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Improving Students' Critical Thinking Skills through Module Ion Equilibrium in Salt Solution Based on Discovery Learning with Probing Prompting Techniques

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Abstract: This study aims to determine the improvement of student critical thinking based on discovery learning with probing prompting techniques the material of ion equilibrium in salt solution (salt hydrolysis). The research design used was the Design of the Posstest Non-Equivalent Group. The population in this study was students of class XI IPA SMAN 1 Payakumbuh 2018/2019 academic year. The selection of sample classes is done by cluster purposive sampling technique. The sample in this study was class XI IPA 3 as the control class and XI IPA 4 as the experimental class. The learning experimental class uses modules discovery learning with probing prompting techniques, while the control class without using modules. The research instrument used was a test of the results of learning critical thinking questions. The results showed that modules discovery learning with probing prompting techniques can improve students' critical thinking skills, as evidenced by the increase in the average in the posttest results. The results of testing for normality and homogeneity state that the critical thinking value of the two distributed samples is normal and homogeneous. Hypothesis test results obtained by GIS. (2-tailed) of 0.002 <0.05 means that the value of critical thinking learners who use modules is based on discovery learning with probing prompting techniques significantly different.

Keywords: Ion Equilibrium in Salt Solution Module, *Discovery Learning, Probing Prompting* Technique, Critical Thinking.

I. Introduction

Chemistry is the study of matter and the accompanying changes (Chang, 2010: 4). Chemistry is obtained and developed based on experiments to find answers to the questions of what, why, and how the natural phenomena in particular about composition, structure and properties, changes in matter and the accompanying energy. Scientists study natural phenomena through certain scientific processes and attitudes; therefore chemical learning should also be carried out through a scientific approach or scientific approach.

According to Permendikbud 2014, learning in the 2013 curriculum for all levels of education is carried out using a scientific approach. Scientific learning is learning that applies the steps of scientists in building knowledge through scientific methods (Abidin, 2014: 122). The learning process can run well when students are involved, where interaction between students affects the level of understanding. By actively participating, students have a greater opportunity to understand and remember subject matter rather than just listening and watching passively (Sardiman, 2011: 27).

One of the active learning models is the model *discovery learning*. In order for learning to be *teacher oriented to* be *student oriented,* the learning process will run well and creatively if the teacher provides an opportunity for students to find a concept, theory, rule, or understanding through examples that are encountered in life. The goal in *Discovery Learning* according to Bruner is that the teacher should provide an opportunity for his students to become a *problem solver*, a *scientist*, or mathematician. And through these activities students will apply, and find things that are beneficial to themselves (2013 Curriculum Implementation Training Module, 2014: 40).

Discovery learning can be interpreted as a learning model that can develop the way students learn actively by finding themselves, investigating on their own, then the results obtained will be long lasting in memory, not easily forgotten by students (Hosnan, 2014: 282). According Jalius (2012: 50-51) in learning there are two techniques that can enhance the activity asks students sehigga help students understand the concept that ask probing technique (Probing) and questions that are guiding(Prompting).

Huda (2013: 281-282), states that techniques *probing-prompting* can improve students 'critical thinking skills by using questions that can direct and explore students' knowledge so that they are able to associate the knowledge they have gained with the knowledge to be learned. *Discovery Learning is* considered to be suitable with techniques *probing-prompting* where in each syntax a good question technique can be combined which is expected to improve students' critical thinking skills. Critical thinking is one of five reinforcement of character values that will be able to encourage students to have the 21st Century skills needed in pursuing their lives.

Solutions to make students active in the learning process include applying an active learning model or by designing a set of teaching materials, one of them in the form of modules. Modules can be used as teaching materials that help teachers in the learning process. The selection of teaching materials with appropriate learning models or methods can support the success of the learning process (Isworini, 2015: 9)

II. Discussion

Learning discovery according to Sani (2014: 97-98) "is a learning model that is used to build cognitive that requires teachers to be more creative in creating situations that can make students active learning find their own knowledge". This learning model is in accordance with Bruner's theory which suggests that students learn actively to develop concepts and principles.

Suherman (in Huda, 2013: 281-282), states that probing-prompting techniques can improve students 'critical thinking skills by using questions that can direct and explore students' knowledge so that they are able to associate the knowledge they have gained with the knowledge to be learned.

Critical thinking skills are activities to analyze ideas or ideas in a more specific direction, distinguish them sharply, choose, identify, study and develop it towards a more perfect. Indicators of critical thinking skills are divided into 5 groups by Ennis (1985) as in Table 1.

Table 1. Indicators and Operational Words of Critical Thinking Skills according to Ennis, 1985 (Tawil, M and Liliasari, 2014)

No	Indicator	Operational Word
1	Give a simple explanation (*elementary clarification*)	Analyze statements, submit and answer clarification questions
2	Build basic skills (*basic support*)	Assessing the credibility of a source, researching, evaluating the results of research
3	Make inference (*inferring*)	Reduce and assess deduction, induce and assess induction, make and assess valuable judgments
4	Make further explanation (*advanced clarification*)	Defines terms, evaluates definitions, identifies assumptions.
5	Manage strategies and techniques (*strategis and tacties*)	Decide on an action, integrate with others.

