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By Ratu Betta

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The Effect of Problem Solving Models to Improve High Levels of Skills Ability Students

Ratu Betta Rudibyani[1] and Ryzal Perdana[2*]

[1]Teacher Training and Education Faculty, Universitas Lampung, Jl. Prof. Dr. Soemantri Brojonegoro No. 1, Bandar Lampung, Indonesia
[2]Doktoral Program of Educational Science, Universitas Sebelas Maret, Jl. Ir. Sutami 36A, Surakarta, Indonesia

*ryzalperdana2009@gmail.com

Abstract. This study aims to describe the practicality, effectiveness and size of the influence of problem solving learning model in improving the ability of high-level thinking students of senior high school state 13 at Bandar Lampung. The method used is "pre-experimental" with One Group Pre-test Post-test Design. The population in this study are all students of class X *MIPA*. The sample in this research are the students of class X *MIPA 2* obtained by cluster random sampling technique. Practicality is measured based on the implementation of the problem solving learning model (seen from the observation sheet of the learning model's model) and the attractiveness of the problem solving learning model (seen from the student response questionnaire). The effectiveness is measured based on the teacher's observation capability in managing the learning process, observation sheet of student activity during the learning process and the result of the students' high-level thinking ability improvements. Effect size is measured by t-test and effect size test. The results showed that the model of problem solving learning has practicality in improving students' high thinking ability on the material of electrolyte and non electrolyte solution. The problem solving learning model also has the effectiveness and size of the "big" influence in improving students' high-order thinking ability on the material of electrolyte and non electrolyte solution.

1. Introduction

The education curriculum currently applied in Indonesia is the 2013 curriculum. According to the Ministry of Education and Culture, in the 2013 curriculum, the 2013 curriculum learning pattern emphasizes high order thinking skills. High-level thinking is thinking skills that combine critical thinking and creative thinking. High level skills or in the English language Higher Order Thinking Skill is a pattern of thinking of students by relying on the ability to analyze, create and evaluate all aspects and problems.

Based on the results of interviews and observations with the chemistry teacher at Bandar Lampung 13 State High School, that chemistry learning in class X senior high school has used the 2013 curriculum but in the learning process there are still many using the lecture method. The learning process still refers to teacher centered as the main source of knowledge, as the teacher asks students to hear and record the material presented. The teacher is less involved in the students to express their ideas on a problem, less giving students an understanding of how the process of finding concepts, laws, facts and theories of

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chemistry and less students are trained in solve a problem. Teacher centered learning activities make students tend to be passive, have low thinking skills, the material obtained by students is instant and students do not understand the concept being taught [1]

Followed the students actively in learning, and to train students in the process inquiry concept and problem solving, it is necessary to apply a model that suits competency learning or objectives to be achieved. The learning model that is expected is an innovative learning model that is a learning model whose basic philosophy is constructivism[2]. According to [3]constructivism teaching is suitable for use in science learning. One constructivism learning model that directs the concept discovery process and problem solving is a problem solving learning model. According to [4]learning based on problem solving is learning used by the teacher to develop students' thinking processes through the provision of problems that will be analyzed individually and in groups to find solutions to these problems. . Problem solving learning can increase learning activities and achievements that include competence, knowledge, attitudes, and students' skills [5]. The problem solving learning model has steps, there are clear problems to be broken down; looking for data or information that can be used to solve problems; establish answers to questions about the problem; test the truth of the answer; and draw conclusions [6].

The advantages of learning with a problem solving model is that it can develop a fundamental concept in students; can make students face and solve problems problematically. Problem solving learning process can stimulate the development of students' ability to think actively, creatively and comprehensively, because in the learning process, students highlight a lot of times from various aspects in order to find solutions [6].

The success of the application of problem solving learning models is determined by the results of research from [7] that there is an increase in students 'learning ability by using models of problem solving learning compared with conventional learning and can improve students' activeness to achieve an average percentage of 82.32 %. In addition, [8]concluded that problem solving models were effective in improving the skills of grouping and mastery of concepts in colloidal material and [9]conclude that the problem solving model is effective in enhancing classroom classification and mastery of students' concepts in salt hydrolysis material.

Based on the description above, this article will describe the practicality, effectiveness, and size of the effect of problem solving learning models in improving students' high-level thinking skills in electrolyte and non-electrolyte solution materials. This application uses student worksheets *(LKS)* and assessment tools for problem solving based knowledge.

2. Methodology

The Method in this study is pre-experimental with one group pretest posttest design [10]. The population of this study is the 2016/2017 class X *MIPA* students consisting of five classes. The sample was obtained by using cluster random sampling technique and obtained class X *MIPA* 2 with a total of 31 students.

