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The Implementation of PODE Worksheet to Improve Students' Scientific Attitude, Analysis Ability and Self-Regulation

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Abstract. Students' scientific attitude is very important to support the achievement of natural science learning in the 2013 curriculum in an effort to shape the character of students through attitudes formation on students when carrying out the learning process through experimentation, discussion, group work and the overall learning process. The ability to analyze and self-regulation is part of critical thinking skills that must be built on each student so that it becomes a directed character in everyday life to solve all kinds of problems. This research aims to describe the implementation of PODE (Predict, Observe, Discuss and Explain) worksheet in natural science learning to improve students' scientific attitudes, students' analysis ability and students' self-regulation. The research was conducted in class VII.3 with 32 students of SMPN 4 Nganjuk, East Java. Type of research is Classroom Action Research. The method used is a pre-experimental design type One Shot Case Study, meaning that there is a group given treatment then the results are observed. The results of this research show the following: 1) Students' scientific attitude before using PODE worksheet (pre cycle) is 2.92 (sufficient category) and after using PODE worksheet (cycle I) is 3.03 (good category), 2) Ability to analyze students before using PODE worksheet (pre cycle) is 37.5% (less category) and after using PODE worksheet (cycle I) is 70.31% (sufficient category), 3) Students' Self-regulation before using PODE worksheet (pre cycle) is 37.5% (less category) and after using PODE worksheet (Cycle I) is 71.87% (sufficient category). Thus it can be concluded that the implementation of PODE worksheet can improve scientific attitudes, analysis ability and self-regulation of students.

Keyword: PODE Worksheet, Scientific Attitude, Analysis Ability, Self-Regulation, Natural Science Learning

INTRODUCTION

Quality learning is provides facilities to students with the aim of developing the think ability, skills and the right attitude to face global challenges, especially in the 21st century [1]. The relevance of science learning in the 21st century in the 2013 curriculum emphasizes scientific attitudes through a scientific approach to provide understanding to students in recognizing and understanding various materials using methods that are in accordance with the scientific method [2]. Scientific attitude is an attitude that must be possessed by scientists or science seekers with several points that can be characterized, among others: objective, open, diligent, patient, not arrogant and do not absolute a scientific truth [3]. The scientific attitude of students is influenced by the creativity and role of the teacher in formal education learning, thus the efforts of the teacher in preparing, implementing and evaluating learning greatly influence the scientific attitude of students [4].

In addition to the scientific attitude in science learning that needs to be given and trained to students is the high order thinking skill (HOTS). The taxonomy of blooms in the field of education is designed to distinguish students' thinking abilities from the lowest level to the highest level of thinking ability [5]. One of the thinking skills in accordance with the 2013 curriculum is the ability to think critically. Critical thinking ability is one of the abilities students must have in the 21st century to solve problems in everyday life. Critical thinking ability is a thinking model of problem solving as an effort to improve the quality of thinking skillfully [6]. The indicator of critical thinking

ability according to Fascione consists of: Interpretation, analysis, explanation, inference, evaluation, and self regulation [7]. Based on the six indicators, analysis ability and self-regulation is an important part that must be possessed by students, this is reinforced by Wulandari's opinion stating that science learning requires an ability to analyze, because in science learning many types of questions require analytical thinking [8] Self regulation has a positive and significant influence on student learning outcomes. This shows that if students' self-regulation capabilities increase, student learning outcomes will increase, and vice versa [9]. Both of these capabilities are still relatively low and need to be improved so that this research is limited by self-analysis and regulation capabilities.

Students' low analytical skills are shown by research at Banjarmasin State High School class X2 on initial observations indicating that the teaching and learning process is sourced from teachers so students are not trained to develop the ability to think synthesis analysis in solving problems [10]. The results of Winarti's research in 2015 showed that students' analytical skills at a low level with differentiating scores had a value of 16.6; organizing at 46.6 and attributing at 7.2 [11]. Research conducted by Octheria in 2018 can be concluded that the self-regulation of students in Sangkuriang Cimahi 1 Vocational School is in a low three-dimensional self-regulation ability and measured using seven indicators obtaining an average yield of 1.77 [9]. Based on the research results of Lilis Nuryanti in 2018 at junior high school in Delanggu Klaten Central Java, the teachers and researchers describe the condition of critical thinking skills of class VIII junior high school students, which is evidenced by the students' low (B) average achievement. The low level of critical thinking skills of students is because students are not used to being presented with active learning that maximizes the potential of students' thinking [12]. The results of Dian Kurnia's research in 2016 showed that junior high school students in JJember district with low-level HOTS skills were less able to identify the main ideas, analyze arguments, and showed the usefulness of things that were known to answer all questions, so they had poor analytical skills [13]. Based on the description that has been delivered, it can be concluded that scientific attitudes are very important to be taught, humans think not because humans love to think, but think is used to deal with problems. Thinking activity is a basic human characteristic that shows that humans have a curiosity about the problems at hand. Learning models that have existed and are often used by teachers in the learning process in the classroom have integrated scientific attitudes but in their implementation this scientific attitude is less than optimal in conditioning so that it often blurs and makes students unconscious about the scientific attitude itself [14].

