



RESEARCH ARTICLE

THE EFFECTIVENESS OF THE ADVANCE PROJECT LEARNING (APL) MODEL TO IMPROVE STUDENTS' MULTIREPRESENTATION ABILITY IN CHEMISTRY LEARNING AT PUBLIC HIGH SCHOOL

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Abstract

The background of this research is not optimal Chemistry learning in public high school because students still have difficulty in understanding the abstract chemistry. The lack of interest and motivation of students towards Chemistry subjects is a major problem to be solved. With the increasing ability of multirepresentation, students can more easily learn chemistry. The purpose of this study is to determine the effectiveness of the Advance Project Learning (APL) model to improve the ability of multirepresentation of students in learning chemistry in public high school. The research model used in this study is Research and Development using Borg and Gall design which includes ten steps, namely preliminary study, planning, initial product development, limited test, revision of limited test results, large group test, revision of field trial results, feasibility test, revision of results feasibility test, dissemination and implementation. The results showed that the APL model is an effective model to improve the ability of multirepresentation.

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Introduction:-

The development of science and technology is currently running very rapidly. Each individual must be able to compete in maintaining his life. We must be able to solve various problems that exist around us by finding creative solutions [1]. Learning in schools today must be able to make a generation that can adapt to the surrounding environment. The learning process must be made so that students can practice to overcome various problems that exist around them.

Chemistry is one of the branches of Natural Science that studies about matter, changes in matter and energy involved in these changes [2]. Chemistry is now widely used to solve various problems that arise around us. Therefore, in studying chemistry students must be trained to overcome various problems that occur in their lives. Giving real problems will encourage students to be more interested and motivated to learn.

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Currently Chemistry learning is still felt difficult for students. Students tend to be less interested and unmotivated in the learning process, this causes mastery of the material in Chemistry learning to be very less. Based on the results of a needs analysis conducted on eighteen high school teachers in Jember obtained results that learning chemistry at school is still not optimal, as evidenced by the results of various Olympiads that show low scores. Teachers need a learning model that makes students more motivated to do the learning process so that mastery of the concept will be easier to do.

The Indonesian government has developed the 2013 curriculum to deal with the rapid pace of Science and technology. Some models can be used are Problem Based Learning, Project Based Learning, Inquiry Learning dan Discovery Learning. One of the learning models that can increase the sense of interest and motivation to learn chemistry is Project Based Learning. With the provision of contextual phenomena, students are given more freedom in expressing ideas and ideas about a problem. This Model is not suitable for students who have low mastery of concepts and tend to require a long time in completing them [3]. This deficiency can be reduced if the use of this model in conjunction with other learning models.

The learning model that can be used in Chemistry learning is the Advance Organizer learning model. This learning model can make it easier for students to accept new concepts with the help of old concepts that are already owned by students. The learning model initiated by David Ausubel was originally used for distance learning [4]. However, currently this learning model has been widely used for face-to-face learning, including in Chemistry learning. The Advance Organizer learning model has been widely used in colloidal chemistry, atomic structure, molecular chemistry, basic chemistry, electrolyte and non-electrolyte solutions and also buffer solutions [5]-[9]. The use of this learning model has proven effective to improve understanding of a new concept.

Chemists will find it easier to understand a concept if it is multirepresented. Representation is a way to convey a concept back into another form that has the same meaning. In chemistry, there are three kinds of representation: macroscopic representation (to explain a phenomenon based on visual observation), submicroscopic (explain something abstract) and symbolic (explain the equation of the reaction that occurs). Multirepresentation learning can also improve concept mastery [10]. Thus students will be more interested and motivated to study chemistry.

Based on the above background, the formulation of the problem in this study is how the effectiveness of the APL model improve the ability of multirepresentation in Chemistry learning in high school.

Methods:-

This type of research is a development research with a product in the form of a learning model. The research design used is Borg and Gall design which consists of ten steps, namely preliminary study, planning, initial product development, limited test, revision of limited test results, field test/large group test, revision of field test results, feasibility test, revision of feasibility test results, dissemination and implementation. The research steps can be seen in Figure 1.

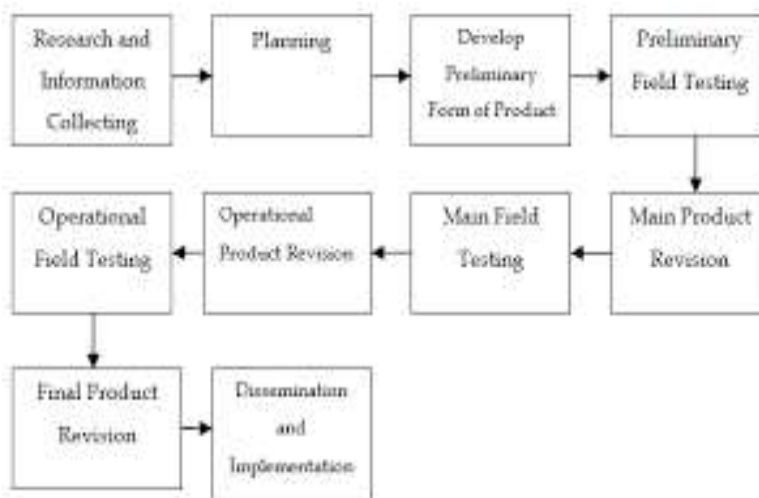


Figure 1:- Borg and Gall Design Research

This study was conducted at SMAN BalungJember. For small-scale test with the number of respondents 12 people, large-scale test with the number of respondents 36 people. While the dissemination stage was carried out in SMAN 1 Jember, SMAN 2 Tanggul and SMAN 3 Jember. The steps of APL model can be seen in the following table.

