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Project Based Learning Tools Development on Salt Hydrolysis Materials through Scientific Approach

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Abstract: *The application of the Project Based Learning in order to compromise the student's centered learning, because the students are fully engaged in the learning process, from planning to investigative reporting. The main purpose of this research is to produce the valid and effective Project Based Learning, included: syllabus, lesson plans, module, project worksheets, evaluation instruments, and research instruments. The subject of the research is two classes of the eleventh year student of science program in SMA N 1 Pemalang. The research applied 4-D models of Thiagarajan, Semmel and Semmel. The 4-D models. Researcher has tested the validity and the effectiveness. Developed a learning device called valid if it has been through a process of expert validation. The device developed effective learning, average scores and the pretest results posttest then to determine the level of significance of the increase is in the pretest results - posttest t test with results of 69.07. Observations attitude Data showed an average student with a good attitude to have. The results of the questionnaire showed no positive response from students so that it can be concluded that the development of project-based learning through a scientific approach is valid and effective.*

Keywords: *Project Based Learning, the project worksheet, Scientific Methods*

I. Introduction

The government's commitment to improve the education system and curriculum in Indonesia began to show a bright spot. Through the Ministry of Education and Culture (Kemdikbud), government revamps the curriculum in three stages of schools at the same time from basic level, medium to above. Based on the curriculum material public test in 2013 (Husamah, 2013) obtained some information about the current conditions, among others: the learning process is still centered on the teacher, nature-oriented learning in textbooks, assessment is still on cognitive, and textbooks just load the material.

Ideal conditions expected is the student-centered learning, learning is contextual, emphasizing assessment of cognitive psychomotor and affective aspects proportionally, and more emphasis on learning that produce certain products that push to do research with project-based learning.

Learning activities in SMA 1 Pemalang has been less turn, students are less interested in learning model used by teachers, students always crammed by concept, the teacher prefers the final results in the form of cognitive tests, and the subject matter has not been directed to make certain products, based on that circumstances, in order that chemistry learning is more meaningful should be directed onto the learning process that can foster science process skills that refer to the appropriate scientific approach to fit curriculum 2013's mandate.

Curriculum 2013 focuses on scientific approaches, emphasizes personal experience through the process of observing, ask, reasoning, trying (observation-based learning) and communicate so that will increase student mastery of abstract concepts to more concrete concepts and Science Process Skills can be realized, then Suggested models are PBL and PjBL. To answer these problems and adapted to the object of research, then research of project-based learning tools development conducted, to direct the abstract concepts of salt hydrolysis learning to contextual learning so that learning is not just memorize.

Through project-based learning students will experience and learn concepts, project-based learning focused on questions or problems that encourage undergo concepts and principles. The project also involves students in a constructive investigation. This investigation may include the design, decision-making, problem-finding, problem solving, discovery or model development process (Wiyarsi, 2006)

Model of project-based learning is closely connected with scientific approach, because the scientific approach is spearheading which integrates the sciences learning both originated from the appearance of the problem. Scientific approach is the way to make and answer scientific questions through observation and or experiment. Stages of the scientific method consists of: (1) create a scientific question, (2) conduct theoretical studies (research), (3) construct a hypothesis, (4) run observation and or experimentation, (5) to analyze the data and make conclusions, (6) report the results of publication (Bahri, 2010). The steps of Project Based Learning according Kemdikbud (2013) can be seen in the following figure;

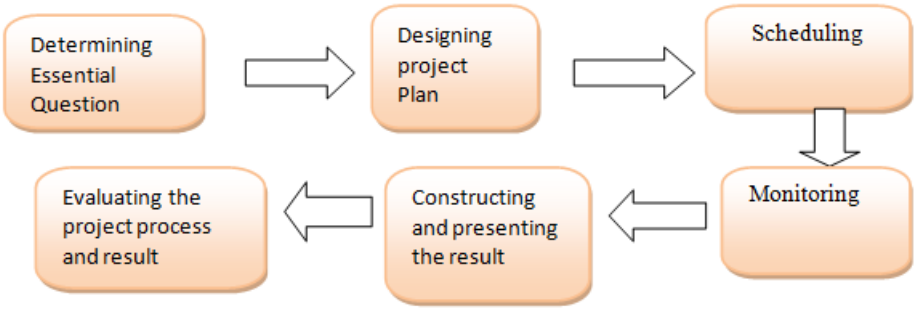

Figure 1. project-based learning Syntax

These stages, starting from the filing of the problem. Issues can be raised with a scientific question. The next process is also relatively similar, which is makes the hypothesis, observation and or experiments, and finally make a conclusion.