The problem about the low analysis ability, self-regulation and scientific attitudes of the students above is in accordance with the conditions in class VII.3 of SMPN 4 Nganjuk, East Java. The results of observations showed that there were several problems in students' critical thinking skills in accordance with indicators of critical thinking according to Fascione, including: 1) Students' answers to questions or opinions of friends are still single and disconnected, students have not been able to analyze problems and provide solutions, these are indicators students' analysis ability is still low. 2) Students are not accustomed to evaluating their own knowledge related to problems or phenomena that exist, this shows that students' self-regulation ability is still low. 3) The scientific attitude of students in solving problems and questions in learning is still low. Scientific attitude indicators used in this study include: honest, open with new ideas, responsibilities, objectives, cooperation and critical thinking have not been clearly seen, this is evidenced by students not being able to cooperate objectively, honestly and responsibly and openly in conveying ideas from the results of their critical thinking process with friends in their groups during practical activities and presentations, this is due to the lack of presentation of more contextual phenomena so that students' scientific attitudes have not been clearly seen and are still low. Based on the relevant research literature review and the results of observations, then these problems are very important to immediately find solutions to help improve scientific attitudes, analytical ability and self-regulation of students.

The provision of teaching materials that prioritize contextualization and the meaning of teaching materials relating to the phenomenon of everyday problems is needed to foster students' scientific attitudes, analytical and self-regulation abilities. Learning can be done through giving assignments that encourage the use of knowledge and skills in different conditions for each student in the same class [15]. Teaching materials that can be used in accordance with the needs of students are Student Worksheets, which are sheets that provide guidance to facilitate students in conducting learning activities. The Student worksheet contains steps to complete a task given by the teacher through clear instructions [16]. Student worksheet is a form of learning guide that functions as a student learning guide and can facilitate students to be easier when carrying out learning both inside and outside the classroom [17]. Worksheet is one part of the learning tool that must be prepared by the teacher. Worksheet that is in accordance with the 2013 Curriculum and is the solution for students in facing the challenges of the 21st century are worksheet that can foster a scientific attitude and can improve their analysis ability and self-regulation are PODE Worksheet (*Predict, Observe, Discuss, Explain*). PODE worksheet contains learning activities that can train thinking skills and improve the scientific attitude of students through problem solving activities with sequential steps starting

from: 1) Students make predictions on a problem, 2) Students make observations which are continuation of previous activities, 3) Students conduct discussion activities from the results of observations that have been made, and the last 4) Students explain the results of observations that have been carried out from all the previous stages through the presentation activities in front of the class.

RESEARCH METHOD

This research was carried out in class VII.3 of SMP N 4 Nganjuk East Java with 32 students. This type of research is classroom action research conducted through the pre-cycle and first cycle, each cycle consisting of four steps, including: 1) Planning, 2) Implementation, 3) Observation, and 4) Reflection [18]. The method in this study uses a pre-experimental design type One-Shot Case Study, which can be seen in the explanation below:

$$\boxed{X\ O} \qquad \begin{array}{l} X = \text{Treatment given} \\ O = \text{Observation} \end{array}$$
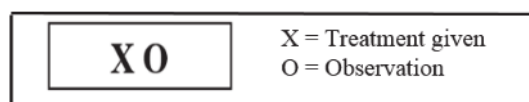
(Source: Sugiyono)

One-Shot Case Study is a research method where there is a group given treatment then the results are observed. Treatment is an independent variable and the result is the dependent variable [19]. The data analysis technique used is quantitative and qualitative descriptive in the form of percentage (%) then described in the form of verbal sentences. The analysis technique is used to determine the average percentage increase in variables in this research, those are: 1) scientific attitude, 2) analysis ability and 3) self-regulation of students at each stage of the research conducted. The increase of the three variables in this research at each cycle can be used as an indicator that the students' understanding of the PODE worksheet is good so that it can help improve the research variables that are still low. The equation and criteria for the assessment scores of students' scientific attitudes used are as follows:

$$X = \frac{\sum X}{(\text{Number of aspects assessed}) \times (N)}$$

X   = Average
$\sum X$ = Number of scores obtained
N   = Number of students

TABLE I. Scoring categories and giving predicates as listed in the table below:

