DEVELOPMENT OF PROJECT BASED LEARNING SUBSTANCES ON TOPIC SOLUBILITY AND SOLUBILITY PRODUCT IN SENIOR HIGH SCHOOL

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ABSTRACT: Development of teaching substances aimed to find teaching topics used fulfill the criteria BSNP, knowing that student learning outcomes using project-based teaching substances module higher than the KKM, and to determine the development aspects of effective and psychomotor aspects of students. Type of research was the development of Research and Development (R & D) with a pretest-posttest design one group (One Group Pretest-Posttest Design). The population in this study were all UNIMED chemistry professor who teaches General Chemistry, the whole chemistry teacher SMA Negeri 1 Galang and all students of class XI MIA Semester II SMA Negeri 1 Galang which consists of three classes school year 2015/2016. Samples were determined by purposive sampling for teaching substances module and random sampling to take a class that is used as the experimental class. This study used questionnaires and objective test instruments as much as 20 questions that have been on test validity, reliability, level of difficulty, different power and distruktor. The results showed BSNP teaching substances fulfilled the criteria, data were obtained: Feasibility Content (3.26), Feasibility Languages (3.26), Feasibility Presentation (3.23) with valid criteria and do not need revision. For learning outcomes data analyzed by t the right. Results of t-test for learning outcomes obtained t > t table (α) (15.989> 1.699). Based on the analysis of data, then Ho is rejected and Ha accepted, namely: chemistry student learning outcomes that learned to use a project-based teaching materials module higher than the KKM (70). Value affective and psychomotor student is also growing, to the average value of affective student is $\pm$ 66.11 and an average value that is $\pm$ 70.70 psychomotor students.

KEYWORDS: Project Based Learning, teaching materials module, learning outcomes

1. INTRODUCTION

One branch of science education is to chemistry education. Chemical Education is expected to provide direct experience of the power of reason and should develop students to be able to form their own knowledge. The learning process is an important thing for students and teachers. The problem is, most educators are less innovative and creative in seeking and finding learning approaches that can stimulate students' motivation. Lessons are theoretically lead students to understand difficult chemistry teaching materials in a comprehensive manner. Therefore, students tend to memorize and chemical tasks incompatible with the concept of actual chemistry (Cynthya and Stacey, 2014).

In addition, the learning resources that are generally present only limited material. Learners still relies on educators in the process of understanding. The existence of these problems pushed the necessity of learning resources.

Instructional materials are all materials arranged in a systematic and display the competencies that must be mastered by students. One source of teaching material is widely used in the learning module.

The module has a wide variety of uses as proposed Andriani cit. Prastowo (2012), namely as a provider of basic information, because the modules are presented a variety of subject matter that could be developed further, as material or user instructions for the students, as supplementary material with illustrations and photographs communicative.

Based on the background described earlier, then that becomes the problem in this research are: (1) Is the teaching materials developed meet the criteria for National Education Standards Agency (BSNP)? (2) Is the student learning outcomes using project-based teaching materials module higher than the KKM (minimum completeness criteria) is 70?

The purpose of this research are: (1) To obtain teaching materials module project based on the material solubility and solubility product in accordance with the assessment criteria BNSP. (2) To determine the learning outcome of students that learned by using a project-based teaching materials module.

The expected benefits of this research are as follows: (1) For researchers, broaden and as inputs for researchers personally as prospective teachers of chemistry in terms of the effort to develop the project based teaching materials. (2) For Teachers / Teachers, provide information and referrals in delivering learning about the solubility and solubility product to students. Open horizons of teachers in teaching and developing learning models in the learning process as well as feedback for a chemistry teacher in choosing appropriate learning models. (3) For Learners, provide feedback and help improve learning achievement and increase the independence of learners. (4) For Advanced Study, as study materials and literature studies for the development of project-based teaching materials.

This study is limited by developing learning modules to integrate project-based learning in teaching solubility and solubility product in accordance with the criteria BSNP. Student learning outcomes measured were cognitive, affective, and psychomotor students through student worksheet contained in teaching materials module.

