The Effect of Problem Posing Type Post-Solution Posing Learning Model on Self-regulation Skills and Science Process Skill of the Tenth-grade Students of Islamic Senior High School Kebumen, Tanggamus

U. Hijriyah¹, E. Pratiwi², A. Susanti³, W. Anggraini⁴, and A. P. Febriani⁵.

¹Physical Education, Raden Intan State Islamic University Lampung, Lampung, Indonesia.
*Correspondent author: Arekap18@gmail.com

Abstract. This study aims to determine the influence of the Problem Posing Type Post-Solution Posing learning model on the self-regulation and science process skills of the tenth-grade students. This research was conducted at Islamic Senior High School Kebumen, Tanggamus. The research method used was a quasi-experiment design. The population of this study was all of the tenth-grade science students of Islamic Senior High School Kebumen. The samples in this study were the students of X MIPA 1 as the experimental class which consisted of 36 students and the students of X MIPA 2 as the control class which consisted of 36 students. The instruments used in this study were the non-tests and test instruments; non-tests in the form of questionnaires to measure self-regulation and test instrument in the form of essay questions to measure science process skills. The Multivariate of variance (MANOVA) hypothesis test was used using the SPSS 0.17 program. The established results are sig 0,000 meaning sig < 0.05 so that H₀ is rejected and H₁ accepted. It can be concluded that there is an influence of the Problem Posing Type Post-Solution Posing learning model on self-regulation skills and science process skills.

1. Introduction

Science means the study of the causes and effects of phenomena that occur in nature [1]. One of the natural science studies in physics. Physics learning, in essence, is knowledge, ways of thinking, and experiments. In its implementation, effective and efficient learning will be able to make students interested and motivated to learn physics [2]. Zimmerman [3] argues that achieving learning is not explained entirely by individual skills and capacities, but there are also factors of self-regulation and motivation [4]. The main task of students is learning but not all students can manage themselves in the learning process well, especially self-regulation.

According to Ferla and Vrielig, students who have self-regulation in learning activities will have a strong impact on awareness of learning activities that include knowledge, confidence, and arguments so that it also impacts the learning activities [5]. Students with self-regulation will be more directed to learning. It will motivate the students' intentions and motivations in learning activities. By having the science process skills, the students will be able to solve any problems they face [6]. To support the students' achievement improvement, the science process skills need to be emphasized so that students will find facts, theoretical concepts, and scientific attitudes that will have a positive impact on themselves which will also affect the quality of good educational outcomes [7]. Problem posing aims to introduce the conceptual and procedural problems to problem-solving [8]. This is worth worrying
since metacognition is one of the requirements set by the government in the Curriculum 2013 [9]. Students will not be able to build their understanding without science process skills. Science process skills can overcome the scientific problems. These skills are used by scientists in scientific investigations [10]. Science process skills have indicators namely, observing, classifying, measuring, communicating, interpreting, predicting, utilizing tools, conducting experiments, and concluding [11]. Students will discover new knowledge and develop the knowledge they already have [12]. By developing science process skills that students already have, they will be able to discover and develop and discover the concepts or facts [13]. Physics is one of the most basic element of science [14, 15].

Based on previous research, students need to train and develop science process skills in learning because science process skills have a role to develop their thinking. The students will have the opportunity to make discoveries, increase memory capacity, learn the concept of science, and they will feel intrinsic satisfaction if they can get things done [16]. Science process skills aim to make students more active and creative in gaining knowledge, skills, values, attitudes, develop an understanding of facts and concepts found, and will foster and develop attitudes and values as expected [17]. Education is a conscious effort and important factor of investment in human resources [18 - 19]. From the results of the Pre-research through interview and observation with one of the physics teachers at the Islamic Senior High School Kebumen, Tanggamus, it was found that the learning process still used the lecturing method and questions and answers. The science process skills haven't been applied in the learning process, consequently, the science process skills have never been assessed directly. The students were passive and lack of enthusiasm. There are still many students who have not completed the learning outcomes and less active in expressing their opinions, lack of preparation, and lack of confidence. Based on the science process skills test, the self-regulation was low. Almost 50% of students still in the low category. This is because students were not active in learning activities and in problem-solving which made the classroom atmosphere less conducive and lack enthusiasm. The lack of self-regulation in the learning process made the class passive. The students were afraid to express their opinions when teachers asked questions. They did not prepare themselves when learning began. Lack of independence and the lack of interaction between teachers and students during the learning process made the class passive.