Scientific Attitudes	
Modus	Category
4,00	Very Good
3,00	Good
2,00	Sufficient
1,00	Poor

(Source: Permendikbud)

The scale for scientific attitudes of students uses a range of numbers and letters 4.0 (A) - 1.00 (D). The assessment was later converted according to the results of the assessment of Permendikbud number 104 of 2014 [20]. The equation and weighting criteria for the assessment scores for analyzing ability and self-regulation used are as follows [21]:

$$P = \frac{\sum ni}{N} \times 100\%$$

P   = Percentage of scores obtained
∑ni   = Number of scores obtained
∑n   = Maximum number of scores

TABLE I. The criteria table for assessment scores is critical thinking:

Score	Criteria
90% - 100%	Very Good
80% - 89 %	Good
70%-79%	Fairly Good
<70%	Unfavorable/ Bad

(Source: Prastowo)

RESULT AND DISCUSSION

The scientific attitude of students before using the PODE worksheet (pre cycle) shows a fairly good category with an overall percentage gain of 2.92%, with the following indicators: 1) Honest: 2.84%; 2) Open with new ideas: 2.90%; 3) Responsibilities: 3.12%; 4) Objective: 2.96%; 5) Cooperation: 2.87%; and 6) Critical thinking: 2.81%. After using the PODE worksheet (cycle I) students' scientific attitudes have increased with the average acquisition of an overall percentage of 3.03% showing good categories with the following indicators: 1) Honest: 2.93%; 2) Open with new ideas: 3.18%; 3) Responsibilities: 3.18%; 4) Objective: 3.12%; 5) Cooperation: 3.03%; and 6) Critical thinking: 2.90%. The increase in the average percentage of students' scientific attitudes from pre-cycle to cycle I was 0.11%. Explanation of the improvement of students' scientific attitude more fully can be seen in figure.1
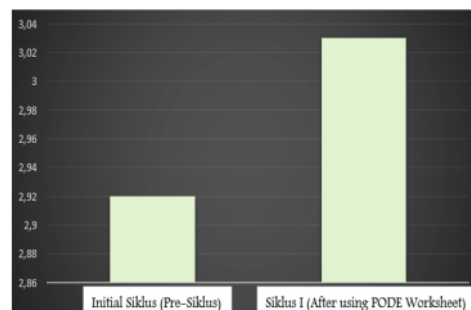

FIGURE.1 Enhancement Students' Scientific Attitude

Scientific approach is also called a natural approach. The learning process can be integrated with a scientific process. 2013 curriculum mandates the essence of the scientific approach in every science learning. The scientific approach can be used by the teacher as an effort to develop attitudes, skills, and knowledge of students [22]. One way to grow the scientific attitude of students is that the teacher can apply the scientific approach in learning to solve problems related to student contextualization, so that the scientific attitude of students can be trained little by little and become good habits. This is in accordance with Rana Kamel's research in 2017 which instructed science teachers in general, especially biology teachers to use a scientific approach to learning. The teacher needs to provide all the tools and equipment and facilities needed for learning in the laboratory to support scientific science and its application [23].

Activities in science learning using PODE worksheet can train students to solve problems scientifically through the process of observing, asking, trying, associating and communicating, this is in accordance with the steps of learning activities contained in worksheet consists of four sequential steps starting from predict, observe, discuss and

explain with problem-based learning models so that it can be used to facilitate and assist students when addressing problems with scientific attitudes that are in accordance with the attitude that must be possessed by a scientist or knowledge seeker. One of the activities in the PODE worksheet is practicum. Science learning with practicum activities can train students to solve problems using the right scientific attitudes, thus students will get used to and be trained be scientific when facing problems in their daily lives.

The increase in the average percentage of students' scientific attitudes from pre-cycle to cycle I was 0.11%. The scientific attitude of students before using the PODE worksheet (pre cycle) is in the fairly good category with an average overall percentage of 2.92%. The scientific attitude of students after using the PODE worksheet (cycle I) increased by 3.03% in the good category. This is in accordance with the results of research and analysis conducted by Devi Puriyandari in 2014 showing that the application of Prediction learning models, Observation and Explanation (POE) accompanied by student worksheets can improve students' scientific attitudes. The percentage of scientific attitudes of students with a high category of 50% in the first cycle and increased to 84.4% in the second cycle [24]. The scientific attitude between male and female students did not show a significant difference. The scientific attitude that increases from pre cycle to cycle I is influenced by the number of problem solving exercises carried out positively so that students are accustomed to addressing the problem with a good and correct scientific attitude. This statement is in accordance with the results of a study by Secil Erokten in 2016 which states students have a positive attitude towards science, but this positive attitude does not differ according to gender [25].

