



Learning of Physics with Scientific Approach in Boyolali Regency High School

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Abstract

This study aims to describe the implementation of the scientific approach carried out by teachers of State High Schools in Boyolali District. The study used a qualitative descriptive method. The research was carried out on three state high school in Boyolali Regency which were grouped according to the accreditation value. The research subjects were 3 physics teachers of class X and class X students of State High Schools in Boyolali Regency totaling 96 students. The instruments used are observation sheets, questionnaires, and interview guidelines. The results showed that the implementation of the scientific approach in Boyolali District High School was classified as medium. The highest core activity is observing and the lowest is trying. The factors that influence the implementation of the scientific approach by the teacher are infrastructure and laboratory facilities, and time constraints so that the teacher spends time on learning exercises.

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INTRODUCTION

Education consists of various elements of resources, curriculum is one element that contributes significantly to realizing the quality of good student learning outcomes. The improvement of the curriculum that is carried out periodically is one of the efforts to achieve the goals of national education (Widiana 2016). Implementation of 2013 Curriculum is a strategic quality improvement intervention in terms of students who will be the subject, as well as teachers who are the main actors (Bintari et al., 2014). 2013 curriculum emphasizes on student-centered learning using a scientific approach.

The scientific approach encourages students to construct their own cognitive. Learning using a scientific approach is a scientific process, with steps such as observing, asking, trying, reasoning, and communicating (Saregar, 2016). Science education builds students' way of thinking to understand natural phenomena or events with scientific methods such as those carried out by scientists (National Research Council, 1996). The scientific approach is in line with the learning of physics which is conducting experiments to find concepts (Hubber et al, 2015). So that in scientific learning students play an active role in learning and teachers as facilitators. The role of the teacher as a facilitator is being able to plan, carry out pleasant learning (Nurfaizah et al., 2017)

Physics is not only a collection of mathematical formulas and concepts that students must learn, but physics also contains an understanding of the concept to be applied in solving problems of everyday life (Toharudin et al., 2011; Effendy et al., 2018). However, most students consider that physics is a difficult subject (Suhandi & Wibowo, 2012). These problems cause students' interest in learning or low interest in following physics learning (Linuwih & Sukwati, 2014). This is one reason for the lack of mastery of the concept of physics (Suhandi & Wibowo, 2012).

The scientific approach that is carried out optimally, is expected to improve understanding of students' physics concepts. Bintari et al. (2014) conducted research on the scientific approach. The constraints experienced by the teacher in the implementation of scientific learning are the discrepancies between the time and the scope of the learning material, and the examples presented in the student handbook are not contextual, so that a more careful effort in preparing an implementation plan of learning is important to do. Careful planning and selection of the right media in learning can affect student learning outcomes (Prihatiningtyas et al., 2013). Boyolali is one of the districts in Central Java. Upper secondary education institutions in Boyolali Regency consist of 49 high schools, consisting of 17 public high schools, 4 public MAs, and 28 private high schools. All State High Schools in Boyolali have implemented the 2013 Curriculum. Based on the descriptions presented above, it is a reason to analyze the scientific approach to learning in physics learning that has been carried out by teachers of State High Schools in Boyolali regency.

METHODS

This study used descriptive qualitative method. The research was carried out on three state high school in Boyolali Regency namely Boyolali 1 State High School, Andong 1 State High School, and Karanggede 1 State High School which were grouped according to accreditation value. The research subjects were 3 physics teachers of class X and class X students of State High Schools in Boyolali Regency totaling 96 students. The instruments used are observation sheets, questionnaires, and interview guidelines. The research was carried out by conducting a survey on the feasibility of a scientific approach based on the 2013 curriculum on physics learning. The results of observations carried out during the learning process take place and then analyzed and then scanned for each aspect of the core activities of the scientific approach.

RESULTS AND DISCUSSION

The implementation of a scientific approach in three public high schools in Boyolali Regency is in the high, medium and low category based on the school accreditation value. Three major aspects observed in the implementation of the scientific approach, namely preliminary activities, core activities that include observing, asking, trying, trying, reasoning, communicating, and end activities. Based on observations made, the implementation of all activities can be seen in Figure 1 and the average implementation of the scientific approach for each core activity can be seen in Figure 2.