For learning to be conveyed well and can increase the activity, confidence, and skills of students, it is necessary to have an appropriate learning model [20]. Learning models are made to achieve goals, understand concepts, develop ways of thinking, and social values so students can be actively involved in cognitive and social tasks [1]. Thus, to overcome the problems, one alternative learning model that can be used is Problem Posing Type Post-Solution Posing. Silver states that the Problem Posing Type Post-Solution Posing is a simple problem formulation or re-formulation of the problem so that it is easier to understand and simpler in solving complex problems [21]. This learning model invites students to be more active in finding their information and students are required to explore new knowledge from information and prior knowledge [22]. The Problem Posing Type Post-Solution Posing was chosen to improve students' self-regulation and science process skills. Based on previous research, the Problem Posing Type Post-Solution Posing learning model can make the students more active in the learning process, develop creative thinking skills, and develop the information obtained [23]. By using the Problem Posing Type Post-Solution Posing learning model, it is expected to stimulate students to find the real relationships of the information they get. The more students expand the information, the easier it will be to find solutions to solve problems. They will feel satisfied with the answers obtained. They will understand the questions asked by teachers so that with this activity, they will be more active and confident in expressing opinions. This model is considered able to improve students' self-regulation and science process skills. This model will train the science process skills in developing students' thinking, inviting them to solve problems with their findings related to the original problem, improving memory, and giving satisfaction to the success of the findings, thus it will increase their confidence.
This study aims to know the Effect of a Model Learning Problem Posing Type Post-Solution Posing on Self-Regulating Skills and science Process Skill of Class X Students in Kebumen Tanggamus Islamic High School.

2. Method
The study was conducted in the first semester of the 2019/2020 academic year. The research was conducted at Islamic Senior High School Kebumen, Tanggamus. The subjects in this study were the tenth-grade students. This study employed the quasi-experimental research design. Experimental research is referred to as a method to find out whether there is a relationship between one variable with another variable. This research was conducted in two classes, namely one experimental class (36 students) and one control class (36 students). In carrying out learning activities, the experimental class was taught by using the Problem Posing Type Post-Solution Posing learning model and the control class was taught by using the learning model that was applied at the school. After the learning activities were completed, questionnaires were distributed to determine the level of self-regulation. A posttest was also given to the subjects to find out the science process skills. The research design used was the Posttest-Only Control Group Design. The material discussed was straight motion. Before the research was conducted, the researchers conducted the validity of the instrument to find out whether or not an instrument was suitable to be used. After that, the researchers gave treatment to the experimental class and the control class.

The results of the posttest were analyzed using the normality test (Kolmogorov-Smirnov), homogeneity using Levene's Test, the hypothesis testing using the multivariate test of variance (MANOVA) assisted by SPSS 17.00 program.

3. Results and Discussion
The highest posttest score in the control class is 89.17, the lowest score is 48.33, and the average score is 71.27. The highest score in the experimental class is 89.17, the lowest score is 58.33, and the average score is 79.38. Based on the posttest data on science process skills, it can be seen that the scores obtained for each indicator were varied. In the experiment class, the indicators with the highest scores are classifying, utilizing tools and materials, asking questions, applying concepts, and communicating. The highest indicators in the control class are classifying, utilizing tools and materials, and asking questions. Based on the data obtained, it is known that the significant level for science process skills in the experimental and control classes is 0.64 and 0.73, then for self-regulation in the control class is 0.75 and in the experimental class is 2.00, then the data for self-regulation and science process skills have exceeded the significant level of (0.05) so that both data are normally distributed. After conducting the normality test, next is the homogeneity test. From the data, it is known that the significant value of science process skills is 0.432 and self-regulation is 0.547 which is greater than the significant level that has been determined, thus, the data can be said to be homogeneous. The hypothesis test was done by using the multivariate test of variance (MANOVA) assisted by SPSS 17.00. The results can be seen in the following table.