The module has five kinds of characteristic, namely: First, the module is a unit (package) teaching the smallest and complete. Second, the module contains a series of learning activities planned and systematic. Third, the module contains learning objectives (teaching) formulated explicitly and specifically. Fourth, the module allows students to learn their own (independent), the module contains material which is selft-instructional. The fifth module is a realization and recognition of individual differences (Prastowo, 2014).

Learning module is based on the principles of a module development, implementation, assessment, evaluation, and validation, as well as quality assurance. Development of a module is conducted in stages that define learning strategies and media, producing modules, and develop assessment tools.

National Education Standards Agency (BSNP) is an independent agency that has the authority to establish the feasibility of textbooks for use in schools. BSNP assigned to assist the Minister of National Education has the authority to, among others; 1) to develop the National Education Standards; 2) organizes National Exam; 3) provide recommendations to the government in assurance and quality control of education; 4) formulating criteria for graduation in the educational unit of primary and secondary education; 5) assess the feasibility of the content, language, presentation and kegrafikan textbooks.

At the time a question is answered, direct learners can see the various major elements as various principles in a discipline that is being studies. The PPA is an in-depth investigation of a topic the real world, it would be valuable to potential learners and businesses (Flippatau 2010 and Guo, 2012)

In addition, project-based learning is the development of a contextual learning effective as models of project-based learning has the potential to make the learning experience more interesting where students are required to think creatively and be able to work in a team or group to form the creativity of students and students' learning experience with real project (Doppelt, 2003 and Land, 2000).

2. METHODS

The method used is a method of research and development Research and Development (R & D) who study the field share research findings related to the product that will be developed. This study used a pretest-posttest design one group (One Group Pretest-Posttest Design).

The population of this research is all Unimed chemistry professor who teaches courses in General Chemistry and the whole chemistry teacher SMA Negeri 1 Galang. To determine the learning outcomes with the use of teaching materials all over MIA class XI student of SMAN 1 Assemble the school year of 2015/2016 consisting of three classes with 105 students enrolled each class consists of 35 people.

The sample in this study were two UNIMED chemistry professor who teaches General Chemistry and one chemistry teacher SMA Negeri 1 Galang. For the study sample used is in class XI MIA 2 totaling 30 people. This is a place to study in SMA Negeri 1 Galang. The research was conducted in the second semester of the academic year 2015/2016

In this study, there are several steps that overall research procedures presented in figure a and b below:

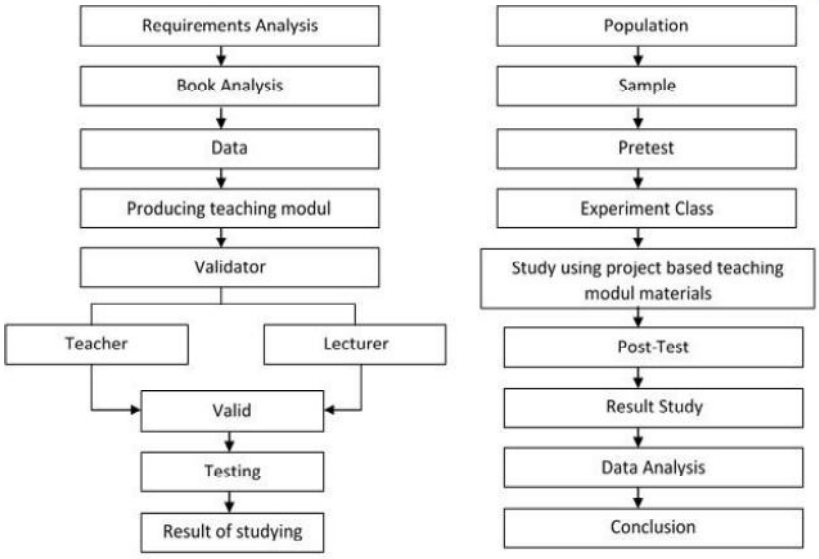

Fig. 2.1 (a) Schematic Design Steps - Step Instructional Materials and (b) Schematic Design Study Outcomes Research