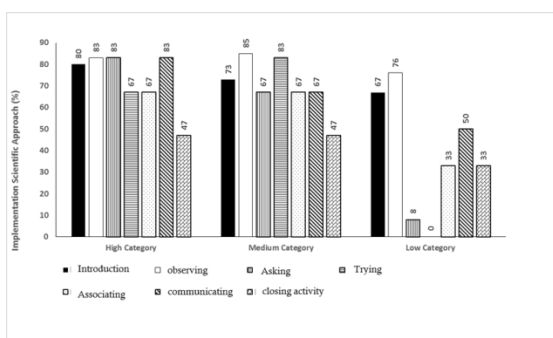


Figure 1. Percentage of Activity Implementation in the Scientific Approach

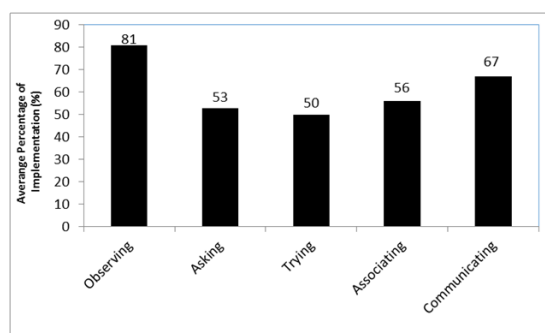


Figure 2. Average Percentage of Implementation of the Scientific Approach

The ignorance of the scientific approach taken by the third teacher of state high schools in Boyolali District as seen in Figure 1, high category schools get a high percentage for the activities of the scientific approach. Low category schools have not optimally carried out activities in the scientific approach. Observations

of learning activities carried out by the teacher include preliminary activities, core activities, and closing activities. The preliminary activity is seen from the aspect of conditioning the learning atmosphere, discussing the competence of learning that has been learned, conveying the learning objectives, conveying an outline of the scope of material and assessment techniques. Figure 1 shows that the preliminary activities in the low category schools obtained the highest percentage. Low category school teachers explain learning objectives and basic competencies achieved. Overall, the three schools are optimal in conditioning the learning atmosphere. However, from the three schools did not explain the evaluation and assessment used. A teacher should carry out preliminary activities effectively because these activities indicate the teacher is in control of the class and is ready to learn (Djajadi et al., 2012; Pradani et al., 2018).

The 2013 curriculum with a scientific approach includes the core activities of observing, asking, trying, reasoning, and communicating. Observation of the feasibility of the scientific approach that has been carried out, shows that the core activities are observed from the three highest schools compared to other aspects of core activities as shown in Figure 2. The three schools obtained the same percentage for observing activities, namely 83%. Observing activities have been optimally carried out by the three schools. The proportion of the core activities observed in the scientific approach is 30%. Impulse and Momentum material is better taught according to cognitivism learning theory which states that learning is the result of individual efforts that define experiences related to the world around. This means that learning is also linked to relationships with the outside world, especially technology and information (Jamaris, 2012).

The observation process can be done by displaying videos, images, or animations related to impulse and momentum material. This activity can also be done by observing events that are related to the material being taught. The teacher facilitates students in observing events

around directly/through animations and videos as revealed by the teacher at the time of the interview. The teacher needs to show the connection between learning material and other fields, especially related to real life. According to Daryanto (2014), with the observation method students find the fact that there is a relationship between objects analyzed with the learning material delivered by the teacher.

Observation of learning activities for the three teacher schools is sufficient in facilitating students to ask questions. Schools are in high category and there are already students who ask questions related to the material presented. However, low category schools based on observations there are no students who have asked questions. Need to increase the provision of stimulant questions by the teacher. Saregar's (2016) research shows that by implementing a scientific approach students who initially rarely find opinions slowly begin to dare to express their opinions.

The core activity tries to obtain the lowest percentage of the three schools. According to Leonard & Penick (1993) physics is a science that emphasizes learning centered on student activity, which reduces memorization activities but to science process skills. Schools are high category and are already trying activities, but low category schools do not try activities because teacher-centered learning. Students get the concept by spending time in the laboratory or field work. According to Holbrook & Rannikmae (Haristy, 2012) physics learning must also include social issues that incorporate scientific concepts to solve a problem.

According to Sari (2013) government policy contributes to the problem of science learning including quality improvement that depends on the project, when the project is completed, the teacher returns to his original habits. Exams that make most teachers spend time on the practice questions so students are only told to memorize formulas to complete exam questions. The teacher's workload given by the teacher is 24 hours a week, whereas the teacher's activities are not only teaching but they have to prepare teaching materials, research and

teaching materials. These problems become one of the factors teachers rarely do activities in the laboratoris (Sambada, 2012).

