentsactivity said to be performed well and support the inquiry learning model effectiveness in training students creativity and support the creativity of students if the relevant percentage of the student activity is greater than the activity of students that are not relevant [9].

The observer assess the student's creativity in the pretest and posttest answer sheet using an assessment refference to Table 1. Below:

Tabel 1. The Assesment Rubric of The Students' Creativity.

Score	Criteria
20	If the students give ≥ 2 problem solution with an appropriate reason
15	If the students give 1-2 problem solution but those are only one appropriate reason.
10	If the students give 1 problem solution with an appropriate reason
5	If the students answer doesn't appropriate with the right answer
0	If the students didn't answer

The students' creativite thinking skills are obtained from the pretest and posttest score. Creativity pretest and posttest score are analyze using the following formula:

$$\text{Students creative thinking aspect} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\%$$

The obtained score of students creativity are converted using the following formula:

$$\text{Score} = \frac{\text{obtained score}}{25}$$

Then it converted in scale 0-4 as follows in Table 2.

Table 2. Score Conversion.

Score	Predicate
3,85-4	A
3,51-3,84	A-
3,18-3,50	B+
2,85-3,17	B
2,51-2,84	B-
2,18-2,50	C+
1,85-2,17	C
1,51-1,84	C-
1,18-1,50	D+
1,00-1,17	D

The students creative thinking skill have been trained proved by the achievement of individual creativity score in the posttest should be at least $\geq 3,00$ and get B[10].

RESULT AND DISCUSSION

The research results of implementation of semi guided inquiry learning model in reactions rate material includes observation of students activity during the learning process, and students creative thinking skills to the learning undertaken.

There were 12 dominant aspect of students activity to observe by the observer. The data of dominant students activity shown in Figure 2. Below:

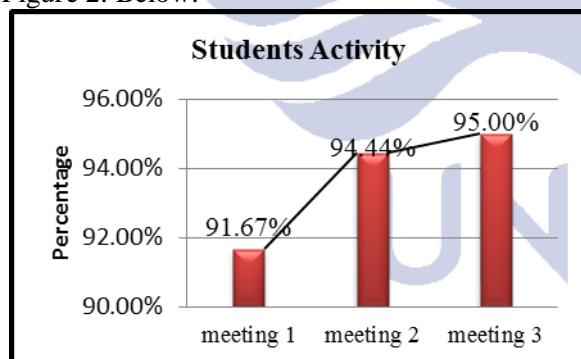


Figure 2. Graph of Student Activities Percentage

Based on the Figure 2 it can be said that the activities of the students at the first meeting, the second and the third has risen by an average percentage consecutive, that is 91.67%; 94.44%; 95%. This shows that students respond properly in every learning activity, in accordance with the data expressed by. Observation of student activities should be carried out in inquiry learning activities to know the training process of students

creative thinking skills and to support the feasibility of the entire syntax of inquiry. The dominant students activity that correspond to inquiry phase supported the inquiry learning model effectiveness in training students creativity and support the creativity of students if the relevant percentage of the student activity is greater than the activity of students that are not relevant. Students activities have an important role in the learning process, because without the presence of student activity, the learning process may not occur. The learning process is more meaningful with the increasing of active involvement of students in the learning process [11].

Students creativity thinking skill has four characteristics, those are originality, elaboration, fluency and flexibility. Fluency character can be measured using the question that make students can provide more than one idea or solution used to accelerate the rates of reaction. Students fluency showed by their answer on pretest and posttest answer sheet from of how many ideas or solutions provided by students that will increase the possibility of students choose the right answer. This is in line with the statement of Filsaime [12] that said fluency illustrates the ability of students to create a myriad of ideas. This is perhaps the most powerful indicator of creative thinking, because the more ideas, the more likely there is to gain a significant idea.

There are two students who received a score of 15 with sample answers "Raising HCl temperature using a water bath because when the temperature is high then kinetic energy will increase and the particles will move faster by enabling effective collision and reaction occurs fastly and so the rates of reaction would be greater". A total of 7 students get a score of 10 with the answer "increasing the temperature of HCl so that collision can occurs faster and the reaction rate will be increase". Examples of students answers to question 1 pretest assessed correctly because the students' answers in accordance with the objective indicators of achievement of the basic competency that students are able to analyze the factors that influence the reaction rate in accordance with the concept of the factors that influence the reaction rate by Wistrom, Phillips ,& Strozak [13], which revealed that high temperatures cause the number of particles collide faster than at low temperatures. This is because at high temperatures the kinetic energy of the particles will be increased. This causes the number of collisions too over so that

the reaction rate will increase. A total of 17 students get a score of 5 to answer "burning spirit, adding to the concentration of substances, because of the temperature and concentration affect the rate of reaction". that is not correspond to the theory.

In the learning process, Fluency have been train in phase three of inquiry namely students formulate hypotheses to explain the problem or event. And so in posttest fluency have been train proved by a total 25 students who received the maximum score of 20. A total of five students obtain a score of 15 and total of 2 students obtain a score of 10.