Validity and Reliability Analysis

The first validity is the expert validity-test with a validator regarding the aspects of readability, construction, and content compatibility. The average percentage of questionnaires was then interpreted with a per-percentage price on **Table 1**.

Table 1. Interpretation of the percentage of questionnaires

Percentage	Criteria
80,1% - 100%	Strongly Agree
60,1% - 80%	Agree
40,1% - 60%	Simple
20,1% - 40%	Less agree
0,0% - 20%	Poor

Furthermore, the validity and reliability tests were conducted using SPSS statistics 17.0. The reality test is done by using the pearson correlation product moment formula compared to r_{count} and r_{table} values, it is said to be valid if $r_{count} > r_{table}$ with a significant level of 5%. The reliability test is conducted using the Cronbach Alpha formula which is then interpreted by using the degree of reliability (r11) evaluation tools designated in Table 2.

Table 2. Criteria Reability of Evaluation

Reability Degree(r_{11})	Criteria
$0,80 < r_{11} \leq 1,00$	Very High
$0,60 < r_{11} \leq 0,80$	High
$0,40 < r_{11} \leq 0,60$	Moderate
$0,20 < r_{11} \leq 0,40$	Low
$0,00 < r_{11} \leq 0,20$	Not reable

Data Analysis of the Practicality of Problem Solving Learning Models The practicality of problem solving learning models is determined by the effectiveness of the problem solving model measured through the assessment of *RPP* negligence. The results obtained are interpreted with the percentage price in **Table 3** according to[11]

Table 3. Analysis Percentage

Percentage	Category
75,1% - 100,0%	Good
50,1% - 75,0%	Moderate
25,1% - 50,0%	Less
0,0% - 25,0%	Poor

Practicality is also determined from the learning model's effectiveness measured through the student response questionnaire given at the end of the meeting. The questionnaire consists of 13 positive and 13 negative statements. Students give a positive response when students give answers agreeing on positive statements and giving answers disagreeing with negative statements.

Effectiveness Data Analysis of Problem Solving Learning Models

The effectiveness of learning models and problem solving is determined by the teacher's ability to manage learning using a problem solving model measured by observation sheets. The formula used is the same as *RPP* implementation according to [12] Other effectiveness is also determined from the activities of students during continuous learning through student activity observation sheets. Student activity is also assessed through an assessment of attitudes and skills when conducting a practicum on electrical conductivity experiments. The assessment criteria are shown in Table 4

Table 4. Criteria *effect size*

Effect Size (μ)	Criteria
$\mu \leq 0,15$	Extra small
$0,15 < \mu \leq 0,40$	small
$0,40 < \mu \leq 0,75$	Medium
$0,75 < \mu \leq 1,10$	Big
$\mu > 1,10$	Large

3. Results and Discussion

Validity and Reliability

The question of the high-level thinking ability test that was tested with a validator obtained the results of the average readability aspect calculation of 98.33% with the criteria of "strongly agree", the construction aspect of 90% with the ministry "strongly agree" and on the content aspect of the content

of 86, 67% with the criteria "strongly agree". Based on the validation results by the validator, it can be said that the test instrument is valid. This is in accordance with the research conducted by [13] in his journal, namely the test instrument is said to be valid if it is on the criteria agreed to strongly agree with the percentage greater than 80%. The results of the validity of the test questions are shown in Table 5.

Table 5. Research Validity of Instrument

No	R_{number}	r_{tanbe}	Criteria
1	0,377	0,329	Valid
2	0,734	0,329	Valid
3	0,466	0,329	Valid
4	0,637	0,329	Valid
5	0,796	0,329	Valid
6	0,518	0,329	Valid
7	0,541	0,329	Valid
8	0,829	0,329	Valid
9	0,599	0,329	Valid
10	0,597	0,329	Valid

Based on Table 7, shows that high-level thinking ability items are valid. The results of the calculation of the reliability of the test instruments show that the criteria of the degree of reliability are "high". Based on the results of the analysis of validity and reliability, it can be concluded that the items of high-level thinking ability have been valid and reliable so that they are suitable for use as research institutes.

Practicality of Problem Solving Learning Models

The results of the analysis of the strengths of the problem solving learning model are shown in **Table 6.**

Table 6. The results of the implementation analysis of problem solving learning models

Meet	Aspect	%	Accomplishment
1	Syntax	73,75%	Good
	Social system	70,00%	Good
	Reaction	72,50%	Good
	Average	72,08%	Good
2	Syntax	88,75%	Very Good
	Social System	87,50%	Very Good
	Reaction	92,50%	Very Good
	Average	89,58%	Very Good
Average		80,83%	Very Good

Based on Table 8 it can be seen that the learning model of problem solving learning in class X MIPA 2 which includes syntax, social system and the principle of reaction to experience improvement in each of its knowledge. At the first meeting the average per ¬ percentage of all aspects of observation was 72.08% with the criteria of "Good".

