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# Analysis of the Implementation of Reasoning Learning Based on the Scientific Approach in Physics Learning

**Suhardi Effendy**✉**, Faiz Mudhofir, Hartono, Ian Yulianti**

Graduate School Universitas Negeri Semarang, Indonesia

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## Abstract

Physics is an integral part of natural science. Basically physics is the study of natural phenomena in the form of facts, concepts and laws that have been tested by a series of studies. This study aims to describe the implementation of reasoning learning by teachers in public high school students in the city of Palembang. This type of research is descriptive qualitative research. The research was conducted in seven Palembang City State Senior High Schools on Momentum and Impulse material. Subjects in this study consisted of seven teachers and 231 students from seven public high schools in the city of Palembang. Research subjects were determined through purposive sampling technique. The results showed that the implementation of reasoning learning activities was not optimal. Learning the reasoning done by the teacher is limited to reasoning activities which is the final conclusion of the thinking process without observing, asking questions and trying. The final conclusions made by students are only based on the teacher's explanation of the one-way learning process. This can be seen from the percentage of the implementation of reasoning activities on the scientific approach that gets a percentage of 39.04% and is included in the medium category.



✉ Alamat korespondensi:
Kampus Pascasarjana Jl Kelud Utara III, Semarang 50237
E-mail: ardifendy@gmail.com

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## INTRODUCTION

Physics is an integral part of natural science (IPA). Basically physics is the study of natural phenomena in the form of facts, concepts and laws that have been tested by a series of studies (Fitriyani et al., 2017). Physics learning is expected to help students understand various kinds of natural phenomena. This will be realized if students have good reasoning skills (Tala & Vesterinen, 2015). The ability of reasoning that is mature is absolutely necessary in studying physics that links more than one concept (Nurhayati et al., 2016; Muchsin & Khumaedi, 2017).

Curriculum changes that occurred in mid-2014 ago, namely the enactment of the 2013 curriculum allowed for changes in the learning process. The learning process in the 2013 curriculum for all levels of education is carried out using a scientific approach (Imran, 2014). Inclusion of aspects of reasoning in the standard learning process is very important because reasoning is an abstract thinking activity (Wijaya, 2016). The ability of scientific reasoning is one of the factors that influence academic achievement and decision-making ability in everyday life (Ding et al., 2016). Scientific reasoning is needed to carry out scientific explanations that convey the facts of the causal mechanism of action from the results of investigations and phenomena (Chen & She, 2015). Good reasoning can support the mastery of concepts that are also good in physics material (Purwati et al., 2016). But in reality, many students feel unsure of their ability to study physics (Hubber et al., 2015). This is because there are still many students who are not interested in learning physics and regard physics as a difficult subject to master.

The ability of scientific reasoning does not develop naturally (Ding et al., 2016) so the learning process in the classroom must be designed to train and develop the ability to reason students (Lee & She, 2010). The best way to train and develop scientific reasoning abilities is to invite students to observe phenomena and be directly involved in the observation process for example by experimenting (Varma, 2014; Piraksa et al., 2014). Some studies that have succeeded in improving students' scientific reasoning and conceptual change in students are learning using inquiry strategies (Bao et al., 2009; Jensen & Lawson, 2011; Varma, 2014; Fitriyati & Munzil, 2016), learning with multiple learning models (DSLM) ( Lee & She, 2010) and learning by Adapted Primary Literarture (APL) (Norris et al., 2009).

Scientific reasoning that is good and built systematically will improve students' high-level thinking skills (Abdullah et al., 2015). Physics learning also requires students' high-level thinking skills in making decisions, solving problems, understanding complex concepts and theories and knowing the nature of science in order to avoid scientific misunderstandings (Barak & Dori, 2009). Higher-order thinking skills in learning can be developed in several ways, one of them is by using inquiry learning strategies (Jensen & Lawson, 2011), linking theory and practice (Barak & Dori, 2009) and connecting students' initial knowledge of concepts and ideas -ide learned (Varma, 2014). A teacher needs to know scientific reasoning skills and mastery of students' concepts (Adurrahman et al., 2013). This knowledge will help teachers in designing learning processes that can hone students' scientific reasoning skills. In addition, the teacher must also design innovative learning tools so that the learning process of reasoning can be carried out optimally (Rochmanasari et al., 2014).

