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Scientific Method By Using Project Method in Acid, Base and Salt Material

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Abstract. This study aims to determine the effect of scientific method using project method on student's achievement. This research was conducted at SMPN 2 Karanganyar. The descriptive quantitative method was used in this research. Samples were taken two classes using cluster random sampling. Data was obtained based on cognitive instruments. This data represents the value pretest and posttest. Data was analyzed by using descriptive analysis techniques. The results show that the class which using scientific method using project method has an average value of 37.50% of students' achievement (high), 37.50% (moderate) and 4.16% (very low). On the other hand, the class which using one method, scientific method, have the students' achievement at 33.3% (high), 8.33% (moderate) and 20.83% (very low).

INTRODUCTION

Curriculum in Indonesia evolved over time. One reason is the low achievement of curriculum development in Indonesia in the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA). TIMSS and PISA assessment was held in 2011 and 2012. Based on that results, Indonesia ranks 64th out of 68 countries. The important aspect of the assessment is mathematics, science and reading.

Science learning process in Indonesia is changing because of that reasons. Twenty one century current knowledge, desire oriented learning paradigm on the project, problem, inquiry (inquiry), the discovery and creation (Wilson, 1996)[1]. Based on Permendikbud No. 81A in 2013 [2] revealed that in the standard of education process should require a learning process through five fundamental learning experience of observing, ask, gather information, associate and communicate, through the application of scientific method. Learning Scientific is a learning process that is designed so that students construct concepts actively, laws, or principles through the stages observed (to identify or find the problem), to formulate the problem, propose or formulate hypotheses, collect data with a variety of techniques, analyze the data, draw conclusions, and communicate the concept, law or principle "discovered". The learning process consists of five basic learning experiences are: observe, ask, gather information, associates, and communicate (Kemendikbud: 2013b) (Permendikbud No. 65 of 2013)[3][4].

Discovery Education [5] states that, "The scientific method is the "tool" that scientists use to find the answers to questions. It is the process of thinking through the possible solutions to a problem and testing each possibility to find the best solution ". Scientific method is a series of processes to answer questions. Through a process of thinking, a hypothesis put forward to be a temporary answer to questions. A series of tests were run to test the hypothesis, to find the true answer to the question that appears at the beginning of the process.

Kemendikbud [3] gives the conception of its own that the scientific method in learning also includes components: observe, to question, to reason, to try/ create, present/ communicate. Scientific method refers to the investigative techniques on one or several phenomena or symptoms, acquire new knowledge, or correcting and integrating previous knowledge.

The application of scientific methods in the learning process involves skills such as observing, classifying, measuring, predicting, explaining, and concluding. In carrying out these processes, teacher assistance required. However, the teacher must help decreases with increasing adult student or the higher class of students.

Lawson [6] says that, to teach science as science must work (teach science as science is done). As one science, chemistry learning process must follow the process for learning science more meaningful. Chemistry learning should use the scientific method so that students get used to conduct the inquiry so that the learning more meaningful. Furthermore, meaningful learning can be done if students can apply learning in daily life. Applications in the learning process can be carried out if the student is able to create a work based on the students' learning experience and collaboration with other students in one group.

Project method is an instructional method that gives freedom to the students to plan learning activities, carry out collaborative projects, and ultimately produce work products that can be presented to others. Tan [7] also mentions that project method has been recognized as a development of active learning and teaching methods centered learning, which uses the problems of unstructured (the problems of the real world or the problems of complex simulation) as a point initial and anchor or anchors for the learning process. According to Apriyono [8] as a model of learning, project method based on the idea that learning should encourage and help students to engage actively build up its knowledge so as to achieve a deep learning.

Based on that points, scientific method and project method have different process of learning. The researcher want to know whether joining two methods between scientific method and project method will be effect in student's achievement based on difference criteria.

METHODS

This research uses descriptive quantitative method. Nana Sudjana [9] revealed that the descriptive method with quantitative method is used when aiming to describe or explain an event or events that occur in the present in the form of significant figures. This research uses two groups of subjects, the first group as the experimental class (Scientific Method with Project Method) and the second class as a baseline class (Scientific Method without learning methods).