In the second meeting, the average percentage of all aspects of experience experienced an increase of 89.58% with the criteria of "very good". Improvement occurs because students are more conceptive than first meetings, students are more active, and have a more self-sustaining attitude in communicating ideas, results of discussions or observations that have been carried out.

The average persentation of the two companies is 80.83% with the "very good" ministry that shows that the implementation of the problem solving me learning model ¬ has excellent practices in increasing students' high-level thinking skills. This is in accordance with the Nieveen statement [14] that a learning model is said to have practicality, if it is implemented the application of a model in learning in a class of "high or good" criteria.

The learning of problem solving learning models is measured from the student response questionnaire. The results of student response analysis are shown in Table 7.

Table 7. Results of student response data on learning

Observation	Number of statement							Average
Problem solving models	8 97%	9 85%	15 97%	16 100%	21 100%	23 100%		96,50%
Chemical relationship with enviroment	1 100%	2 94%	7 98%	14 95%	22 97%	24 97%	26 100%	97,29%
LKS *problem solving*	3 100%	4 100%	5 100%	6 97%				99,25%
Learning evaluation instrument knowledge assesment	19 100%	20 98%						99%
Learning teacher and student respon	10 100%	11 97%	12 100%	13 87%	17 95%	18 98%	25 100%	96,71%

Based on Table 9, learning with a problem solving model has a positive response from students, as evidenced by the response to agreeing students on positive situations such as students liking the learning atmosphere in the classroom by group discussion and practicum in solving problems to improve chemistry, learning by way of group discussions to train students to be confident in expressing their opinions and being brave to appear in class, students are interested in participating in further learning activities by using a problem solving learning model.

Student attraction towards problem solving learning is also evidenced by the response of disagreeing students with negative statements as students disagree when learning with group discussions requires a long time, students do not agree with the statement is not happy when asked by the teacher to go forward to present the results of the answers to group discussion, and students also do not agree with the statement bored with the implementation of problem solving models. This is in accordance with what [15] that is the positive response of students is obtained if students give positive responses to the interest and interest in learning carried out in the classroom. The ability of teachers to manage learning is shown in Table 8.

Table 8. Competency teacher

Meet		Aspect	% Accomplishment	
1	I.	Introduction Orient the problem	75%	1 Good
	II.	Core Activities Exploring	68,75%	Good
		Hypothesis of problem	68,75%	Good
		Hypothesis testing	69,64%	Good
	III.	Closing Decision making	75%	Good
	IV.	Time management	62,50%	Good
	V.	Class situation	75%	Good
Average			70,66%	Good
2	I.	Introduction Orient the problem	87,50%	1 Very Good
	II.	Core activities Exploration Information	87,50%	Very Good
		Hypothesis of problem	93,75%	Very Good
		Testing Hypothesis	85,71%	Very Good
	III.	Closing		

		Decision making	89,58%	Very Good
	IV.	Time management	87,50%	Very Good
	V.	Class Situation	96,88%	Very Good
Average			89,77%	Very Good
Average Total			80,22%	Very Good

Effectiveness of Problem Solving Learning Models

Based on Table 10, it can be seen that the teacher's ability to manage learning using problem solving models has increased at each meeting. The average percentage of all aspects of observation at the first meeting was 70.66%. This percentage is lower than the second meeting. This is because at the first meeting the class atmosphere tends to be less conducive, so that it will have an impact on the management of unfavorable time during the learning process. At the second meeting it increased to 89.77%. At this second meeting the observation aspects experienced a significant increase. Improvement occurs because students' conditions are more controllable and students become more active in seeking information from relevant sources about the problems they encounter, students become more active in group discussions, answer questions, and also interact with the teacher. In addition, observers also provide comments that the stages of learning by using problem solving learning models run better than the first meeting.

The average percentage of all observation aspects of the two meetings was obtained by the teacher's ability to manage 80.22% of the learning with the criteria of "very good". This shows that the teacher's ability to manage learning uses effective problem solving models in increasing the mastery of students' concepts, especially in the material of electrolyte and non-electrolyte solutions.

Student activities during ongoing teaching are shown in Table 9.