This module is based on the Discovery Learning model which consists of 6 steps, where each process is followed by the guiding questions:

a. In the stimulation step, you are asked to observe by reading, listening, seeing (without or with a tool) then answering questions about observations that are in modules.

b. In the problem statement step, you are expected to be able to identify any problems that you observe at the stimulation stage. Questions guide you to formulate and formulate hypotheses.
c. In the step of data collection (data collection), you are asked to collect information in various ways, namely, experimentation, observing objects / events and reading other sources to prove your hypothesis on the questions helps direct you to collect data.
d. In the step of data processing (data processing), you are asked to answer questions and solve problems and find concepts from the material being studied.
e. At the verification step, you are asked to prove whether the hypothesis that you have compiled before is correct after you have collected and processed the data based on the questions given to you.
f. In the stage of drawing conclusions (generalization), you are asked to write material conclusions that you get according to the learning objectives.

III. Methodology

Type of research used is experimental research. The design of this experiment is the *Non Equivalent Control Group Posttest Only Design*. The population in this study was students of SMAN 1 Payakumbuh. The selection of sample classes is determined by *purposive cluster* sampling which is a sampling technique by selecting classes (not individual types). The steps we have taken to select this sample, first collect the initial knowledge data in the form of students' daily test scores, namely acid-base material. Second, look for and calculate the value of the normality and homogeneity of each class. And then, select two classes of homogeneity namely XI IPA 3 and XI IPA 4.

In this experiment, there are two classes namely the experimental class and the control class, also each group will have the *posttest.* The experimental class during the learning process uses an ion equilibrium module in salt solution based on *discovery learning* by *probing prompting.* While the control class uses teaching materials used in school. In detail, *Non Equivalent Control Group Postest Only Design*. This design can be illustrated in Table 2 below:

Table 2. Design of Field Trial Implementation

Class	Treatment	Posttest
Experiment Class	X	T
Control Class	Y	T

Description:
X: Learning by using modules based discovery learning with probing prompting techniques.
Y: Learning without modules
T: Final test

The instrument of this research is five critical thinking questions in the form of essays.

IV. Result And Discussion

Analysis of learning outcomes data is determined systemically starting with knowing the contradiction scores of the experimental class and the control class, the normality test, the homogeneity test, and the t-test. Both of these sample classes are taken based on the percentage score of students who think critically. The score of students' critical thinking after being treated during the learning process, the average posttest of the experimental class was higher than the control class.

The results of the Posttest score are used to perform a hypothesis test, before doing this test we get a normality test and a homogeneity test. The normality test used is Kolmogorov-Smirnov. The results of the normality test can be observed from Table 3.

Table 3. Normality Test Results

Class	**α**	**Sig.**	**Distribution**
Experiment	0,05	0,800	Normal
Control		0,539	Normal

Based on the table above, the sample data has a significant value> 0.05 real standard $\alpha = 0.05$. However, the posttest score data (critical thinking) of two samples is normally distributed. The homogeneity of the test used is the Levene test. The results of homogeneity tests can be observed in Table 4 as follows:

Table 4. Homogeneity Test Results

Class	**α**	**Sig.**	**Distribution**
Experiment	0,05	0,172	Homogeneous
Control			

Based on the table above, the sample data has a significant score> 0.05 in the real standard $\alpha = 0.05$. However, the posttest data score (critical thinking) of these two samples has a variance in homogeneity.

And the results point is determined that the sample class can be distributed normally and have a homogeneous variant. Therefore, to make the hypothesis used is the independent sample t-test listed in Table 5.

Table 5. Hypothesis Test Results; Critical Thinking Score in the sample class

Kelas	α	Sig.	Distribution
Eksperiment	0,05	0,002	H_0 ditolak
Control			

Based on the table above, if the significance value is> 0.05 then accept H0 and if the value is significant <0.05 then H0 is rejected. Decision to reject H0 means that critical thinking skills of students who learn using modules and without modules differ significantly. Acceptance decision H0 means critical thinking skills of students who learn by using modules based on discovery learning with probing prompting techniques and without modules not significantly different. The average critical thinking ability of students using modules does not differ too far from students who do not use the module.

Similarly, research conducted by Sowel Ilhami (2018: 138) found that student learning outcomes using modules based on discovery with a scientific approach and without modules differed significantly. The use of ion equilibrium modules in salt solutions based on discovery learning with probing prompting techniques carried out in group learning systems can make students work together in building their understanding and knowledge, so students are easier to remember and understand. This is known when students answer probing prompting questions and encourage students to work together and discuss in answering this question.

Thus learning becomes more effective and will have a positive effect on scientific attitudes, students' thinking skills and student learning outcomes. According to (Jacobsen, 2009: 184) through probing questions teachers try to make students explain answers to improve student understanding. While the questions asked are questions that involve the use of signals, or instructions that are used to help students answer correctly.

V. Conclusion

Effectiveness of modules ion equilibrium in salt solutions based on *discovery learning* with *probing prompting* techniques can improve students' critical thinking skills and can be observed with a comparison score of students who think critically in the experimental class and control class with a significant 95% confidence level (α) 0,05. Hypothesis testing shows that the results of students' critical thinking learning with modules ion equilibrium in salt solutions based on *discovery learning* with *probing prompting* techniques and without modules differ significantly. Which means using an module ion equilibrium in salt solution based on *discovery learning* with *probing prompting* techniques for higher student learning outcomes than without modules and can help improve students' critical thinking skills.

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