Problem-Based Learning Model Used to Scientific Approach Based Worksheet for Physics to Develop Senior High School Students Characters

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Abstract. The purpose of this study is to explore the application of Problem Based Learning(PBL) model aided withscientific approach and character integrated physics worksheets (LKS). Another purpose is to investigate the increase in cognitive and psychomotor learning outcomes and to know the character development of students. The method used in this study was the quasi-experiment. The instruments were observation and cognitive test. Worksheets can improve students' cognitive, psychomotor learning outcomes. Improvements in cognitive learning results of students who have learned using worksheets are higher than students who received learning without worksheets. LKS can also develop the students' character.

1. Introduction

To improve Indonesian Education, Curriculum 2013 has to undergo constant evaluation. According to the Minister of Education Regulation (*Permendikbud*) No 69, 2013, Curriculum 2013 aims to create Indonesia citizen who possesses excellent life skills and characters. For example, religious, creative, productive, innovative and efficient both as an individual and citizen and are also able to contribute to the society, nation, state, and world civilisation. The success of Curriculum 2013 is everyone's responsibility. Character education implemented in Curriculum 2013 through the process of integrating learning objective, synergizing educational institution roles, strengthening teachers' competence and model [1]. Curriculum 2013 adopts the scientific approach which not only promotes cognitive development but also character development such as life skills. It is in line with a study by Machin [2] stating that scientific approach affects students' cognitive, affective and psychomotor positively. Students Worksheet (LKS) assist the process of teaching and learning. However scientific approach and characters integrated LKS has not been available in the community. Problem Based Learning (PBL) is a method applied in Curriculum 2013. Based on Rizkianingsih *et al.*[3], PBL can encourage students to actively solve problems so they can get the concept of the material independently. This involvement will increase students' achievement. It is in line with Astuti's and Junaedi's study [4] discovering that PBL can improve students' activities and achievement. It can also increase students' creativity. Sungur et.al's [5] research also shows that the students taught using PBL have more skill score rather than the one taught and in a conventional method. Besides, students' right

character nurtured through PBL. Okinoglu and Tandogan [6] discover that the implementation of PBL in science program classroom contributes to the change of students' attitude. Teaching and learning model used in Curriculum 2013 is Problem Based Learning. This study aims to describe the implementation of PBL classroom using scientific method and characters integrated student worksheet (LKS) with the material temperature and thermal expansion and to investigate students' cognitive, affective and psychomotor improvement after the treatment.

2. Method

This study was a trial from LKS classroom created in 2015. The subjects were students grade X in eight different schools in Semarang. The method was the quasi-experiment. The PBL using scientific method and characters integrated student worksheet (LKS) with the material temperature, and thermal expansion was implemented in experiment classes while the control one gave conventional method. All classes were given pre-test and post-test to discover students' increase of cognitive learning outcome. The test underwent the test of validity, reliability, a level of difficulty, and concurrent validity. Questionnaires related to characters given to student before and after the teaching and learning process. Data gathering instruments were the test, questionnaires, and documentation.

3. Results And Discussion

3.1. Cognitive Learning Outcome

The effectiveness of the material discovered through the increase of students cognitive test outcome. Effectiveness test can be analysed by using gain test and t-test. The result of the gain test shown in Table 1.

Table 1. Result of Improvement of Cognitive Learning Outcomes

Character	Result of Gain Test	Criteria
Control Class	0,472	Middle
Experiment Class	0,795	High

The table shows that experiment class shows better achievement in cognitive learning outcome rather than the control class. It happens because who gave two different treatments which are the availability of LKS in experiment class and conventional method of teaching in control class. Septiani *et al.*[7] study support this idea with the finding of the fact that the use of LKS can increase the average score of gain related to students' understanding of the concept. Another research by Ristiyani & Yulianti [8] also shows that students gain a better understanding of material's concept after suing scientific approach integrated worksheet.

The result of post-test score t-test analysis is available in Table 2.

Table 2. Result of T-Test Analysis

T-test	Result
t-counted	32,922
t(0,95)(68)	1,9955

It seen that $t_{\text{-counted}} > t_{(0,95)(68)}$ thus H_0 is rejected (Sugiyono, 2009 : 197). From t-test, it concluded that experiment group is better than the control group. It is in with the study from Ni'mah *et al.*[9], average learning outcome from the student who given LKS a is better than the one not proven by $t_{\text{-counted}} > t_{(0,95)(68)}$.

The results from both gain test and t-test showed that is the worksheets developed are effectively improved students understanding of a concept. That is in line with research from Yusuf [10] claiming that LKS use can increase students' achievement. This achievement is a result of the growth of students' interest in learning physics. The output from Isnaini *et al.*[11] supports the idea that physics worksheet developed can increase students' activities and learning motivation. Students' interest comes from the simple language use and the format of the LKS.