Students' flexibility is measured through questions that make students can interpreting problem by choosing an idea which is more appropriate solution based on the problem. Students' flexibility showed by their answer on their pretest and posttest answer sheet because of the many solutions devised by the student. The student will choose the right solution based on the analysis of students from various perspectives to problems given. This is in line with the statement of Filsaime [13] that the characteristics of this flexibility describes the ability of an individual to change his mental device when the circumstances required for it, or a tendency to view a problem instantly from a variety of perspectives

As many of the students who received a score of 15 on the student's pretest answer sheet of question number 4 which asked "When taking ulcer medication, it is advisable to chew the medicine first. Explain the relevance of such phenomena with the rate of the reaction. And provide another alternative if they already in a severe ulcer disease and required the medication to work fastly." And the example of students answer is "when chewed, the surface area of the medicine will be even greater, thus increasing the chances of collisions effectively and reaction of stomach acid with an ulcer medicine to be faster, the alternative way is drinking ulcer liquid medicine the larger surface area ". A total of nine students received a score of 10 with the answer "because if the drug will be chewed and smaller particles with a greater surface area and will be more easily digested and give a faster effect". Examples of students' answers were assessed correctly in terms of cognitive because it is in conformity with the objective indicators of achievement of the competency that students are able to analyze the factors of surface area that affect reaction rates in accordance with the concept of the factors that influence the reaction

rate delivered by Wistrom, Phillips, & Strozak [14] that the surface area factors accelerate the reaction rate because the more surface area, more and more of the substance collide and the greater their chances of collisions effectively bring about change. A total of 18 students received a score of 5 with sample answers "in order to work more effectively ulcer drug it must be chewed beforehand". Students receive a score of 5 for students' answers are not related to the reaction rate theory.

Flexibility students can be measured through the number 2 on the students' posttest answer sheet which is students are required to provide solutions to the problems that are being faced by the banana seller who must estimate their bananas to rip as a consumer demand, because through those problem, students can give a problem interpretation by choosing an idea which is most appropriate solutions to a banana crops could ready to eat in the varies time according to the consumer's order. In this case, students are required to determine the most appropriate response to a banana seller in order to make the harvest bananas riped in a different time. flexibility character of the students showed by a students' creative thinking in terms of the most appropriate response given by the students of all the problem solutions that have been thought up by students. Selection of this answer is based on the analysis of students from a variety of perspectives on a given problem.

There are 25 students who received a maximum score of posttest that is 20 with examples of student answers "(1) Bananas were given calcium carbide as a catalyst to accelerate the ripening of fruit by different amounts according to the needs, carbide given more for bananas that want a faster riped; (2) Banana placed in a closed sacks because fruit ripening much faster in a dark place; (3) wrapped banana with newspaper and put in the rice place because the fruit will cook faster if placed on the rice because the fruit will riped faster when placed on a storage which have a high temperature because of high temperature of rice in a closed container will accelerate the ripening of bananas; and (4) Banana wrapped in newspaper, then placed with ripe apples in plastic bag because ripe apples also produces ethylene gas which can speed up the ripening of bananas. As much as 6 students obtain a score of 15. And one student gets a score of 10.

Based on cognitive assessment, students answers are assessed properly due to the addition of carbide as a catalyst that reacts with water it

will produce acetylene gas that work the same as ethylene gas that helps speed up the ripening process of bananas; Fruit stored in a rice storage is also speed up ripening process of bananas because the heat contained in the rice storage will make ethylene gas at a banana quicker to be ripened due to the activity of ethylene in ripening fruit will increase with increases in temperature to the optimum temperature; storing bananas in a dark place can also speed up ripening fruit in the dark because the auxin and ethylene can stimulate fruit ripening; storing the fruit in an enclosed place with ripe apples also accelerate fruit ripening because apples are climacteric fruit that has a high ethylene so that the plastic which is contain ethylene gas produced by apples will be accumulated with ethylene gas which produced by bananas and accelerate the process of bananas fruit ripening. It is accordance with the concept of the factors that affect the rate of reaction by Wistrom, Phillips, & Strozak [13], which revealed that high temperatures cause the number of particles that collide more than at low temperatures. This is because at high temperatures the kinetic energy of the particles will be greater. This causes the collisions occurs faster so that the reaction rate will increase; and (3) the use of a catalyst to accelerate the reaction provides an alternative reaction mechanism with a lower activation energy value so the reaction can occurs faster and the reaction rate will be increase.

In the learning process, flexibility trained in phase three of inquiry which helps students formulate hypotheses to explain the problem or phenomenon that is when students consider the possibilities before choosing the best answer and in phase five namely formulate explanations, flexibility trained when the students associate the data obtained during the experiment with materials that have been given by teachers. This is supported by Suratno [14] which statethat the skills to compare their opinions with other people's opinion, explain the problem or phenomenon which is when students consider the possibilities before choosing the best answer, and associate the data is flexibility character of creative thinking.

