

DEVELOPMENT OF PROJECT BASED LEARNING(PjBL) STUDENT WORKSHEET TO TRAIN CREATIVITY OF VOCATIONAL HIGH SCHOOL STUDENT XI GRADE IN SOLUTION MATERIAL

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Abstract

The challenges in 21st century demands that student have creativity, so they can be a good problem solver. Students' creativity can be trained by using project based learning (PjBL's) media which emphasizes hand-on and mind-on skills especially in chemistry learning. This study aims to determine the feasibility of PjBL's student worksheet to train student's creativity in solution material. The research used research and development (R&D) method. The research and development method consist of preliminary study, development, and testing which is done until limited trials step. The data respondent consist of 20 students of XI grade Vocational High School, chemistry lecturer, and teacher. The instrument used in this study are a review and validation sheet as a determinant of validity student worksheet. Response questionnaire to find out the practicality and effectiveness of student worksheet uses material understanding test, creative thinking skills test, and creativity observation. The data obtained were analyzed descriptively. The validity and practicality of student worksheet is feasible with the respective percentage ranges of 66.67% -86.67% and 70% -100% in both good and excellent category. The effectiveness of student worksheet from pre-test and post-test data shows increasing score even though some students did not pass minimum score. The average result of creative thinking skill of each component: fluency, flexibility, and elaboration are included in enough category whereas originality included in good category. Student creativity observation results are generally considered feasible in the approaching the standard and reaching the standards category except for presentation of the results indicator in component process and style in component product which are in under standard category.

Keywords: Student Worksheet, Project Based Learning, Creativity, Solution

INTRODUCTION

Education is the main factor that determines the quality of human resources. Efforts to improve the quality of education can be done by improving the curriculum, educators, student books, teacher handbooks, and supporting teaching facilities and learning process [1]. According to Mihardi [2], education supports the advancement of the nation and country, because the level of education of a person becomes the assessment of the country human resources level. The development of the 2013 curriculum is based on the external and internal challenges that will be faced by the Indonesian[3].

The external and internal challenges that faced the Indonesian can caused to the increasing competition in getting jobs. This makes 21st century skill is required to be trained, especially problem-solving and creativity skills. Creativity is one of 21st century skills [4]. This skills are needed for learners to be a good problem solvers and having creative thinking skills.

Project based learning (PjBL) is considered to be able to train 21st century skills [5].

Sari [1] mentions that PjBL aims to deepen, understand lessons, using technology and investigations related to daily life issues. The use of project-based learning can show creativity in problem solving [2].

Scientific learning emphasizes on constructing activities to competence, so students can explore and understand the environment scientifically [6]. Chemistry is part of scientific learning so it can be linked to the environment and daily activities.

One area of expertise Vocational High School namely Agribusiness and Agrotechnology which has variety of laboratories. One of them is the tissue culture laboratory and hydroponics. The implementation of chemistry subjects is associated with the area of Vocational High School expertise and can utilize laboratory and hydroponic tissue culture laboratory facilities. Conditions of students who have practiced hydroponic cultivation facilitate the work of PjBL model project on the solution material.

The use of appropriate learning model to the specific materials should be supported by the use of appropriate learning media such as the

student worksheet. According to Mihardi [2] who stated that the use of instructional media and learning which adapt the student environment makes learning active and creative.

Based on the results of pre-study shows that 100% of vocational high school students say that chemistry subjects is difficult. Fifty percent of vocational high school students expect teachers to be the main informants by explaining the material from the beginning to the end and then given the exercise. Based on the results of teacher interviews, the student especially 11th grade have never done lab work activities due to the absence of laboratory assistant and bad laboratory conditions. In addition, most of vocational high school students prefer to practice in the field directly than the classroom learning and student worksheet not use as a learning media.

Based on the background that has been proposed, researchers want to develop learning media in the form of students worksheet based on PjBL which able to train students creativity. The developed student worksheet is expected feasible to be developed so that student can understand the material about solution and train their creativity through project activities based on daily issues. The formulation of the problem in this research is how the feasibility of student worksheet based on project based learning (PjBL) to train the creativity of students of XI grade vocational high school student on the solution material. The general problem formulation is described: 1) How is the validity of the developed of PjBL students worksheet to train creativity of vocational high school student XI grade in solution material in terms of content and construction? 2) How is the practicality of the developed developed of PjBL students worksheet to train creativity of vocational high school student XI grade in solution material in terms of student responses? 3) How is the effectiveness of the developed developed of PjBL students worksheet to train creativity of vocational high school student XI grade in solution material in terms of students' learning outcomes, creative thinking skills, and creativity observation?