Reasoning activities for high and medium category schools are optimal. After conducting experiments in the learning process, students analyze the data of the findings or experiments and draw conclusions according to the data obtained. Low category schools have not carried out this activity optimally. Students only listen to the explanation from the teacher during the learning process, understand the material presented themselves, and draw conclusions in groups after the observation process. However, because the learning process does not conduct experiments, so students do not carry out the processing of experimental results data.

The final activity of the scientific approach is to communicate. The purpose of this activity is to train students in delivering their findings confidently. High category school students compile written reports and verbally by presenting the results of the experiment. While the school students in the category are presenting the results of the products that have been made. In the final activity the teacher's learning from the three schools directs students to draw conclusions from the material that has been studied.

In addition to the observation sheet, the instrument for implementing the scientific approach uses a response questionnaire to the teacher and students which contains 16 statement items. The statement is adjusted to the observation sheet. The results of the teacher and student questionnaires related to learning with the scientific approach can be seen in Table 1.

Based on Table 1, it can be seen that the highest teacher and student responses related to the implementation of scientific learning with scientific approach are high school categories, and the lowest teacher and student responses are low category high schools.

The implementation of the scientific approach in public high schools is high and is being implemented optimally. The teacher uses a student-centered learning model. In the learning process both schools carry out

experimental activities that emphasize the activities of students in discovering the concept of an experiment. Schools are high categories, involving students in conducting simple experiments to determine the coefficient of restitution in collision events. In the school the category is implementing project-based learning, where students are assigned to make teaching aids related to the concept of physics. Then presented in front of the class.

Table 1. Results of Teacher and Student Response Questionnaire

School	Implementation of the Scientific Approach (%)	
	Teacher	Student
SMA Kategori Tinggi	75	76
SMA Kategori Sedang	69	75
SMA Kategori Rendah	63	69

The scientific approach is a student-centered learning approach through scientific methods. Based on the results of interviews with high school high school teachers, stated that physics learning was more active in students, because if teacher-centered it would be boring. Moreover, physics is a difficult lesson, so how do students become more active by searching for information, by browsing or asking friends. According to Atsnan, et al (2013) teachers act as scaffolding when students experience difficulties, and teachers are not the only source of learning. Students are more likely to hold discussions, namely methods that lead to educative talks to solve a problem (Suparno, 2006).

The scientific approach emphasizes the involvement of students in the learning process, giving enthusiasm and motivation so that learning is more meaningful, but cannot be separated from the role of the teacher. The role of the teacher is important in guiding students in discussions. Based on the results of the teacher

interview stated that during the discussion process many students asked questions, then the teacher gave an explanation, because physics was not a lesson that once read immediately understood.

The implementation of the lowest scientific approach in low category schools has not been optimal. The method applied by the teacher is still focused on the teacher center / lecture. The media used is only centered on power points, without media or other props. Based on the observations of the teacher implementing the learning using power point media, displaying animation, explaining definitions and mathematically, students discuss working on the questions and convey the results of the discussion. Judging from the core activities of the scientific approach in the low category schools, the teacher observing activities featured animations on power point slides related to the concept of momentum. The questioning process is not carried out optimally. Based on interviews with the teacher stated that there was rarely a question and answer during the learning process. This shows that the learning process is still monotonous. Interest in participating in learning activities has not yet emerged, which should arouse students' curiosity.

The core activity of trying at low-class schools is not implemented. The results of interviews with students stated that they had never conducted an experiment independently during the learning process. The low category teacher interview results stated that, the learning process with experiments or practicum is still rarely done because of lack of infrastructure. The interview with the teacher stated that the lab was still used as a class, it was difficult to have to bring the equipment in the classroom so that practicum was rarely done. Reasoning activities have also not been carried out optimally, because teachers rarely conduct experiments/experiments, so students are not used to processing and analyzing data. The activity of communicating students is less in presenting the results of the experiment in the form of graphics/drawings, writing reports and

describing the findings. The implementation of a scientific approach that is not optimal requires a re-evaluation.

CONCLUSION

The implementation of the scientific approach of State High Schools in Boyolali Regency is classified as medium. Schools in high and medium categories are optimal in carrying out scientific approaches. The highest percentage is the core activity observed, and the lowest is the core activity of trying. The factors that influence the implementation of the scientific approach by the teacher are infrastructure and laboratory facilities, and time constraints so that the teacher spends time on learning exercises. The next step the teacher needs to apply the scientific approach effectively. Teachers need to master learning materials to apply learning models that focus on students and enhance creativity to make learning fun.

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