II. Research Methods

This type of research is the development of research using a modified model of the 4-D (to 3-D) with phases: Define, Design, and Develop (Sugiyono, 2008). Data collection was using observation, tests and questionnaires. Data collection instrument using the validation sheet (Nana, S. 2004), the observation sheet of science process skills in project activities, product assessment sheets, student questionnaire responses, and test of understanding concepts.

Analysis of the data in this study is the assessment of science process skills in project activities, product assessment, and student questionnaire responses using descriptive percentage, while the analysis of student learning outcomes using N-Gain, test for normality using the One-Sample Kolmogorov-Smirnov test and t test.

III. Results And Discussions

Students activity in learning was observed using the attitude observation sheet. The observation sheet contains a chemistry learning of Project Based Learning model. Based on observations during the four meetings, students cooperative attitude have a good rating. This evident is from the average score of the indicator reached the highest score of 3.00 out of 4. Overall from the five attitudes observed in students has a good rating with a score of 3.2 class IPA 1 and 3.23 class IPA 2. Research conducted by Doppelt, Y (2003) project based learning activities give the fact that they can work together, and they were able to listen to the ideas of others, they become learners who not only think about themselves, how social learning is as important as their academic learning. The results of these studies are relevant to this study is that the project-based learning activities can enable social interaction of students.

Project assessment in learning observed using the observation sheet. The observation sheet contains a chemistry learning of Project Based Learning model. Based on observations during the project activities, students are conducting experiments with a good rating. This evident is from the average assessment of the project reached 81.58 for the class IPA 1 and 82.76 for class IPA 2 of the highest value 120 so that the average of the two classes of 81.17.

Product assessment is an assessment of the product or the work of students that can be used to support the success of the process of project-based learning. The mean score of student's product assessment reached 77.12 for class IPA 1 and 77.71 for class IPA 2 of the highest value of 100, which means that products produced by students were averagely well, scientifically correct and feasibly use. Implementation of project-based learning that is done by Robinson (2012) concluded that the application of the steps taken on project-based learning model in improving aspects of psychomotor in the laboratory is very effective to enhance the students' understanding.

Students' understanding of the concept of learning material was measured using a cognitive ability test or tests of student learning outcomes. In this study the question consists of 25 items that have been tested for validity and reliability. Average score of student learning outcomes are presented in Table 1 as follows:

Table 1. Student's score on pretest-posttest results

chemistry concept undestanding score (pre-test)	Class IPA 1	Class IPA 2
80 – 100	3	2
60 – 79	7	11
<60	24	21
average	52,3	55,8

completeness	9%	6%
chemistry concept undestanding score (post-test)	Class IPA 1	Class IPA 2
80 – 100	28	26
60 – 79	6	8
<60	-	-
average	86,3	85,2
completeness	82%	76%

Score's data of student learning outcomes in Table 1 shows the increase in the classical student learning outcomes in the class IPA 1 and IPA 2. It is seen in the average pretest score of 52.3 then increase in the average posttest score to 86.3 in class IPA 1 and the average pretest score of 55.8 then increase in the average posttest score at 86.7 in class IPA 2. The average score of learning outcomes has meet the minimum completeness criteria (KKM) prevailing at SMA Negeri 1 Pemalang (KKM = 80).

The number of students who meet the KKM during the pretest are 3 students from 34 students or only 9% for class IPA 1 and 2 students from 34 students or only 6% for class IPA 2, while from the posttest the number of students who meet the KKM increase to 28 students from 34 students or 82% for class IPA 1 and 26 students from 34 students or 76% for class IPA 2. Existence of this increase indicates that the student has understood the salt hydrolysis concepts presented in learning which use the project-based learning model. Pretest-posttest results data are shown in the following diagram:

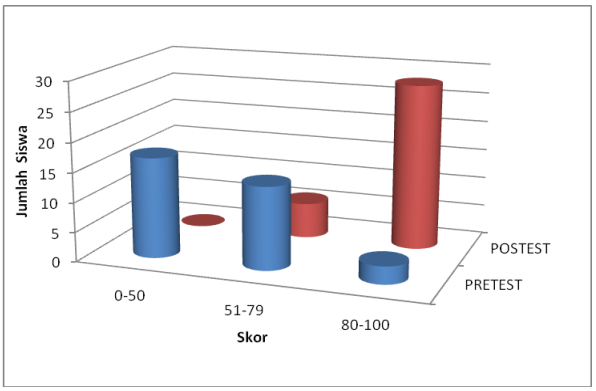

Figure 2. Diagram of the pretest-posttest results class IPA 1

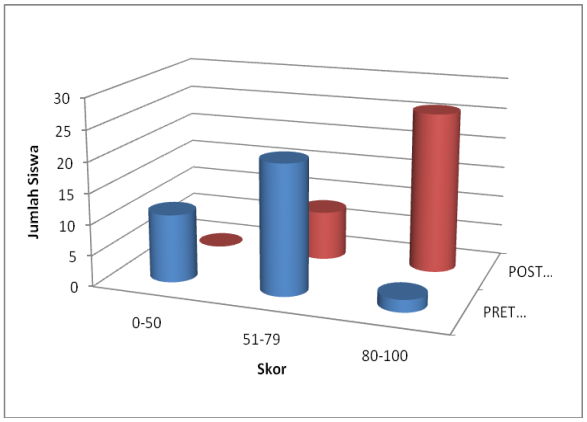

Figure 3. Diagram of the pretest-posttest results class IPA 2

To test an increase of pretest and posttest results conducted N-Gain tested (Sudarmin, 2007) from the test results using Excel and SPSS program obtained N-Gain data of 0.721 with high criteria for class IPA 1 and N-Gain of 0.664 with the criteria medium for class IPA 2 so that it can be concluded that increased significantly between pretest and posttest results scores.

Before the t-test conducted against pretest and posttest results must be confirmed that pretest and posttest result's data are normally distributed (Priyatno 2009). It's proven from the results of data from SPSS program with normality tests of One-Sample Kolmogorov-Smirnov. Data from pretest and posttest results have significance respectively of 0.24 and 0.56 as the significance value> 0.05 then Ho is accepted, meaning that data from the pretest and posttest results has normal distribution. Data from normality test results can be seen in the following table:

Table 2. Data from normality test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pretest	162	34	0,24	939	34	0,56
Posttest	150	34	0,50	941	34	0,68

Then from the results of the pretest and posttest conducted t-test (Partino and Idrus 2010). The results of the t-test gives a significance of 69.07 for class IPA 1 and 72.60 for class IPA 2, because the significant value> 0.05 then Ho is accepted, meaning that there is an increase in significant cognitive learning outcomes.
Student response data to project-based learning models obtained by using the student questionnaire responses. Questionnaire data analysis using descriptive analysis. Results diagram of student questionnaire responses can be seen in Fig. 4 as follows:

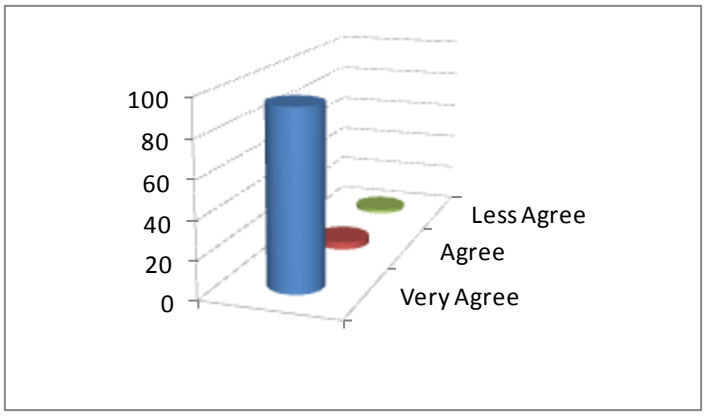

Figure 4. Diagram of student questionnaire responses

Student's response data on learning show that generally students responded positively to the learning activities of project-based learning models that have been implemented. It can be seen from the number of students who strongly agree by 94%, agreed by 4%, 2% less agree. Total scores of all response items 2590 while the highest total score is 2720 or by 94%. Such data if confirmed by the criteria then obtained positive response results of the students to the implementation of project-based learning. The results of this study are relevant to previous research conducted by Doymus et al (2009) which gives result that project-based learning activities scored higher learning outcomes than other treatments then this study has effective contributes to better learning outcomes.

IV. Conclusion

Based on expert validation of the learning tools can be concluded that learning tools development outcomes meet the valid criteria. It is based on achieved average validation score of 3.41 that meet the criteria of very well. While based on the results of the study showed that the implementation of learning tools development outcomes meet the criteria of effective. Effectiveness of the learning tools development outcomes is characterized by: (1) the acquisition of the average value of psychomotor 82.17 (≥ 80); (2) the average value of affective 3.21 in good criteria (3) student achievement 82% class IPA 1 and 76% class IPA 2 has reached the KKM = 80. Student responses 94% strongly agree meet the criteria of positive response.

V. Suggestion

Application of Project Based Learning should be pursued because the students are directed to apply chemical concepts abstract to produce a tangible product that will touch all three domains of learning outcomes in accordance with the curriculum 2013. Each practice should be linked to real chemical products that met the students in their daily lives so that will enhance the students' understanding of concepts.

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