Table 1:- Stages of the APL Model.

Stages	of learning activities
Issue	a. Students observe a contextual phenomenon about the material to be studied. b. Students find problems related to the material to be studied.
Brainstorming	c. Students identify problems and conduct Brainstorming (by sharing information and data about existing problems) with groups of each d. Student submit ideas and ideas about alternative solutions to overcome problems that arise at the stage of issue
Analyze	e. Students in groups perform data analysis activities through experiments or literature studies to find solutions that can be appropriate to address existing problems.
Apply and Sharing	f. Students apply established concepts to solve problems in the form of products. g. Students present the results or products resulting from the learning process in the form of macroscopic, sub-microscopic and symbolic representations.
Reinforcement	h. Students get reinforcement in the form of questions that are done in front of the class and randomly selected by the teacher. i. The questions that the students were doing were immediately discussed at that time.

The method of data collection in the study conducted by the test method. The research design used in measuring the effectiveness of APL model development is pre-experimental with one-Group Pretest-posttest design. Experimental design using only one group of subjects and data retrieval in the form of test scores before given treatment (pre-test), and after given treatment (post-test).

Table 2:- One group pretest-posttest design.

Pre-test	Treatment	Post-test
O1	X	O2

O1 = Pretest Score

O2 = Posttest Score

X = treatment /application (use of APL Model)

The effectiveness of learning outcomes was then analyzed using N-Gain (normalized Gain), normalized gain score obtained from the comparison of actual gain score with the maximum gain score.

Results And Discussion:-

The effectiveness of the APL model in improving the ability of students in SMAN multirepresentation can be obtained from the results of pre-test and post-test. Pre-test questions are given to students before doing the APL model, while the posttest questions are given after students are given material using the APL model.

Indicators of multirepresentation ability which used are the ability of macroscopic representation submicroscopic representation and symbolic representation. Pretest and post test result for small scale trial can be seen in the following table.

Table 3:- Results Effectiveness Multirepresentation Capability Small Scale Test.

Indicators of multirepresentation	Meeting 1			Meeting 2		
	Pre	Post	N-Gain	Pre	Post	N-Gain
Makroskopik	80,00	91,67	0,58	71,67	96,67	0,88
Submikroskopik	76,67	95,00	0,42	73,33	93,33	0,75
Symbolic	38,33	44,17	0,50	40,00	47,50	0,75
Total N-Gain	0,50			0,79		
Criteria	Medium			High		

Based on the table above, students' multirepresentation ability in small scale test increased from meeting 1 to meeting 2. At meeting 1, the results of the representation capability is still not so visible improvement from the results of pretest and posttest. One of the causes is that students are still not familiar with the use of the APL model. therefore continued with meeting 2 . The results of meeting 2 the average value of N-gain has increased so that the trial continued to large-scale tests.

For large-scale tests conducted on 36 respondents. The results of the large-scale test can be seen in the following table.

Table 4:- Results effectiveness Multirepresentation capability Large-Scale Test.

Indicators of multirepresentation	Meeting 1			Meeting 2			Meeting 3		
	Pre	Post	N-Gain	Pre	Post	N-Gain	Pre	Post	N-Gain
Makroskopik	68,33	88,89	0,65	68,33	92,22	0,75	68,89	94,44	0,82
Submikroskopik	60,00	83,89	0,60	60,56	83,89	0,59	61,67	89,44	0,72
Symbolic	73,89	90,00	0,62	73,89	90,56	0,64	76,67	94,44	0,76
Total N-Gain	0,62			0,66			0,77		
Criteria	Medium			Medium			High		

From the table above it can be seen that the total N-gain increases at each meeting. This is because students are already familiar with the use of the APL model. Thus students are more interested in following Chemistry learning. Through APL students are invited to analyze the problems of a contextual phenomenon commonly encountered in everyday life. Students will more easily understand the abstract material in the chemical process. At the apply and sharing stage, students can also practice communicating the concepts they have learned by using multirepresentation.

In the dissemination stage, the ability of multirepresentation of students for SMAN 1 Jember obtained a total N-Gain value of 0.78 with high criteria. Multirepresentation ability of students for SMAN 2 Tanggul obtained a total N-Gain of 0.71 with medium criteria. While the ability of multirepresentation students for SMAN 3 Jember obtained a total N-Gain of 0.64 with medium criteria.

From the results obtained, the APL model has proven effective if used to improve the ability of multirepresentation of students in learning chemistry at public high school. The characteristic of APL is that learning is done by providing contextual problems so that students can master new concepts using old knowledge that they already have. Furthermore, students are invited to do a project to apply the concepts that have been learned and convey them using multirepresentation. Some chemicals that are suitable for use with the APL model include electrolyte and non-electrolyte solutions, hydrocarbons and petroleum, thermochemistry, reaction rates, acid bases (acid base concept, salt hydrolysis and buffers), colligative properties of solutions, redox and electrochemistry, Alkane derivative compounds, and biomolecules [5,6,7,8,9]. In addition, this model can also be used in other related subjects such as physics and biology.

Conclusion:-

From the results of the study concluded that the APL model proved to be effective in improving the ability of multirepresentation in Chemistry learning at SMAN. There was an increase in the average N-gain score for students' multirepresentation ability at each meeting.

Based on the findings in this study the advice given is: (a) for teachers, should be before doing APL model teachers prepare LKPD to facilitate learning, but it is also teachers should pay attention to the characteristics of the material to be delivered (b) for further research, research needs to be done on the application of the APL model to improve skills 21st century.

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