| Table 1. Inter-Subjects Effects Test |
|--------------------------------------|
| Source | Dependent Variable | Type III Sum of Squares | D f | Mean Square | F | Sig. |
| Corrected Model | SR | 1250,000 | 1 | 1250,000 | 119,463 | .000 |
| | KPS | 1530,889 | 1 | 1530,889 | 24,573 | .000 |
| Intercept | SR | 424427,556 | 1 | 424427,556 | 40562,706 | .000 |
| | KPS | 394568,056 | 1 | 394568,056 | 6333,275 | .000 |
| Class | SR | 1250,000 | 1 | 1250,000 | 119,463 | .000 |
| | KPS | 1530,889 | 1 | 1530,889 | 24,573 | .000 |
Based on Table 1, $H_0$ is accepted if the significant value is greater than 0.05. If the value is significantly less than 0.05, $H_0$ is rejected. The results of this hypothesis test are:

- The value of self-regulation is less than 0.05 which is 0.000, thus, $H_0$ is rejected and $H_1$ is accepted. The explanation concludes that there is a difference in the students' self-regulation between the experimental class and the control class. The value of the post-test in the experimental class is greater than the control class so that the Problem Posing Type Post-Solution Posing learning model influences self-regulation. Science process skills value obtained is less than 0.05 which is 0.000, thus, $H_0$ is rejected and $H_1$ accepted. The Problem Posing Type Post-Solution Posing learning model affects the science process skills because the percentage of experimental class science process skills is greater than the control class.

3.1 Discussion of Problem Posing Type Post-Solution Posing Learning Model on Self-Regulation

results of students' self-regulation can be seen from the results of the posttest conducted at the end of learning. The posttest results show a significant difference between the control class and the experimental class where the control class obtained an average value of 71 and the experimental class obtained an average value of 79. It can be seen that the control class and the experimental class have good self-regulation but the experimental class has a higher average value compared to the control class. So it can be concluded that the Problem Posing Type Post-Solution Posing learning model influences the self-regulation.

The self-regulation of experimental class students showed high results as expected by researchers. This is consistent with research conducted by Erni Nurjanah[19] which states that the Problem Posing Type Post-Solution Posing learning model can provide an increase in students' self-regulation[24]. This shows that the research conducted by researchers is in line with previous studies. The differences are in the self-regulation, and science process skills, and the selected learning material.

Through the implementation of the Problem Posing Type Post-Solution Posing learning model, the students can be more independent in learning, have positive self-confidence because they are allowed to formulate their problems based on previously existing problems. Furthermore, the class given the treatment of Problem Posing Type Post-Solution Posing learning model can have a sense of responsibility to behave according to their positive mindset and be able to exercise self-control.

In group discussion activities, after conducting a simple experiment by using the Problem Posing Type Post-Solution Posing learning model, the students interacted with each other, dared to ask questions, expressed opinions and can present their work in front of the class. This encourages students to actively explore their potential and find answers to problems that they formulated themselves, as explained by Fathur Rozy, self-regulation is an active process in constructing and setting learning goals by monitoring, organizing, controlling, motivating the behaviors that have been set[25]. After the application of the learning model, students were able to build new relationships from the concepts and principles that they have learned based on prior knowledge. This is not obtained through the existing models that have been applied at the school.

3.2 Discussion of Problem Posing Type Post Solution Posing Learning Model on Science Process Skills.

To assess the science process skills after the treatment with the problem-posing type post-solution posing learning model, an essay test that consisted of 11 items was conducted. The posttest results show a significant difference between the control class and the experimental class where the control class obtained an average score of 69 and the experimental class obtained an average score of 78.