Students' analysis ability before using PODE worksheet (pre cycle) shows an unfavorable category with the average acquisition percentage of 37.5%, then the students' analysis ability has increased after being given PODE worksheet which contains learning activities to train how to analyze through the presentation of problems in life phenomena everyday using sequential steps in the PODE worksheet starting from: 1) Students make predictions on a problem, 2) Students make observations which are a continuation of previous activities, 3) Students conduct discussion activities from the results of observations that have been done, and those who last 4) Students explain the results of observations that have been carried out from all the previous stages through presentation activities in front of the class. This is evidenced by an increase in the average percentage of 70.31% which shows a fairly good category. The description of increasing the ability to analyze more fully can be seen in the figure.2
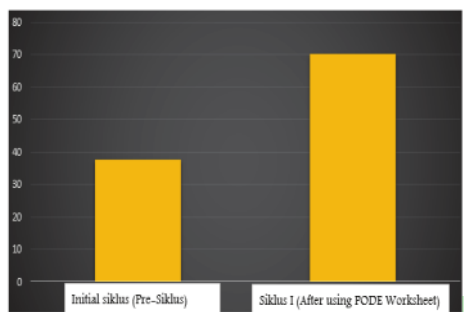

FIGURE.2 Enhancement Students' Analysis Ability

The presentation of problems in LKS worksheet is based on the students' contextual needs that are relevant to students' daily phenomena, aiming to be able to practice analyzing abilities in solving problems. Students' analysis ability before using and after using PODE worksheet has increased due to the PODE worksheet containing learning activities that train students to solve problems based on their contextual experience. Students before using PODE worksheets tend to do conventional learning and only practice a few times, so that the ability to analyze it is poorly trained. This is relevant to the research conducted by Tata in 2015 which stated that the achievement and improvement of learning of students who received contextual learning was better than students who received conventional learning [26]. Cooperative learning can help students to improve their ability to analyze, because in cooperative learning students are divided into small groups where effective interaction must occur between group members to solve problems presented in learning. Teachers need to move from a traditional approach to a more student centere learning to the implementation of effective cooperative learning [27]. According to the results of Yee Mei Heong's research in 2011, there were no significant differences in the level of thinking between male and

female students, but from how often students did analytic exercises to solve problems through scientific methods and appropriate steps [28].

Self-regulation of students before using PODE worksheet (pre-cycle) shows an unfavorable category with an average percentage of 37.5%, then increases by 71.87% with a fairly good category. Student self-regulation increases after being given the PODE worksheet which contains learning activities to train self-regulation through presenting the problems of phenomena in everyday life to evaluate one's own abilities in accordance with learning material. More complete improvement in student self regulation can be seen in figure.3
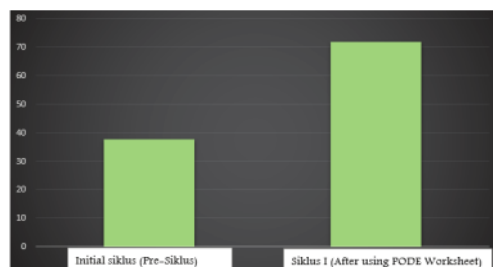
FIGURE.3 Enhancement Students' Self-regulation

Problem-based learning can train students to evaluate themselves (self-regulation), through this learning students can construct their knowledge then connect with existing phenomena to get solutions. These activities can help students to find out how far they are able to solve the problem. According to Fauziah's research in 2015 stated that students were able to overcome problems in problem-based learning and they managed to get better grades compared to the previous semester [29]. Regulatory activities in constructivist learning such as problem based learning ensure students are involved and take responsibility with their learning outcomes through the facilities provided [30]. The results of the 2018 Octheria Friskilia S study found that self-regulation has a positive and significant influence on student learning outcomes, both partially and simultaneously. Therefore, student learning outcomes can be improved through increased self-regulation (self-regulation) abilities of students [9].

CONCLUSION

Based on the research that has been done, three main conclusions can be taken. First, students' scientific attitude increased by 0.11% from 2.92% (quite good category) to 3.03% (good category). Second, an increase in students' ability to analyze has increased from 37.5% (poor category) to 70.31% (quite good category). The third increase in student self-regulation has increased from 37.5% (poor category) to 71.87% (quite good category). The overall conclusion shows that the PODE worksheet can help to improve scientific attitudes, students' ability to analyze and self-regulation.

RECOMMENDATION

1. PODE worksheets can be used by teachers as additional teaching materials in science learning in junior high schools to foster scientific attitude and improve students' analytical ability and self-regulation.
2. Teachers can be inspired to make similar teaching materials to improve students' analytical ability and self-regulation.
3. Researcher need further research about how to describe students' scientific attitudes, analysis ability and self-regulation of senior high school students in natural science learning using PODE worksheet.

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