To test this hypothesis by calculating the value of the respondent and each aspect or sub variables using Likert scale. Aspects contained in the questionnaire standardization of teaching materials is the feasibility of content, appropriateness of language, presentation feasibility, and feasibility kegrafikaan. Answer a questionnaire obtained using a Likert scale with the following categories:

1. Value 4 means very good / strongly agree
2. Value 3 means good / agree
3. Value 2 means poor / disagree
4. Value 1 means very poorly / strongly disagree

To strengthen the results of data validation, developed levels of qualification criteria for the validity. In this study, the grading scale used is 1 to 4, with 1 being the lowest score and 4 is the highest score. Each aspect will be summed score, then each score will be averaged in accordance with aspects assessed. Based on the determination of such range is obtained 0.75 range. The criteria for the validity of the analysis of the average used can be seen in Table 1.1 below (Situmorang, 2013):

Table 1.1 Validation Criteria of Analysis Average Value of Teaching Material Modul

	Validation Criteria
3,26-4,00	Valid and do not need revision
2,51-3,25	Quite valid
1,76-2,50	Less valid, most of the content of the modules need revision
1,00-1,75	Invalid and need revision total

To test this hypothesis learning outcomes, should be done first before the prerequisite test data that conduct normality and homogeneity test data. If the data is otherwise normal and homogeneous, then continue to the hypothesis that data.

To test this hypothesis is done by calculating the results of studying chemistry using project-based teaching materials module with the KKM using the formula:

$$t = \frac{\bar{x} - \mu_o}{\frac{s}{\sqrt{n}}}$$

Information:

$\bar{x}$ =Average

μ_0 = hypothesis value

s = standard deviation

n = numbers of sample

t_{val} = t value which count

With the critical areas on: t > tα, count > t table (α) (db = n-1), Ha accepted because it is the region of rejection Ho

3. RESULTS AND DISCUSSION

The results of a valuation analysis performed by three people validator of experts consisting of two lecturers FMIPA UNIMED Chemistry Department, who teaches courses in General Chemistry and a chemistry teacher SMAN 1 Assemble the teaching materials chemistry for SMA / MA class XI with material solubility and solubility product gain the average value and adjusted to the validity criteria table analyzes average (Situmorang, 2013). Table 3.1 below shows results for Instructional Materials Standards.

Table 3.1 Results of Teaching Material Standards

No	Criteria	Average	Validation criteria
1	Feasibility contents	3,26	Valid and do not need revision
2	Feasibility languages	3,26	Valid and do not need revision
3	Feasibility presentation	3,23	Is valid and does not need revision

For the experimental group, before being given treatment, students must first be given an early test is intended to test and determine the ability of the start of each student, as well as to determine the class of normally distributed and homogeneous. Then given instruction by using a project-based teaching materials module on material solubility and solubility product. Furthermore, at the end of the learning process, students are given a final test that aims to identify student learn ing outcomes.

Based on the data that has been obtained and have performed calculations using Microsoft Excel, the statistical data obtained student learning outcomes in the classroom experiments are summarized in Table 3.2 the following descriptive statistics:

Table 3.2. Summary Descriptive Statistics Student Results

Data	Statistik	Kelas Eksperimen
Pre-test	Average	40,50
	Standard Deviaton	8,13
	Varians	66,12
	Smallest value	20
	Biggest value	55
	Total	1215
Post-test	Average	85,50
	Standard Deviaton	5,31
	Varians	28,18
	Smallest value	75
	Biggest value	95
	Total	2565

Based on Table 3.2, the value of the average pretest students is 40.50 and the average value posttes students is 85.50. Visible differences from the beginning and end of the test on students. Standard deviation is 8.31 and the value pretest pretest variance is 66.12. Posttes standard deviation is 5.31 and posttes variance value is 28.18.

