

The Development of Students' Worksheet Based on Predict-Observe-Explain (POE)

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Abstract

The research and development have been done to develop student worksheets (LKPD) based on predicting, observing, and explaining (POE). The development research model used refers to the ADDIE development model which consists of 5 stages: analysis, design, development, implementation, and evaluation. The assessment of product quality of LKPD development results carried out by validator and 14 physics teachers. The percentage of eligibility obtained from each validator and physics teacher is 77% and 83%. The test implementation of LKPD products applied to 20 students of class X MIA 2 SMAN 3 Unggul Sigli that chosen by purposive sampling. The results of a POE-based LKPD testing can improve the students' critical thinking skills. Based on these results, it can be concluded that POE-based LKPD developed with the ADDIE development model is decent to be implemented. An investigation on a broader scale should be undertaken to assess the effectiveness in teaching physics.

Keywords: Development, LKPD, POE.

Introduction

Education is an important influencing factor in the national development. Education serves to create a new smarter generation. Education is never separated from the learning process so it should be done seriously (Kola, 2013). The school is an important component in the education system. The development of society depends on the progress of education and teaching (Turkkahraman, 2012). The education process undertaken in the school should be managed as well as possible with the procedures established for a successful achievement. In advance, the learning process has been done by the teachers greatly affects the achievement of learning objectives. The success of the learning process depends on the ability of the teacher (Riyani, 2012). The learning model used should also be in accordance with the lessons and the material being taught.

One of the mandatory subjects to be taught with a learning model in senior high school is physics. Physics is learning about the natural sciences and the development of new technologies through its application. Along with the development of science and technology, there is a paradigm shift in models, methods, and approaches to

physics learning (Mahardika et al., 2012). Learning Physics need a learning model that can involve students directly (Hanna et al., 2016).

To alter the student centered learning paradigm, provide a learner's work sheet that facilitates a cooperative learning environment and active learning, and optimize the critical thinking skills of learners require learning strategies that train the students to think critically about analyzing, linking the known variables, analyzing the data, associating, summarizing and communicating (Wardatun et al., 2015). The demands of the curriculum require the teachers to develop their own teaching materials which can develop the thinking skills of students (Depdiknas, 2008: 10). Teachers are expected to design learning activities that can develop critical thinking skills of students (Fithriyah et al., 2016). The teachers should not busy with the other activities outside the curriculum that can disrupt the learning process, so it cannot take the time to develop the right teaching materials and can improve the critical thinking skills of students (Zaini, 2013).

Using the learning model is also an effort that determines the successful of improving critical thinking skills (Karim & Normaya, 2015). The existence of critical thinking skills can be assessed through the ability of learners in mastering the four categories of Bloom's taxonomy that are application, analysis, synthesis and evaluation (Bissell and Lemons, 2006). During the learning process, it is necessary to apply the model and teaching materials that support the learning process which is students centered that can improve their thinking skills. The students are required to be more active and critical in seeking their knowledge, they are not dependent on the teachers because teachers only act as facilitators and mediators during learning process (Karim & Normaya, 2015). There are not only the teachers who become mediators and facilitators, worksheets also used as a mediator that can help learners work directly during the learning process (Rahmi et al., 2013). LKPD is teaching materials provided by teachers to help the students to gain knowledge and be active in learning (Kaymakci, 2012). The LKPD used should be able to construct the knowledge and thinking skills of students. LKPD is structured with the interesting steps in order to enhance students' learning interests and can develop their thinking skills (Fannie & Rohati, 2014).

The LKPD that has been used by teachers has not facilitated learners to construct their knowledge, the content of LKPD is more emphasized on the definition of a concept and given a number of problems to be solved (Fannie & Rohati, 2014). This kind of LKPD less developing the ability of students' thinking, so it needs to be developed LKPD oriented learning model that can improve the students' critical thinking skills of constructivist learning theory. One of the learning models based on constructivist theory is POE (Dinanti, 2015). Through POE, the learners will also understand directly the application of knowledge in daily life (Zulaeha et al., 2014). Learning of POE will increase the critical and students' curiosity and they can prove the real situation by themselves (Anisa et al., 2013). The POE model triggers the students to do predictive, observational and explanatory activities, so that learners can think at a high level (McCune & Alexander, 2012, p. 77). One of the characteristics of POE is build thinking skills so that critical thinking can be maximized. This is related to constructivism learning, which is student-centered learning and building their thinking skills (Pedron, 2006: 22). The ability of learners in scientific learning includes critical thinking skills, it is a scientific aspect that can be improved through POE (Espinoza, 2012: 122). POE has three stages, namely predict, observe and explain (Teerasong et al., 2010). Rahmah and Kusasi (2016) obtained that the application of POE model can improve the students' critical thinking skills. Students participate directly during the study and can develop their critical thinking skills (Lederman and Abel, 2006: 305). LKPD-based POE learning model is an appropriate solution to use during the learning process, LKPD POE can

