



# Improving Students' Critical Thinking Skills Through Buffer Solutions Module Based on Scientific Approaches Assisted Probing Prompting Questions at SMAN 1 Payakumbuh

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Abstract – This study aims to determine the improvement of students' critical thinking through a module-based scientific approach assisted probing prompting questions on buffer solution material. The research design used was a Non-equivalent Control Group Posstest Only Design. The population in this research was a class of students of XI IPA SMAN 1 Payakumbuh academic year 2018/2019. Sample class selection was performed with purposive sampling cluster technique. The samples in this study were XI IPA 3 class as the control class and XI IPA 4 as the experimental class. The experimental class learnt to use a module based on scientific approaches assisted by probing prompting questions, while the control class without using a module. The research instrument used was a learning results test in a matter of essay critical thinking. The results of the study showed that the module-based scientific approach assisted by probing prompting question can improve students' critical thinking skills, evidenced by the average increase in posttest results. The test result of normality and homogenity stated that the critical thinking values of both the distributed samples were normal and homogeneous. The hypothesis test results obtained by SIG. (2-tailed) of 0.001 < 0.05 mean that the critical thinking value of learners who learn to use modules based on scientific approaches assisted by probing questions was differ significantly.

Keywords - Buffer Solution Module, Scientific Approach, Probing Prompting Question, Critical Thinking.

#### I. INTRODUCTION

Chemistry is the science that search answers to the questions of what, why, and how natural phenomena are related to composition, structure and properties, changes, dynamics, and substance energetics that involve skills and reasoning (Brady, 2009: 23). There are two things related to chemistry that are inseparable, namely chemistry as a product (chemical knowledge in the form of facts, concepts, principles, law, and theory) and chemistry as a process (Ministry of National Education, 2008: 459). The 2013 curriculum is a competency-based curriculum with basic competencies as the minimum competent to be accomplished by learners. The implementation of the scientific approach in 2013 curriculum is expected to improve learning activities into collaborative, active, and participatory learning and to stimulate students' critical thinking skills (Sumarna,2004:4)

Reviewed from the purpose of learning according to 2013 curriculum is to improve students' critical thinking

skills. To improve students' thinking skills, students should be trained to think through questions. These questions can either be digging questions or lead questions. So that students are able to actively think about finding answers to the questions asked (Shoimin,2014:126)

Probing prompting questions are learning method that can develop and improve students' critical thinking skills, because students are involved directly in the learning process. Students are given a series of questions to a high level whose nature is digging and guiding, so a high-level thought process happen that associates the students' attitude knowledge and experience with the new knowledge that being studied. Such high level of thinking is the ability of critical thinking (Elsa,2017:2)

Several studies have been conducted stating that student thinking skills can be enhanced through learning activities specifically designed to develop critical thinking skills.

In the learning process a teacher must have teaching materials. Teachers or educators have a fundamental task to plan, implement, and evaluate the learning process. The establishment of a teacher planning learning in the form of creating and preparing learning devices is used to carry out the learning process, the implementation of the learning process, assessment of learning outcomes as stated in Permendiknas No. 41 year 2007. As a form of implementation of curriculum 2013 that emphasizes learning with a scientific approach, a learning device is needed one of them is teaching materials.

One of the teaching materials that can be developed is the module. The use of modules can increase the motivation of students to learn because it is equipped with concept maps, charts and images that are color-related. The existence of concept maps in modules makes it easy for students to remember information, focus and improve understanding. The charts and images make the brain more active and enhance the student's happy Taste (Ellizar, dkk. 2013).

# **II. LITERATURE REVIEW**

Critical thinking is a sensible reflective thinking or based on logical reasoning focused on determining what to believe and do (Ennis,1990:68). Critical thinking is a cognitive skill to effectively identify, analyse and evaluate arguments for discovering and addressing personal prejudice, formulating and presenting compelling reasons to support conclusions, make a sensible and intelligent decision (Bassham et al, 2011:1). In short, critical thinking involves evaluating the truthfulness of information (Lang,2006:461).

Enis classify critical thinking skills into five aspects, providing basic clarification, making the basis of a decision (the

bases for adecision), concluding inference, providing further explanation (Advanced clarification) as well as set strategy and tactics. Each aspect is divided into several indicators as seen in table 2 (Ennis, 1990:68-69).

Module-based scientific approach assisted by probing prompting question is designed and adapted to scientific learning step. According to Jacobsen (2009:184) through probing question the teacher seeks to make his students explain about the answers in order to improve the depth of student understanding. While prompting question is a question involving the use of cues, or clues used to help students answer correctly.

The application of probing prompting questions adapted into scientific learning measures. The stage of observing the scientific approach of students is given problems that will require students to be able to identify the problems that will be discussed assisted by probing prompting questions. At this stage students are given the opportunity to identify problems based on the observing stage. At the stage of collecting this data students are given the opportunity to read various references in order to provide an inquiry on the questions asked, conducting a laboratory experiment if the answer to the question requires scientific evidence. Students are assisted by questions that dig and guide to find themselves concepts learned through the collecting stages of data. Furthermore, the stage of associating is developing and deepening the concepts already found. At the stage of communicating students are not only required to understand the material and solve the problems given in learning, but students should also be able to communicate the ideas or answers that they have both orally and writing.

# **III. METHODOLOGY**

The type of research used is experimental research. The design of this experiment is *Non-equivalent Control Group* Posstest *Only Design*. Population in this experiment is student of SMAN 1 Payakumbuh. The selection of sample class is determined by *cluster purposive* sampling which is sampling technique by selecting class ( not individu type). The steps we've already done of selecting this sample, first the collecting initial knowledge data in the form of students' daily test scores, namely acid-base material. Second, searching and calculating normality value and homogenity of each classes. And then, select two homogenity classes which are XI IPA 3 and XI IPA 4.