Another reason behind the result of LKS effectiveness in helping students understanding the material is that it also assists optimising students' scientific process. The LKS will contribute nurturing students' scientific attitude through experiment and discussion. Subagyo *et al.*[12] say that the use of LKS inquiry can assist students understanding the concept and bring out scientific attitude such as preparing, experimenting, observing, data analysing and concluding. Research from Hidayati & Endryansyah [13] also claims that scientific learning can improve students' achievement because students become active and communicative in discussion and are challenged to solve the problem in experiments. The LKS contains the example of physics' implementation in daily life which can help the students to grasp the real concept of physics.

3.2. Character Development

The characters such as discipline, communicative and curious have been entrenched among the students while creativity is starting seen. The result of observation shown in Table 3.

Table 3. Result of Character Observation

Characters	Observation Result	Criteria
Discipline	93,14%	Entrenched
Creative	73,71%	Developing
Communicative	86,29%	Entrenched
Curious	93,14%	Entrenched
Total	86,57%	Entrenched

Those developments were analysed using gain test and gave a result that presented in Table 4.

Table 4. Analysis of Character Development

Characters	Gain Test Result	Criteria
Discipline	0,662	Middle
Creative	0,146	Low
Communicative	0,361	Middle
Curiosity	0,336	Middle

The table above presents the increase average result between students' character before and after treatment. It means that LKS can effectively improve students' character development. By answering the questionnaires, students show their attitude when facing things related to discipline, creativity, communicativeness and curiosity. As explained by Azwar [14] that the immediate stimulus will bring out the consistency of response related to affective, cognitive, and attitude when facing their surroundings.

Although there is indeed increase in students' character, the degree is not that much. Some characters such as discipline, communicativeness, curiousness belong to middle category while creativity is only low. Discipline gains the most enhance result because of some reasons. The first one is the fact that the school has applied the regulation well with the punishment system which makes students accustom to follow the rules. One example is by coming to school punctually. The low level of creativity is the result of students' lack of developed characters, characters which originate from the first education before school and community, family. Samani and Hariyanto [15] state that characters education occurs in three pillars, school, family and community. Another reason is that the LKS only gave in limited occurrences, only to the discussion of temperature and thermal expansion. According to Ministry of Education (2010: 11), the main principal of character education is a continuous process that starts from the initial until the end of education level.

Character education integrated into students' worksheet in the form of specific suggestions and guidelines in doing discussion and experiment. The guideline encourages students to actively carry out the activities that can develop students' character. This guideline is given continuously to nurture students' habit. It was supported by the declaration from Ministry of Education (2010: 86) that character education should be sustainable, routine, within all subjects. Thus the values will be learnt in an active learning process. Character education integrated into every aspect of learning in every subject. According to Benninga et al. [16], if character education incorporated in, every aspect of school's life both inside and outside a classroom, it can improve students' character.

Discipline scores entrenched based on the percentage and scores middle from an again test. The indicator for such coming on time has been done by the students well (*Kemendiknas*, 2010: 26). LKS provides suggestion to the students sink their teeth in discipline by returning their lab appliance properly, and finishing their assignment on time. Students are accustomed to performing self-discipline because the regulation is applied well in the school.

Students' creativity is low. The indicator is creating learning situations that foster creative thinking and acting and giving challenging tasks to encourage new creation either authentic or modified (*Kemendiknas*, 2010: 26). This indicator achievement showed from students' performance in developing steps in the experiment without any guideline, students' variation and their creativity in creating simple thermometer. Next, character communicative is entrenched and get a middle category in the gain test. It happens because the learning process is done in a group where students work together discussing and experimenting with their friends. Curiosity belongs to the category of entrenched with a mean increase. Curiosity arises between students because the worksheets (LKS) provides a problem that hooks students' curiosity and the students gave the opportunity to find further information from various sources such book and the internet. If the students gave problem, they would be motivated to solve it actively investigate the subject in question to fulfil their curiosity (Pluck & Johnson [17].

This increase proves that LKS developed can be effectively used as a medium to teach integrated character in the process of teaching and learning. It is supported by Amelia et al. [18] claiming that students' character like honesty, discipline, confidence, curiosity, desire for reading, cooperation and communicativeness increase along with the present of character education in physics using LKS.

3.3. Psychomotor Learning Outcome

Psychomotor aspect in this study is about students' performance in preparing discussion/experiment, doing discussion/experiment, writing the report and presenting. The gain test was done to analyse the increase of observation result of students' performance before and after the

Problem Based Learning (PBL) process using a scientific approach and character education integrated worksheet. The result of a gain test presented in Table 5.

Table 5. Analysis Result of Psychomotor Learning Outcome

Group	Average Before	Criteria	Average After	Criteria	*Gain*	Category
Experiment	70,97	Good	83,87	Good	0,34	Middle
Control	69,34	Good	76,44	Good	0,22	Low

The increase presented shows that PBL using a scientific approach and character education integrated worksheet can enhance students learning skills. It is in line with research by Sungur et al. (2006) describing that student who learns using PBL have higher performance scores rather than the one who get to sue traditional model.

4. Conclusion

Application of PBL Model-aided with an integrated scientific approach and character education integrated LKS can improve learning outcomes. Cognitive learning outcomes (knowledge), psychomotor (skills) and the characters in the experimental group increased in medium criteria. Further research is required in sequence to determine other the character development and improvement of learning outcomes.

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