Table 9. Results of observation sheets of student activities

No	Aspect	Activity student (%)		
		Meeting 1	Metting 2	Mean
1.	Attention and listen explore information from teacher and friends	91,67	100,00	95,84
2.	Reading book has relevance with the problem	83,33	100,00	91,67
3.	Active doing exercise in LKS	75,00	91,67	83,34
4.	Discuss and ask question between student and friend	58,33	83,33	70,83
5.	Discuss and ask question between student and friend	66,67	91,67	79,17
6.	Present and making decision after forum discussion group	66,67	100,00	83,34
7.	Comment and respond to other group presentation	58,33	83,33	70,83
Average percentage of student activity frequency that is relevant		71,43	92,86	82,14
Criteria for relevant student activities		Good	Best	Best
The average percentage of student activity frequency that is not relevant		28,57	7,14	17,86
Criteria for irrelevant student activities		Good	Good	Good
Note :		100,00	100,00	100,00

Based on Table 9, it can be seen in the first findings that student activities are expected (relevant) to have a percentage of 71.43% and irrelevant student activity of 28.57%. According to the two ob-servers, there are still many students who do not follow the learning well, for example doing things that are not reliable, such as playing cellphones or making noise with their friends and students, who are still passive in learning lesson.

At the second meeting, student activities that were not relevant began to decline to 7.14% and relevant percentages of students increased to 92.86%. This is in accordance with the observer's consistency that states that students are also seen to be more active in conducting relevant activities than in the first meeting.

The average student activity that was relevant from the two meetings was 82.14% with the criteria of "very good" and the average student activity that was irrelevant from the two meetings amounted to 17.86% with "poor" criteria. This shows that learning uses problem solving models to make students participate actively. The results of this study in accordance with the opinion of [15] that the problem solving learning model makes students more active in learning so that the percentage of student activity increases in each meeting.

Student activities are also assessed through attitude and skill assessment sheets during the electrical conductivity experiment in the first meeting. The average results of the assessment of attitudes and skills of students of class X *MIPA* 2 are equal to 75.69 and 90.87 with the "good" criteria which means the activity of students during conducting electrical conductivity has an attitude and good practicum skills and students work in groups so that they can interact with each other and be actively involved. This is in line with [16] research that problem-based learning can improve student process skills that students passively begin to be active students and when implementing student learning actively involved in all learning processes. The effectiveness of a learning model is also seen from the enhancement of students' concept mastery shown through the magnitude of the n-gain value. The results of the average pretest scores, and the posttest of students in class X MIPA 2 are shown in Figure 1

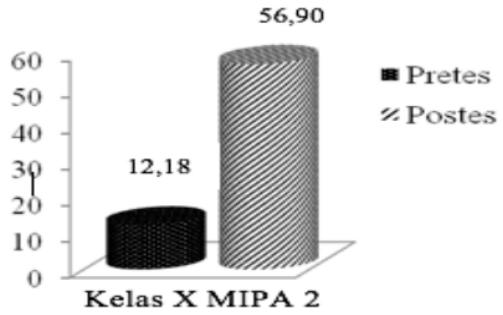

Figure 1. The average score of pretest and posttest mastery of students' concepts

Based on Figure 1 it can be seen that the average student pretest score is lower than the student's posttest mean score. Low student pretest results may be due to lack of knowledge of students about the material of electrolyte and non-electrolyte recruits because students have not obtained the material before, so that students experience difficulties in working out the questions about the pretest give it. After applying learning by using problem solving learning models in electrolyte and non-electrolyte solution material during two meetings, students are given posttest questions about the material. It can be seen that the mean score of students' mastery of concept mastery has increased to 56.9. The average posttest value is higher than the mean score of students' conceptual understanding. After obtaining the pretest and posttest scores, then calculating the n-gain value. The average n-gain value is 0.51 with the "moderate" criterion which means learning by using effective problem solving models in improving students' mastery of concepts in the electrolyte and non-electrolyte solution material

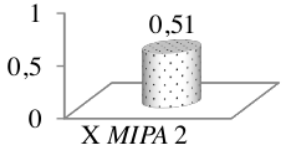

Figure 2. Value n-Gain

This is in accordance with the opinions expressed by [17]who emphasize that learning can be said to be effective when students' learning outcomes indicate a significant difference between students. early understanding with understanding after learning (significant n-gain)

Effect Size

The results of the normality test on the n-gain value showed that the study sample came from normal distribution with Asymp. Sig. (2-tailed) of 0.065. The results of the t test that has been carried out have obtained a value of 14.041. The effect size size of concept acquisition obtained 0.932 with the "big" criteria according to [18] This shows that the problem solving learning model has a "big" effect in increasing the mastery of students' concepts when learning chemistry, especially in electrolyte and non-electrolyte solution materials.

4. Conclusion

Based on the results and analysis of research data, it can be concluded that the problem solving learning model has practicality, effectiveness and has a major influence in increasing the students' conceptual control on electrolyte and non-electrolyte solution material which is shown through the average overall percentage of The problem solving learning model includes the criteria of "very good", positive student response, the ability of teachers to manage student learning and activities that are relevant to the criteria of "very good". The pretest and posttest scores of the students' high level of thinking ability have increased with the "medium" n-gain value and the effect size value is "big".

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