METHOD

The type of research is Research and Development (R&D). Sukmadinata [7] stated that research and development is the process of making new products, refining existing products that can be accounted for.

The research subject is PjBL's students worksheet to train creativity in solution material. The data respondent are 20 students of XI Grade at

SMKN 1 Plosoklaten, chemistry lecturer and chemistry teacher as reviewers and validator.

The research design is a simplified research and development design by Sukmadinata which include preliminary study, development, and testing. This research was done until limited trial steps. The preliminary study step includes preliminary studies, field surveys, and draft the products. After the drafting of the product, it is reviewed, revisioned, and validated. Development stage is done until limited trials step.

The research instruments are review, validation, student response questionnaire, material understanding test, creative thinking skill test, and creativity observation sheets. Collecting data methods are questionnaires, tests, and observations.

The data result is used to refine the product draft, while the validation data is analyzed descriptively. Validation data were analyzed by Likert scale on Table 1:

Table 1 Likert Scale

Score	Criteria
5	Very Good
4	Good
3	Good enough
2	Less Good
1	Not Good

[8]

The value obtained is calculated the percentage of feasibility using formula (1):

$$P(\%) = \frac{(\text{total score data})}{(\text{category score})} \times 100\%$$

With description :

P (%) = percentage (%).

Then, the percentage obtained is interpreted using Likert-scale criterion in Table 2:

Table 2 Likert-Scale Criterion

Percentage (%)	Criteria
0-20	Very Poor
21-40	Poor
41-60	Quite
61-80	Good/Appropriate
81-100	Very Good/Very Appropriate

[8]

The validity of the developed Students Worksheet is feasible if each component gets a percentage of $\geq 61\%$ [8].

Student response data were analyzed using Guttman Scale on Table 3:

Table 3 Guttman Scale

Score	Answer
1	Yes
0	No

[8]

The obtained data is calculated to get the percentage of student response result using formula (2):

$$P(\%) = \frac{F}{N} \times 100\%$$

With description:

P(%) = persentase(%)

F = total "yes" answer

N = total respondent

The result of percentage obtained is interpreted according to Table 2. Based on Table 2, the practicality of developed students worksheet is feasible, if the obtaining percentage is $\geq 61\%$ [8].

Test data to be obtained in the form of tests of material understanding and creative thinking skills. The data of creative thinking skill test is analyzed and then interpreted using Likert scale criterion in Table 2. The effectiveness of students worksheet based on creative thinking skill test result if it is included in good or very good category. Material understanding tests said to be good if the test score of material understanding is ≥ 75 .

Creativity observation is based on rubrics with criteria under standard, approaching standards, and reaching standards. The developed students worksheet is said to be practical from the observation data of the students activity when showing the categories approaching the standard and reaching standard.

RESULTS AND DISCUSSIONS

Validity

The validity of the developed students worksheet is included in the appropriate category with a percentage range of 66.67%-86.67%. students worksheet validity is divided into content and construction validity. One component of content validity is that the conformity of student worksheet with PjBL model on indicator contain PjBL syntax get percentage of 86,67% and PjBL syntax presented in sequence get percentage equal to 80%. It is presented with the syntax of PjBL according to Baker [9] which is presented in sequence in accordance with steps one through eight. Step two Define Problem asks students to determine the problems of the observed ecosystem. This move is consistent with Dewey in Arend [10] who argues that the class is a real investigation and problem-solving laboratory.

The other component of content validity is the conformity of student worksheet with creativity aspect get percentage of 80%. It is presented with student worksheet contained aspect of creativity. One of aspect creativity is generate and select idea. This aspect refers to fluency, flexibility, originality, and elaboration. In this section students are asked to write down ideas from problem solving that include aspects of fluency and flexibility. Then, the best idea selected by considering several things. The process of selecting best idea involves the elaboration process. It is according to Gomez [11] who argued that the reflection and evaluation of ideas is the basis of creativity process that aims as a problem-solving process facility. The idea chosen is a component of originality. This activity is according to the most important principle of creative thought that is separate idea generation from evaluation by Vangundy [12] which explains that creative problem solving requires divergent and convergent thinking.

Components of students worksheet construct validity which are developed include material conformity with PjBL components and conformity of PjBL components with creativity aspects. Material conformity with the PjBL component gained a percentage of 86.67%. One of the indicators is the material used in accordance with the PjBL project. This can be seen by the suitability between the expected project that is hydroponic with the solution material. Resh in Susila [13] suggests that hydroponics is a way of cultivating plants without the use of soil given the nutrient solution necessary for the growth and normal development of the plant.