help learners in learning and can improve their critical thinking skills (Rifzal et al., 2015). In particular, this research will answer how the development process of LKPD based predict observe explain.

Literature Review

The teachers are expected to be able to arrange the appropriate teaching materials that play a role in determining the success of the teaching and learning process (Kusumam et al., 2016). LKPD is a teaching material provided to help learners improve knowledge, and learners are more active during learning (Kaymakci, 2012). POE is a learning model that explores learners' understanding by teaching them to follow 3 stages, predicting an answer to an event, giving reasons justifying their prediction, then experimenting, and explaining the link between their predictions and experiments (Hilario, 2015). The developed LKPD oriented to the POE model, it can be used to improve the critical thinking skills of learners, because every stage in learning POE can delve students' own knowledge according to the constructivism learning theory (Indriana et al., 2015). Constructivism is a learning theory that emphasizes the level of creativity of learners in directing new ideas for the development of their knowledge (Suyidno & Arifuddin, 2012). LKPD POE is a solution that helps learners in learning and can increase their thinking skills (Rifzal et al., 2015).

Research methods

This research used research and development (R&D) methods. This study aims at developing POE-based LKPD. LKPD POE was developed by the ADDIE development model (analysis, design, development, implementation, and evaluation). LKPD POE is implemented for the students of class X MIA 2 SMAN 3 Unggul Sigli which selected 20 people by purposive sampling. The effectiveness of LKPD POE is obtained from the pretest and posttest results analyzed using N-Gain.

Results and Discussion

This research aimed at developing LKPD POE with the development model. The development of LKPD POE employed several stages of the ADDIE development model that consists of five stages: analysis, design, development, implementation, and evaluation. Analysis stage, identify needs. Design stage; determine the achievement of the analysis results. Development stage, select the required product. Implementation stage, test on learning environment. Evaluation stage, test the effectiveness of the product (Azimi et al., 2015).

Analysis

In this step, the researchers conducted the interviews with the physics teachers and learners to collect the information related to the learning process and the use of learning models and teaching materials during the learning process in SMAN 3 Unggul Sigli. This activity was conducted with the aimed at establishing the existing problems (Cheung, 2016). The results of the analysis can be seen in Table 1.

Table 1. Need analysis results.

The Analyzed Aspects	The Results of analysis
Learning Process	<ol style="list-style-type: none"> 1. <i>Teacher centered</i> 2. There was no learning model 3. Learners tend to listen and did not involve actively in the learning process
Teaching Materials	<ol style="list-style-type: none"> 1. Limited teaching materials, only the textbook that available in the schools 2. No teaching materials that keep the learner active and critical during the learning process 3. There is no worksheet that can develop students' thinking skills during the lab
Pendulum swing in simple harmonic motion material	The pendulum swing material is taught with lecture model and discussed the physics problem, the learners got the difficulties in integrating physics concept with the application in daily life.

Design

The results of the analysis used as a reference in choosing the appropriate teaching materials as needed. The researcher arranged the initial design of teaching materials in form of LKPD, it designed with the interesting view for attracting the students to learn, the presence of colorful images, and other LKPD components and equipped with the stage model of learning POE. The design results are validated by the validator with the purpose of the design suitability with the needs being analyzed. The obtained feasibility percentage was 93%.

Development

This is an advanced step of the design phase. At the development step, LKPD POE is developed based on the points in the design step. It is validated by a validator and 14 physics teachers to assess the eligibility. The percentage of eligibility gained from validators and some physics teachers were 77% and 83%, so LKPD POE was feasible to be implemented.