Concerning the description above, this study aims to describe the implementation of reasoning learning by teachers in public high school students in the city of Palembang. The implementation of an optimal learning process of reasoning will greatly influence the way students solve problems in learning physics. The ability to solve problems will also affect learning outcomes and academic achievement obtained by students.

## METHODS

This type of research is a descriptive qualitative research which aims to obtain a general description of how the learning of reasoning is done by public high school teachers in the city of Palembang. The research was conducted in seven Palembang City State Senior High Schools on Momentum and Impulse material. This research was conducted from April to May 2018. The research subjects were determined through purposive sampling. The number of subjects in this study consisted of seven teachers and 231 students from seven public high schools in the city of Palembang.

The instrument used in the study was a reasoning learning observation sheet that was carried out by recording the learning process in the classroom. The observation instrument in this study uses a Likert scale using a score interval of 0-3. The answer categories for the Likert scale are in Table 1 (Sugiyono, 2010).

**Table 1.** Alternative Answer Writing

| Alternative answers | Score |
|---|---|
| Very good | 3 |
| Good | 2 |
| Enough | 1 |
| Less | 0 |

Scores are analyzed for each type of answer. Then converted into percentages using a percentage formula:

$P = (\frac{n}{N})$ x 100 %

With :

P : percentage (%)

n : number of scores obtained

N : maximum score amount

Based on Table 1, the smallest to largest value will be obtained regarding the reasoning learning implementation. Interval learning reasoning can be seen as follows.

Maximum data : $\frac{3}{3}$x100 % = 100 %

Minimum data : $\frac{0}{3}$x100 % = 0%

Range : 100%-0% = 100%

Class interval : 100%/3 = 33,3%

The category of learning reasoning with the scientific approach is outlined in Table 2.

**Tabel 2.** Learning Implementation Category

| Interval (%) | Category |
|---|---|
| $66{,}6 < P \leq 100$ | High |
| $33{,}3 < P \leq 66{,}6$ | Medium |
| $0 < P \leq 33{,}3$ | Low |

## RESULTS AND DISCUSSION

The implementation of reasoning learning is seen from the results of observations that have been conducted by researchers during the learning process. This reasoning learning is part of the scientific approach taken by the teacher. In total there were 5 activities observed as long as the teacher carried out the learning process in the classroom, namely (1) facilitating students to make the process of reasoning / associating, (2) giving questions to students to reason (the process of logical and systematic thinking), (3) oriented activities on results that can be measured and observed, (4) provide opportunities for learners to process information that has been collected, analyze data in the form of categorizing, associating or connecting related phenomena / information in order to find a pattern, and conclude, and (5) correcting any false or false statements from students.

Based on observations that have been made, learning reasoning can be seen from the implementation of reasoning activities that have been done by the teacher. The implementation of these activities can be seen in Table 3.

Based on Table 3, all schools have carried out reasoning activities even though they are not optimal. This is due to the inhibiting factors in between, the teacher does not always conduct experiments in the learning process so that students are not trained and are not familiar with the activities of analyzing the data of findings or experiments. Analyzing activities are examples of reasoning activities in the implementation of scientific approaches.

Reasoning activities can be done by processing data through experimental activities or observations. In fact, teachers do not always carry out these activities. The teacher rarely asks students to connect or analogize experimental activities or observations with the material being studied. This makes students confused about what activities will be done next. Whereas the learning process with experiments will make students directly involved in hands on activities activities which have an impact on increasing mastery and understanding of students' concepts (Yulianti et al., 2011; Putri et al., 2018; Pradani et al., 2018). Another thing found during the learning process takes place, namely the teacher does not help students in developing their creativity to solve problems.