Based on Table 3.2 above, it can be described acquisition of the average value of pretest and posttest value through the experimental class diagram in Figure 3.1 as follows:

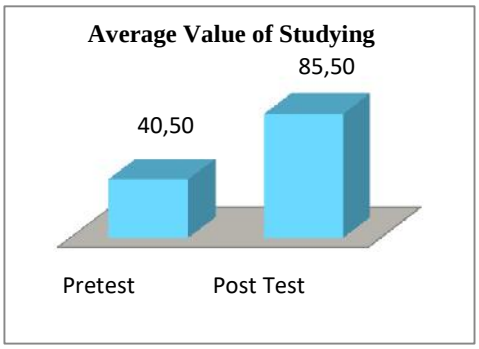

Fig 3.1 Average Value of Studying Result

Based on Figure 1 above the average pretest for experimental classes is 40.50. Subsequently conducted posttest in the experimental class in order to obtain an average of 85.50 posttest experimental class, From the results obtained shown that an increase in student learning outcomes that learned with project-based teaching materials module.

This study uses the curriculum of 2013. Assessment of learning outcomes of curriculum 2013 under three categories, namely the realm of cognitive, affective and psychomotor. In accordance with the results of observations that have been made during the study obtained data such as shown in Table 3.4 below:

Table 3.4 The average value of affective students

class	Affective		
Experiment	concourse 1	concourse 2	average
	44,44	87,78	66,11

Based on Table 3.4 students affective value 44.44 of the first meeting, a second meeting is 87.78 and the average value is ± 66.11 affective student. The calculation of the value of affective students by using Microsoft Excel. The average value of each meeting affective students increased progressively better.

Then it can increase the value of affective described experimental class through Figure 3.2 below:

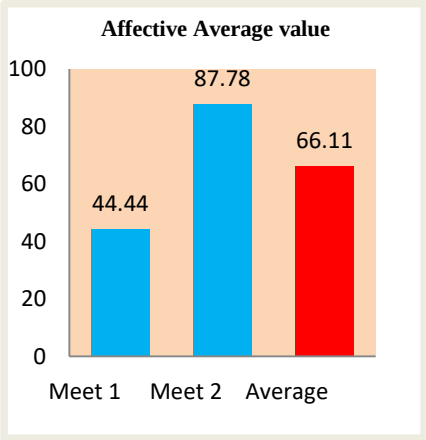

Figure 3.2 Average Value of Affective Students

Based on observations during the learning process, psychomotor aspect (skill) learning of all students has increased. In accordance with the results of observations that have been made during the study obtained from the data presented in Table 3.5 below:

Table 3.5. Average Value Psychomotor Students

class	psychomotor		
Experiment	concour se 1	concourse 2	average
	51,67	89,72	±70,70

Based on Table 3.5 Value of students psychomotor 51.67 of the first meeting, a second meeting is 89.72 and the average value is ± 70.70 psiomotorik students. The calculation of the value of psychomotor students by using Microsoft Excel. Then it can be described the increase in the value of psychomotor experimental classes through Figure 3 below:

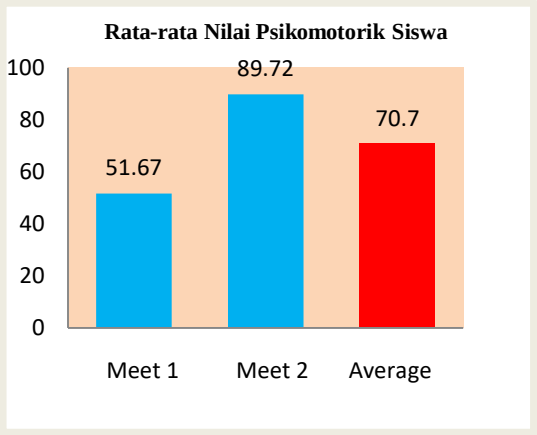

Fig 3.3 Average Value Psychomotor Students

3.1. Feasibility Analysis Teaching Material Module

From the calculation and customized with tables criterion validity analysis of average (Situmorang, 2013), then Ha1 accepted and H01 rejected so that it can be concluded that the teaching material based project on the material solubility and solubility product which has made researchers are valid and do not need revision or are in accordance with the rules BSNP.