Practicality

The practicality of students worksheet developed is proven from the data of student response. Student responses of the developed students worksheet is said to be eligible with a percentage range of 70-100%. The compliance of the students worksheet relating to the presentation of the availability of the place of writing the answers included in the criteria is very good with the percentage of 85%. This is proven by the answer on the box.

Student response for using student worksheet during learning activity is included in the very good criteria. Aspect of interesting chemistry learning using student worksheet is included in very good criteria. These are proven by students' enthusiastic while preparing sugar colour density and the condition of students who have never practiced. The using of PjBL's student

worksheet helps student play a role in groups showing very good criteria. The using PjBL's student worksheet requires student to think creatively included in criteria is very good. This is proven by student worksheet contain creative thinking component in several parts and student must done the student worksheet in group.

Effectiveness

The effectiveness of the developed students worksheet is proven by the students' comprehension test data and the students' creative thinking test. The results of the students' comprehension test indicate an increase in learning outcomes after a limited trial, although there are still students who have not pass. This is because in the first semester the Prakerin (industrial work practice) was done and made the teaching and learning processes were eliminated so students only get the task from the teacher. In addition, Vocational High School students who like practice in the field. It may be because of the students' lack of understanding of the material and tasks when they are doing Prakerin. The increasing scores from pre-test to post-test indicate the effect of developed students worksheet being to student learning outcomes [1].

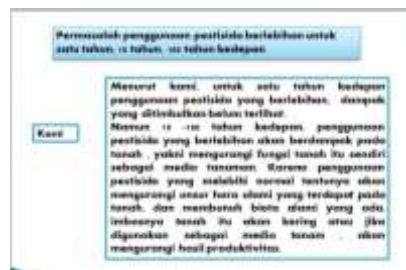
The result of student's creative thinking skill shows some tendency of one of them is, if the fluency component is good and so does the other creative thinking component. An example of this tendency is EN that gets a score of creative thinking skills fluency, flexibility, originality, and elaboration of 4.50; 4.00; 2.63; 3.00 respectively. The other tendency is, if the fluency component is poor and neither do the other creative thinking component. An example of this tendency is JDP that gets a score of creative thinking skills fluency, flexibility, originality, and elaboration of 2.50; 2.00; 1.67; 1.67. If the fluency component is good then the other creative thinking component are poor. An example of this tendency is FNF that gets a score of creative thinking skills fluency, flexibility, originality, and elaboration of 3.50; 2.67; 2.00; 2.33.

Table 4 Average Result of Student Creative Thinking

Component	Score	Category	
		Good enough	Good
Fluency	3,03	✓	-
Flexibility	2,67	✓	-
Originality	2,03	-	✓
Elaboration	2,22	✓	-

The average score of each component is included in good enough criteria except originality. This can be due to the lack of communication and interaction between researchers and students so that PjBL learning process is less successful [14].

Observation of student creativity in general is included in criteria approaching the standard except in the presenting results to users indicator and styles falling under the standard category.



Picture 1 Students Power Point in Under Standard Category

The value indicator on the product component exists in the categories under the standard and approaching the standard. The differences in the level of creativity due to the parts that are less appropriate resulting product. The less suitable part is due to the use of used plastic cups that are actually good but may not sustain the crop when it grows up.



(a)



(b)

Picture 2 Style Indicator (a) Approaching Standard (b) Under Standard

CLOSURE

Conclusion

Based on the formulation of the problem and the results of research, it can be concluded that the feasibility of student worksheet based project based learning to train students creativity of XI grade Vocational High School on the solution materials are:

1. The validity of the developed student worksheet includes content and construction validity is feasible with percentage range of 66.67% - 86.67%.
2. The practicality of the developed students worksheet is proven by the student response

data is feasible with percentage range of 70%-100%.

3. The effectiveness of the developed students worksheet is proven by the material understanding test data and the test of creative thinking skills. The material understanding test data showed score increasing of the pre-test and post-test, but there were still six students who did not pass minimum score after the post-test. In general the results of creative thinking skills tests are included in good enough criteria. Originality aspect is included good category. Result of student creativity observation generally show that the category is approaching the standard except for two groups in the indicator present information to the user or target and one group on the indicator style is still under the standard

Recomendation

Recomendation given for further research include:

1. The development of PjBL student worksheet to train student's creativity is done until limited trials step. So that in the next study is expected to be tested more widely.
2. Creative thinking skills examination should be done in every meeting to know the improvement of creative thinking skills.
3. Put more attention to learning time allocation and adjusted to the ability of students.
4. Enhancing learning time allocation to make the project success is more visible.

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