**Table 3.** Implementation of Reasoning Activities

| School Come From | Implementation of Reasoning Activities (%) |
|---|---|
| SMA N 1 | 20 |
| SMA N 4 | 33,33 |
| SMA N 6 | 33,33 |
| SMA N 8 | 46,67 |
| SMA N 11 | 53,33 |
| SMA N 13 | 33,33 |
| SMA N 17 | 53,33 |
| Total | 273,32 |
| Average (%) | 39,04 |

Learning by teachers tends to emphasize students thinking in one direction so that students are accustomed to thinking and finding knowledge that has been set by the teacher. At this stage students must be able to analyze the knowledge given by the teacher, because if the concept conveyed by the teacher is wrong then students will also experience misconceptions.

Basically, the effort to train students to do reasoning activities can be done by processing data that has been obtained through experimental activities or observations and training students in interpreting based on data to make conclusions (Mihardi et al., 2013). This is in line with the observations found in the field, in carrying out activities to reason students only draw conclusions from the explanations presented by the teacher in the same direction. No critical student is good at asking questions, expressing opinions and making conclusions. Even in explaining the abstract material the teacher seems to have difficulty in analogizing the material so that it is easy for students to understand. As a result, students' reasoning abilities are not well developed and always have difficulties if they have to solve problems that require high-level reasoning skills such as analyzing. In fact, the ability of good analogy for a teacher is very important in carrying out reasoning activities (Desianna et al., 2019). Learning through analogy is an alternative in improving students' reasoning abilities.

Learning the reasoning done by the teacher is limited to reasoning activities which is the final conclusion of the thinking process without observing, asking questions and trying. The final conclusion made by students is only based on the teacher's explanation of the learning process. This happens because the teacher does not implement the scientific approach optimally. In reasoning activities, especially in physics learning teachers only direct students to memorize formulas from the question and answer process carried out. The teacher does not guide students to master and understand the concept of physics comprehensively. The teacher only explains the material to the extent of abstract, without guiding students to be able to concretize the material being studied (Octaviana & Supriyono, 2017). This can be seen from the way teachers teach in class, although some teachers have tried to facilitate students to reason by giving simple demonstration activities and using LCD projector media, but teachers cannot make students interested and pay attention to the material being conveyed by the teacher. Students tend to be indifferent and not concerned with the ongoing learning process. The attitude of students who are indifferent and unconcerned about the learning process is due to the way the teacher in delivering material is not innovative. This can be seen from the way the teacher gives an explanation of the material being studied. All teachers start the learning process by directly providing definitions of the material learned then formulas and sample problems. The teacher should start learning by giving students the opportunity to build their own knowledge, then the teacher confirms the statement delivered by the student. The teacher also does not make optimal use of the prepared media, so that reasoning learning cannot be carried out optimally.

Based on the explanation above, to be able to carry out learning reasoning activities optimally it is expected that the teacher can take the following steps. First, before carrying out the learning process the teacher should give the task to students to summarize the material to be studied at the next meeting. At this stage students are expected to be able to gather as much information as possible from various sources to be used in the learning process at the next meeting. Second, teachers must facilitate students in reasoning activities, whether by using simple demonstrations, modeling with computer software or animated videos related to the material to be studied. This is so that students can do the reasoning process by comparing the information they have collected with the phenomenon used by the teacher during the learning process. Third, the teacher must prepare questions that direct students to master and understand the concepts related to the material being studied. Fourth, the teacher should be able to provide opportunities to students to convey their understanding of the material they have learned, both orally and in writing. It aims to train students in solving problems with in-depth analysis of the concepts learned rather than merely relying on mathematical abilities. If the above activities can be carried out well, it is expected that reasoning learning can be carried out optimally.

## CONCLUSION

The implementation of reasoning learning activities is not optimal. Learning the reasoning done by the teacher is limited to reasoning activities which is the final conclusion of the thinking process without observing, asking questions and trying. The final conclusions made by students are only based on the teacher's explanation of the one-way learning process. This can be seen from the percentage of the implementation of reasoning activities on the scientific approach that gets a percentage of 39.04% and is included in the medium category.

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