3.2. Analysis of Results of Testing Module

As a condition for research data can be used to test the hypothesis, the data must be normally distributed and homogeneous. The calculation result of normality test Chi square test (x2) on the real level α = 0.05 with the criteria of the Chi Square x2hitung <x2tabel, it is stated that data are normally distributed can be seen in Table 3.6 below:

Table 3.6 Normality Test Results

Class	Value	x^2 Table	α	x^2 Count	Note
Eksperiment	Post test	11,07	0,05	8,35	Normal distribution

The calculation of the value of homogeneity postes students by using Microsoft Excel. From the results of the homogeneity test calculations obtained from the data in Table 3.7 below:

Table 3.7 Test Results Homogeneity

Class	Nilai	s^2	s	Note
Eksperiment	Post-test	28,18	5,31	Data homogen

3.3. Hypothesis testing

Alternative Hypothesis 2 (Ha2) is the result of chemistry learning using project-based teaching materials module higher than the KKM (70). Testing using One Sample Test with significance level α = 0.05). Criteria testing if thitung> ttabel, then the alternative hypothesis is accepted and the null hypothesis or null hypothesis is rejected.

Table 3.8 Research Hypothesis Test Results

Data	Class	$\bar{x}$	s^2	T_{count}	t_{table}	Note
Studying Result	Experiment	85,5	28,19	15,989	1,699	Ha received

The result using Microsoft Excel, obtained tcount (15.989), while t table (1.669). Thus thitung> t table (15.989> 1.669). So Ha is received, so it can be concluded that the results of studying chemistry student by using project-based teaching materials module higher than the KKM is 70.

4. CONCLUSION

Based on the research results obtained the following conclusions:

Teaching materials developed meet the criteria for National Education Standards Agency (BSNP), where the data was obtained: Feasibility Content (3.26), Feasibility Languages (3.26), Feasibility Presentation (3.23) with valid criteria and do not need revision ,

The results of studying chemistry using project-based teaching materials module higher than the KKM. Affective and psychomotor ability of students to experience growth at each meeting, the average value of affective ± 66.11 and an average value of psychomotor ± 70.70.

REFERENCES

[1] BSNP, (2007), Kapal Itu Bernama UN, *Buletin BSNP Media Komunikasi dan Dialog Standar Pendidikan*, **2(1)**: 1-23.
Cynthia J. Luxford and Stacey Lowery Bretz, (2014), Development of the Bonding Representations Inventory to Identify student Misconceptions about Covalent and Ionic Bonding Representations, *J.Chem. Educ*.**91**, 312-320

[2] Doppelt, Y. 2003. Implementation and Assesment of Project-Based Learning in a Flexible Environment.*International Journal of Technology and Design Education.***13**,255-272.

[3] Flippatau, D and Kaldi, S. 2010. The Effectiveness of Project Based Learning on Pupils with Learning Difficulties Regarding Academic Performance, Group Work and Motivation. *International Journal of Special Education.***25** (1), 17-26.

[4] Guo, S. dan Yang, Y. 2012. Project-Based Learning: An Effective Approach to Link Teacher Professional Development and Students Learning. *Journal of Educational Technology Development and Exchange.***5**(2), 41-56.

[5] Land, S.M. dan Greene, B.A. 2000. Project-Based Learning with The World Wide, A Qualitative Study of Resource Integration.*Educational Technology Research and Development.***48** (1), 45-66.

[6] Tuncay, N. and Ekizoglu, N. 2010. Bridging Achievement Gaps by Free Project Based Learning. *Procedia Social and Behavioural Sciences.***2**, 5664-5669.

[7] Prastowo, A., 2014, Pengembangan Bahan Ajar Tematik, Kencana Prenadamedia Group, Jakarta.

[8] Situmorang, Benyamin, 2013, Penelitian Pendidikan Konsep dan Implikasi, Unimed Presss, Medan

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