The results of this study are in line with previous studies that prove the Problem Posing Type Post-Solution Posing learning model impacts the students' science process skills[26]. The analysis shows that there is a significant difference between each indicator of students' science process skills in the experimental class and the control class. The 10 indicators of science process skills are explained as follows:
In the observing indicator, the students were asked to make observations carefully. At the time of the practicum, each student was asked to observe a picture and to draw conclusions. At this stage, the students were expected to be able to find special characteristics of the object being observed.

In the classifying indicator, the students were required to be able to categorize objects based on their characteristics. During the practicum, the students were required to be able to distinguish or classify circumstances based on the characteristics.

The predicting indicator aimed to record the observations. The researcher provided questions related to the experiments conducted after students were asked to predict what will happen to the experiment. Based on the results of the t-test, the value obtained by the experimental class was 61 while in the control class was 57.

In the interpreting indicator, the students were asked to make a statement related to the observations. The value obtained by the experimental class on this indicator was 67 and the control class was 63. The value of the experimental class was higher than the control class because, in the experimental class, the students were trained to express their opinions or statements.

In the indicator of utilizing tools and materials, the students were asked to write the tools and materials to be used in experiments. The value obtained in the posttest showed that the experimental class obtained a very high score of 93 while the control class scored 88 because the experimental class students were accustomed to conduct a deeper study of the observations. In the question and answer indicator, before the students learned a problem further, they were asked to ask questions about the object being observed. There was a difference because the experimental class students are accustomed to developing problems from previous problems then independently find solutions that are appropriate to the knowledge they have.

In the applying concept indicator, the students were asked to be able to adjust their interpretation relevant to the concept of the material, make appropriate conclusions relevant to the purpose of the experiment, and show a causal relationship in the experiments. Based on the posttest results, the experimental class obtained a score of 93 while the control class scored 54. This is because the students in the experimental class were able to develop problems from existing problems and indirectly better understand the concepts of the learning material contained in the given problem. This is what causes a significant difference between the experimental class and the control class.

In the constructing hypothesis Indicator, the students were asked to formulate temporary assumptions that can be tested about why or how things happen. They were asked to think deductively according to the concept of the learning material. The success of this indicator can be seen from the results of the posttest data which shows that the experimental class scored 71 while the control class scored 62. This is because the experimental class students can understand the concept in-depth so that it will be easier for them to formulate the presumptive problem.

In the planning an experiment indicator, the students were expected to be able to use tools and materials per the experiments to be performed to obtain the data per the objectives contained in the experiment. The experimental class obtained a value of 76 while the control class obtained a value of 54. There are significant differences between the control class and the experimental class. This is because the experimental class applied the Problem Posing Type Post-Solution Posing learning model. The students are accustomed to independently and actively convey the patterns of thought so that they can easily plan an experiment.

In the communicating indicator, the students were asked to be able to report the results of experiments in the form of conclusions contained in the worksheets where they delivered what they know and the results they got based on the experiments. The whole students in the experimental class were able to fill in the worksheets by using good and appropriate language, able to convey their thoughts based on the results of the experiment using a good, correct, and polite language, and able to explain the results of the experiment in front of the class. Worksheets are one of the means they help and facilitate in the teaching so that effective interaction between students and the teacher could be established so that the students' activity can be increased. Based on the posttest results, the experimental class obtained a value of 92 while the control class obtained a value of 77. These results
show that the experimental class has a higher score than the control class. As explained in the previous indicators, the experimental class students are accustomed to expressing what they think of a problem, formulating other problems from a given problem, and able to independently find the right solution to the problem.

4. Conclusion

Based on the description and discussion of research data, the results of hypothesis testing on self-regulation after treatment obtained a value of less than 0.05 which is 0,000, thus, $H_0$ is rejected and $H_1$ accepted. The explanation concludes that there is a difference in students' self-regulation between the experimental class and the control class. The score in the experimental class is greater than the control class so that the Problem Posing Type Post-Solution Posing learning model influences self-regulation. The science process skills obtained a significant value of less than 0.05 which is 0,000, thus, $H_0$ is rejected and $H_1$ is accepted. The Problem Posing Type Post-Solution Posing learning model affects the science process skills. This explains that the Problem Posing Type Post-Solution Posing learning model influences students' self-regulation and science process skills.

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