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In this experiment, there are two classes namely experiment class and control class, also each groups will be having the *posttest*. Experiment class during study learning proses using module buffer solution based on a scientific approach assisted with probing questions prompting. Whereas control class using module teaching materials used in school. In detail, *Non-equivalent Control Group Posttest only Design* by this table 1 as follow:

Table 1. Non-equivalent Control Group Posttest only Design

Class	Treatment	Posttest	
Е	Х	Т	
K	Y	Т	

Remark :

E = Experiment Class

K = Control Class

X =The treatment given to the experimental class is learning using module-based scientific approach assisted probing prompting questions on buffer solution material.

Y = the treatment given to control class is learning using module teaching materials used in school.

T = Posstest score in control class and experiment class. Instrument of this research is nine critical thinking questions in the form of essays

#### **IV. RESULT AND DISCUSSION**

Analysis of learning outcomes data is determined by systemically which is starting by knowing the contradiction scores from experiment class and control class, normality test, homogenity test, and t-test. Both this sample classes is taken by percentage scores of critical thinking student on Picture 1.



Picture 1. Percentage graph of critical thinking studen to each categories.

From the picture 1 above, to control class is on very good category 8%, good 12%, adequate 52%, and less as much as 28%. Whereas to experiment class, on very good category 53%, good 57,69%, adequate 30,7%, and less as nothing. The score of critical thinking student after given the treatment during the learning process, the average posttest of the experimental class is higher than the control class. Look at table 2.

# Tablel 2. Analysis data outcomes from critcial thinking student performance

Indicator of critical thinking skills	Cont.		Eks.	
1. Analyze arguments	22%	Κ	54%	С
2. Consider credibility of source	65%	В	70%	В
3. Observe and consider the result	64%	В	65%	В
of observations				
4. Make deduction and consider	66%	В	71%	В
deduction				
5. Make Induction and consider	56%	С	63%	В
induction				
<ol><li>Make a decision and consider</li></ol>	58%	С	61%	В
the results				
<ol><li>Identify terms and consider</li></ol>	47%	С	61%	В
defenitions				
8. Identify assumtion	38%	Κ	61%	В
9. Decide action	39%	Κ	53%	С
Mean	51%	C	63%	В

Information:

VG/SB : Very Good/Sangat Baik

- G/B : Good/Baik
- A/C : Adequate/Cukup
- L/K : Less/Kurang

This posstest score is used to do hypothese test, before to do this test we get to normality test and homogenity test.

Normality test used is *Kolmogorov-Smirnov*. the outcomes of normality tes can be observed from Table 3.

Table 3. Outcome Nomality Test

Class	α	Sig.	Distribution
Е	0,05	0,942	Normal
K		0,915	Normal

Based on table above, sample data have significant scores > 0,05 on real standard  $\alpha = 0,05$ . Nevertheless, posttest score data (crictical thinking) two samples is distributed normally. Homogenity tes used is uji Levene. The outcome of homogenity tes can be observed in this Table 4 as follow.

Table 4.	Outcome	Homoger	nity Test
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Class	А	Sig.	Distribution
Е	0,05	0,256	Homogen
K			

Based on the table above, sample data have socre significant > 0,05 in the real standard  $\alpha = 0,05$ . Nevertheless, scores data of posttest (critical thinking) both this sample have variant homogenity.

And the outcome point is determined that sample class can be distributed normally and have variant homogeny. Therefore, to do hypothesis used is *independent sample t-test*. Criteria of acceptance if the sig value (2-tailed) > 0,05 thus Ho is accepted and if the sig value . (2-tailed) < 0,05 so Ho is rejected. And the outcome of this critical thinking on Table 5 as follows:

Table 5. Outcome of Hypothesis test ; Critical Thinking scores in sample class

Class	Sig. (2- tailed)	Decision
Е	0,001	Ho rejected
K		5

Based on the table above the sample class have sig value (2tailed)lwer from 0,05 IS 0,001, can be concluded that Ho is rejected. Decision rejection of Ho defines that critical thinking of student using module buffer-solution on a scientific approach assisted with probing questions prompting and without module of buffer-solution on a scientific approach assisted with probing questions prompting improve the performance of student critical thinking.

Similarly occurred on Siti's research (2015:38) discovered that the application of probing prompting questions can improve student learning outcomes because of the average increase in the second cycle. In line with the research conducted by Ririn (2018: 125) discovered that the learning outcomes of students who learn using modules based on scientific approaches and without modules different significantly. The use of a buffer solution module based on a scientific approach assisted by probing prompting questions conducted in a group learning system can make students work together in building their understanding and knowledge, so students are easier to remember and understand (Hanson, 2006: 4). This is known when students answer probing questions and prompting 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 question the teacher strives to make students explain the answers in order to increase students' understanding. While prompting questions are questions that involve the use of signals, or instructions that are used to help students answer correctly.

#### **V. CONCLUSION**

The effectiveness of module buffer-solution on a scientific approach assisted with probing questions can progress the performance of critical thinking student and can be observed by the comparison scores of critical thinking student in experiment class and control class with level of confident 95% significant standard ( $\alpha$ ) 0,05. Hypothesis test is pointing that the outcome of critical thinking student learning by module buffer-solution on a scientific approach assisted with probing question and without module buffer -solution different significantly. Which is mean using of module buffer-solution on a scientific approach toward the outcome learning of student that is higher than without module and can help to improve the performance of critical thinking student?

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