The population of this research were students of VII grade in SMP Negeri 2 Karanganyar which amounted to seven classes. Each class consists of 24 students. The sampling technique in this study using cluster random sampling. The data are obtained by providing value before treatment (pretest) and posttest (value after learning process). Pretest and posttest was used to determine student's achievement in the subject matter Acids, Bases, and Salts. Gain between pretest and posttest classified in five categories, such as very low, low, moderate, high, and very high. This classification based on variable indicator category as Table 1. [10]

TABLE 1. Variable indicator category

Category	Norm Formula
Very Low	$X \leq \mu - 1.8 SD$
Low	$\mu - 1.8 SD < X \leq \mu - 0.6 SD$
Moderate	$\mu - 0.6 SD < X \leq \mu + 0.6 SD$
High	$\mu + 0.6 SD < X \leq \mu + 1.8 SD$
Very High	$X > \mu + 1.8 SD$

In the experimental class, the learning process using a scientific method with the project method. In this class, the learning process using the experimental activity and students were given the tasks of a project to identify the materials that they use in daily life belonged acid, base or salt using universal indicator. The second tasks is students can create a natural indicator of the materials that they found. In contrast, in the other classes using a scientific method in experimental activities. Students did not get any assignments from teachers. They are simply engaged in an experiment with an instruction from the teacher.

RESULT AND DISCUSSION

In learning to use scientific learning activities carried out through the process of observing, asking, trying, associating and communicating. Fifth process is applied in the model or method of learning based on Permendikbud No. 81A in 2013 [2] are,

- **Observing.** This step is used to observe the learning. Observing is closely related to the context of real situations encountered in daily life. The process of observing the facts or phenomena include searching for information, seeing, hearing, reading, or listening. The teacher facilitates students to make observations, and then training them to pay attention (see, read, hear) the important thing from an object. The teacher opens the opportunity for students to ask questions about what has been seen, listened to, and read.
- **Asking.** Second steps, asking question carried out as part of the process to build the student's knowledge in terms of facts, concepts, principles, procedures, laws and theories. Asking is the process that can be done through discussion, group work and class discussions. Discussing group give space for students to express ideas with their own language. Through asking, the curiosity of students developed. When students trained in asking, the curiosity of the students are growing. Those questions will be the basis to seek further information and a variety of resources that determined by the selected teachers to the students themselves.
- **Trying/ experimental/ exploration.** Experimental activities has beneficial to increase the curiosity of students. This curiosity make the student more understand in facts, concepts, principles or procedures by collecting data and scientific work skills. These activities include planning, designing and carrying out experiments, the presenting data, processing data, and concluding. The use of learning resources, including the use of information and communication technology is strongly recommended. Follow-up from asking activities are dig and gather information from a variety of sources through a variety of ways. In order to collect some information, students can read more books, pay attention to the phenomenon, or object more closely, and even conduct experiments. Application or try an experimental method intended to develop various domains of learning objectives, the attitude, skills and knowledge. Real learning activities for this are: (1) determining the theme or topic in accordance with the basic competencies; (2) studying how to use the tools and materials; (3) studying the relevant theoretical basis and the results of previous experiments; (4) performing and observing trial; (5) recording phenomena, analyzing, and presenting data; (6) writing the conclusion on the results of the experiment; and (7) making a report and communicate the results of the experiment.
- **Associating or reasoning.** Associating activity aims to build thinking skills and scientific attitude. The information of activity results as the basis for subsequent activities that process information. Besides that, the information can find the linkages of information with other information. Furthermore, based on the data, we can found a pattern of linkage information and take the conclusions of the patterns found. The obtained data were classified, processed, and founded specific relationships. The activities can be designed by the teacher through engineered situation in certain activities so that students do activities include analyzing the data, classifying, categorizing, inferring, and predicting by utilizing worksheets discussion or practices.
- **Communicating.** The next activity is write or tell what is found in the activities of finding information, to associate and find patterns. The findings were presented in class and was rated by teachers as a result of learning the student or group of students. Communicating activity is a means to convey the results of conceptualization in the form of oral, written, sketches, charts, or graphs. This activity is done so that the student is able to communicate the knowledge, skills, and practices, as well as the creations of students through presentations, reports, and performance of the work.

The syntax that used in this research is joining of syntax of two method between scientific method and project method. The joining syntax is in "trying/ experimental/ exploration." In this part, student doing their tasks from teacher.