Students creative thinking skill have been trained as shown from pretest score of students in the category of originality, fluency, flexibility, and elaboration are: as many as 6 students or by 21.43% got a score of 0.80 to 1.00 (D-), as many as 11 students or by 39.29% got a score of 1.20-1.40 (D), a total of 8 students or by 28.57% got a score of 1.60-1.80 (C-), a total of 1 student got a

score of 2.00 (C), and a total of 2 students or by 7.14% got a score of 2.20-2.40 (C+) becomes the students posttest score completeness of students creative thinking skills in the category of originality, fluency, flexibility, and elaboration are: as many as 2 or by 6.25 % got a score of 3 (B), as many as 17 people or 53.12% received a score of 3.20 to 3.50 (B+), as many as 11 people or 34.38% received a score of 3.60 to 3.80 (A-), and as many as 2 or 6.25% scored 4 (A).

The successes achieved of learning outcomes test are influenced by the learning process experienced by students. In addition to training students creative thinking, inquiry model also improve student learning outcomes. This is supported by the statement Julianto [15] which states that through the inquiry process students go through to solve the problem which given by the teacher, the student will be familiar with scientific attitude so that the learning process will be more meaningful. Improving student learning outcomes occur in three category, namely cognitive, affective and psychomotor.

CLOSURE

Conclusion

Based on the results of research and discussion, it can be concluded that creative thinking skills of students through the implementation of semi-guided inquiry learning model with demonstration-experiments method successfully trained, as seen in the posttest score completeness of students creative thinking skills in the category of originality, fluency, flexibility, and elaboration is as many as 2 or by 6.25 % got a score of 3 (B), as many as 17 people or 53.12% received a score of 3.20 to 3.50 (B+), as many as 11 people or 34.38% received a score of 3.60 to 3.80 (A-), and as many as 2 or 6.25% scored 4 (A).

Suggestion

1. This research is limited in period of teaching times which is done in three meeting, while for training creative thinking skills and habituation to practice creative thinking should require deeper in the long term period of practice.
2. The learning feasibility of semi guided inquiry learning model with demonstration-experimental method is milt in the sixth phase of inquiry process which is reflect the situation problems because teachers give less direction to students to reflecting problem thus makes the learning process is less interactive. Teachers should provide

feedback and questions or examples of concrete usefulness reaction rate to students.

REFERENCE

1. Sternberg, R. J. 2006. Creative a vision of creativity: The first 25 years. *Psychology of Aesthetics, Creativity, and the Arts*, Hal 2-12.
2. Hadzigeorgiou, Y., Fokialis, P., & Kabouropoulou, M. 2012. Thinking about Creativity in Science Education. *Creative Education*.
3. Depdikbud. 2013. *Salinan Lampiran Peraturan Menteri Pendidikan dan Kebudayaan Nomor 69 Tahun 2013 Tentang Kerangka Dasar dan Struktur Kurikulum Sekolah Menengah Atas atau Madrasah Aliyah*. Jakarta: Depdikbud.
4. Piirto, J. 2011. *Creativity for 21th Century Skills*. Ohio: Sense Publishers.
5. Arends, R. I. 2008. *Belajar Untuk Mengajar*. terjemahan H. P. Soetjipto, dan S. M. Soetjipto. Yogyakarta: Pustaka Pelajar.
6. Trnova, E. 2014. Implementation of Creativity in Science Teacher Training. *International Journal on New Trends in Education and Their Implications*.
7. Ajoke, A. A., & Nna, P. J. 2012. Creativity and Process Skills for Self-Realiance Using Demonstration Approach of Teaching Chemistry. *ARPJ Journal of Science and technology*, (Online), Vol3, (<https://www.ied.edu.hk/apfslt/download/v3.pdf>, diakses 19 Mei 2016).
8. Sugiyono. 2011. *Metode Penelitian Pendidikan*. Bandung: Alfabeta.
9. Arifin, Z. 2010. *Media Pembelajaran*. Yogyakarta: Gramedia.
10. Permendikbud. 2014. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia No.104.
11. Sardiman, A.M. 2011. *Interaksi dan Motivasi Belajar Mengajar*. Jakarta: Rajawali Pers.
12. Filsaime, D. K. 2008. *Menguak Rahasia Berpikir Kritis dan Kreatif*. Terjemahan Sunarni. Jakarta: Prestasi Pustaka Raya.
13. Wistrom, C., Phillips, J., & Strozak, V. 2008. *Glencoe: Chemistry Matter and Change*. Ohio: Glencoe/McGraw-Hill.
14. Suratno, T. Tanpa tahun. Pengembangan Kreativitas Siswa Dalam Pembelajaran Sains Di Sekolah Dasar.
15. Julianto, D. 2011. *Teori dan Implementasi Model – Model Pembelajaran Inovatif*. Surabaya: Unesa University Press.

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