Implementation

LKPD POE was implemented for the students of class X MIA 2 SMAN 3 Unggul Sigli to see its effectiveness. Before the implementation of LKPD POE, the researcher did the pretest to learners to investigate the earlier ability of critical thinking. Thereafter, LKPD POE applied during physics learning. After the learning process was complete, the learners solve the posttest problem.

Evaluation

In the evaluation step, the researcher assesses the implementation results of the developed LKPD POE and measure the achievement of the objectives of the development. LKPD POE requires students to write their own thoughts. It appears that various predictions are written down. Some learners write predictions with the better language, but there are also the learners who write down predictions not related to the concept of physics. Similarly, in the observation and explanation step, the effectiveness of LKPD POE is viewed from the ability of students' critical thinking. After the researcher applied LKPD POE, the students got the posttest. The results obtained by students on posttest have increased. The students have been able to answer the questions properly.

N-Gain of students' critical thinking skills for each indicator in pretest and posttest can be seen in Figure 1.

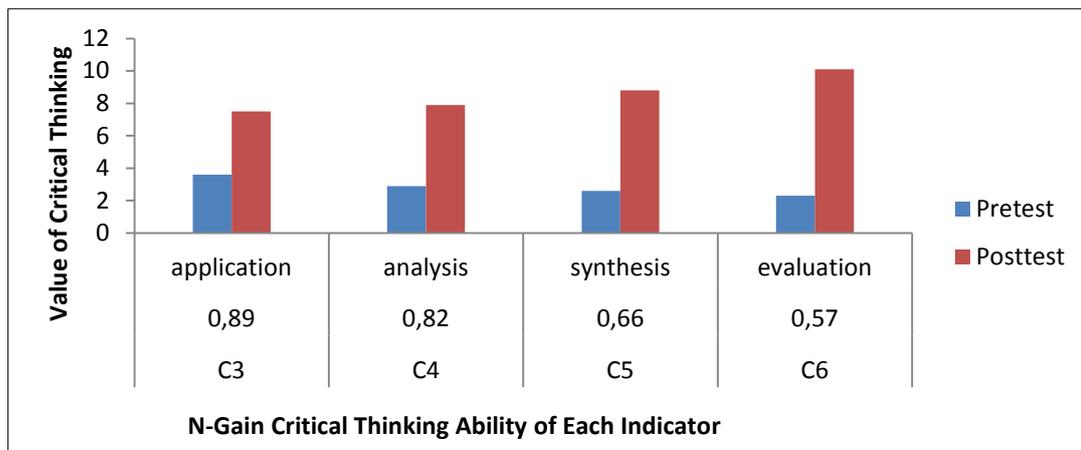


Figure 1. N-Gain students' critical thinking skills on each indicator.

The ability of learners in applying, analyzing, synthesizing and evaluating have increased, indicated by N-Gain in the medium and high category. The category of students who are able to think critically is able to understand problems in applying, analyzing, synthesizing and evaluating (Karim & Normaya, 2015).

The implementation of LKPD POE is effective in improving the critical thinking skills of students. The stages in POE learning teach the students to improve their critical thinking skills (Anisa et al., 2013). The students' curiosity in learning will also form new knowledge for them, so they can interpret it to the other knowledge (Suyidno & Arifuddin, 2012).

The students who are active in learning and completing LKPD POE with critical thinking have the higher test scores than the other learners. The success of solving problem is determined by their thinking skills (Retna et al., 2013). Based on these, the students can think critically if they master in applications, analysis, synthesis, and evaluation skills (Bissell & Lemons, 2006).

Through the LKPD POE, the learners can develop their critical thinking skills (Rifzal et al., 2015). The developed LKPD oriented to the POE model, it can be used to improve the critical thinking skills of learners, because every stage in learning POE, the learners can delve their own knowledge according to the constructivism learning theory (Indriana et al., 2015). The learners can correlate their previous knowledge with the new knowledge gained during the learning process. The Learners can also build their knowledge directly (Habibi, 2015, p. 133).

Conclusion

Based on the results of research and development, it concluded that the developed LKPD POE through the stages of the development model of ADDIE has a very feasible eligibility percentage, so it can be implemented as a material in teaching physics.

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