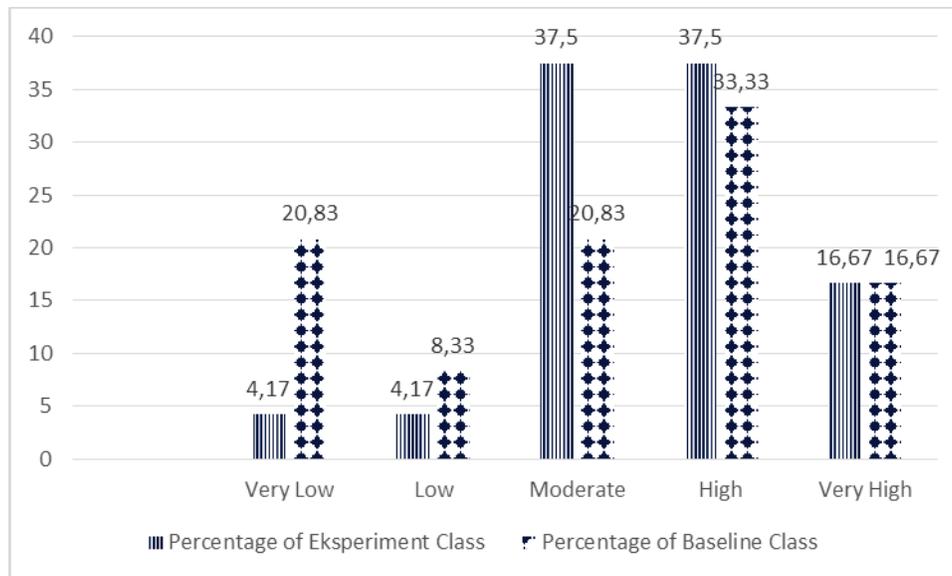


FIGURE 1. Student's achievement criteria

Based on a preliminary analysis from the value of mid semester in second semester of seventh grade students of SMP Negeri 2 Karanganyar shows that all classes that are part of the normal distribution population. It can be concluded that the samples had the same initial conditions, so to determine the sample can be done with a cluster random sampling technique.

Learning in two classroom begins with a pretest. This pretest aims to determine how much prior knowledge possessed by each student. Then, in the end of learning, posttest was held to determine student's achievement of aspects of knowledge. In general, these two classes has an increase learning achievement which indicated by the average difference between the value pretest-posttest for each class.

The average difference pretest-posttest between the experimental class and class baseline because of differences in the formation of concepts by students. According to Bruner, both of these methods require students to find a concept. How the invention of the concept between the two methods is different, learning by using scientific method with project method, students are required to seek the concept by creating a project that was been done in groups. As for learning with scientific method without learning model, students only practice in the laboratory without understanding the essence of the material that was experimented.

Based on Fig 1, Student's achievement in experimental class reach significant value at 37,5%. From category "very low" to "low", achievement of students at steady state position by 4,17%. Then, achievement of students was increased sharply by 37,5% at "moderate" and "high" category. Furthermore, the percentage of student's achievement criteria fell down by 16,67%. On the other hands, on baseline class, the histogram of student's achievement is fluctuated. Start with "very low" criteria at 20,83% and then go down at 8,33% in "low" criteria. After that, the histogram is tend to increase at 20,83% and 33,33% in "moderate" and "high" respectively. Furthermore, the histogram fall from high position into 16,67% at "very high."

The significant difference between these two classes is in the criteria of "very low" and "moderate." In experimental class, the percentage of student's achievement is 4,17%, while the baseline class by 20,83%. This difference is due to the students who are learning to better understand the methods of project construction material itself through a project that has been done. The projects that student must be finished are,

- Classifying the materials that used in daily life to the class of acid, base or salt.
- Creating a natural indicator

Scientific method with project method has many advantages, students have great potential to make the learning experience more interesting. Besides that, scientific method make a learning activity applying in daisy life . In addition, they can find knowledges by themselves through discussions and presentations. They conclude the basic principles that learned. Learning the scientific method has the following characteristics: 1) a student-centered. 2) involves the science process skills in constructing the concept, law or principle, 3) involves the processes of

knowledge potential in stimulating the development of the intellect, especially high-level thinking skills of students.
4) develop students' character.

Project method is a model or method to innovative learning, which emphasizes learning contextual through activities complex [11], The focus of learning is on the concepts and core principles of a discipline of study, involving students in the investigation of problem solving and activities of tasks meaningful others, giving students the opportunity to work autonomously construct their own knowledge, and peaked produce real products [12]. The George Lucas Educational Foundation [13], project method can stimulate motivation, processes, and improve the achievement of students with the use of the problems associated with certain courses in real situations.

Assignments on project method will stimulate all the senses of students to work on assignments or problems, so that students will be accustomed to the active and creative in solving existing problems. At baseline class, students tend to rely on the instructions of the teacher without studying its own material being taught. Students do not formulate the problem but plans were created by teachers. This will lead to the result of achievement of knowledge is low. The interaction between individuals in a group higher so happens closer cooperation. Students in the project group are more motivated to learn so as to produce a feeling of respect between individual opinions during discussions and individual feel to have the invention of the concept. Low student collaboration makes students less familiar with what was done so that the effect at the time of the presentation and understanding of the material. Understanding the material that makes less achievement is not as high-class knowledge baseline experimental class.

CONCLUSION

Scientific method with project method has positive effect to increase students' achievement. The results show that the class which using scientific method with project method has an average value of 37.50% of students' achievement (high), 37.50% (moderate) and 4.16% (very low). On the other hand, the class which using scientific method without learning methods have the students' achievement at 33.3% (high), 8.33% (moderate) and 20.83% (very low).

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