

Article History

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riska.imanda07@unimal.ac.id**THE EFFECTIVENESS OF WORKSHEET-ASSISTED PROBING PROMPTING LEARNING MODEL ON STUDENTS' CRITICAL THINKING SKILLS IN THE SUBJECT OF REACTION RATE AT MAS ULUMUDDIN LHKSEUMAWE**Pocut Intan^a, Riska Imanda^{a*}, Sirry Alvina^a^aDepartment of Chemistry Education, Malikussaleh University, Lhokseumawe, Aceh, Indonesia**Abstract**

This study aimed to determine the differences in critical thinking skills (CTS) between classes using the worksheet-assisted probing prompting learning model and those using only probing prompting learning model for the subject of reaction rate at MAS Ulumuddin Lhokseumawe. The research method was quasi-experimental with the Nonequivalent Control Group research design. The sample used were two classes with 30 students in each. The data was collected by using multiple choice test questions. The results showed that there were differences in the critical thinking skills of students who were taught using the worksheet-assisted probing prompting learning model and students who were taught with only probing prompting learning model. Since there was a significant value of $0.000 < 0.05$, then the H_a was accepted while the H_0 was rejected. It can be concluded that there is a significant effect of the probing prompting learning model assisted with students' worksheet on the critical thinking skills of students at MAS Ulumuddin Lhokseumawe.

Keywords : Learning model, probing prompting, critical thinking, students' worksheetdoi: [10.24815/jcd.v9i1.21095](https://doi.org/10.24815/jcd.v9i1.21095)**INTRODUCTION**

Learning is a process that involves both teacher and student in developing student creativity and ability to construct new knowledge. It also involves a lot of effort from both sides in order to improve students' mastery on the subject. During learning activities, learning models and media are required to support the given subject. Chemistry is a subject that is very interesting to study, but because the theory is abstract, most high school students find it difficult to understand. The students often cannot understand the basic concepts that have been received. Meanwhile, the learning process itself requires the students to master the concepts of the given subject well. Suhendra and Sutiani, 2018 said that the main goal in the learning process is optimal mastery of material by students known as complete learning. Chemistry is a lesson that is basically very interesting if the teacher uses the right learning strategies during the teaching and learning process.

The models applied in the learning process are generally diverse. A certain learning model that is applied to a learning subject is not necessarily suitable to be applied on another subjects. Because of that, a teacher must be proficient in choosing a model so that

the material presented is appropriate and the students can get maximum learning outcomes. [1] stated that the learning model is one of the most important factors in the learning process, because each student basically has a different learning style. Therefore, the competence of the teacher in determining the learning model indirectly affects the ability of students to understand the context of the learning material presented.

Based on the results of observations in class XI MAS Ulumuddin Lhokseumawe, the learning process on chemistry subject is still teacher-centered with verbal teaching and a lack of variation in the learning process. Consequently, the student learning process is passive and tends to be boring because students can only accept what is given from the material and what is delivered by the teacher. Furthermore, it was found that the use of learning media to motivate students in studying chemistry is rare and students have no initiative to state how well they understand the material given so far. They need to be stimulated repeatedly to actively ask questions so that the learning process is in accordance with the subject and student competence in order to improve learning outcomes. This problems require educators to be able to apply models and

learning media that are more precise and effective. In accordance with what is stated by [2-3] if the learning model and media used by the teacher are not appropriate and ineffective, it will cause low student learning outcomes. The results of learning at MAS Ulumuddin showed that the daily test scores obtained were 60 and it is still below the minimum passing score which is 78.

Based on the description above, it is necessary to have an innovative learning model and media that involves students actively during the Chemistry learning process. One alternative that can be used is by using a learning model of probing prompting (PP) assisted with students' worksheet (SWS). This learning model is conducted by submitting a series of questions that require students to think and find out the answer. This is in accordance with [4-7] who stated that the PP learning model is one of the learning models in which the teacher presents a series of questions that is demanding and exploring so that a thought process occurs that links each student's knowledge and experience with the new knowledge that is being learned.

The PP Learning Model has seven stages: 1) The teacher exposes students to situations, for example by paying attention to pictures, formulas or other situations that contain problems, 2) The teacher waits for a few moments to give students the opportunity to formulate answers or have small discussions in formulating, 3) The teacher poses problems to students in accordance with specific learning objectives or indicators to all students, 4) The teacher waits for a few moments to give students the opportunity to formulate answers or have small discussions in formulating, 5) The teacher waits for a few moments to give students the opportunity to formulate answers or have small discussions in formulating, 6) If the answer is correct, the teacher asks other students about the answer to ensure that all students are involved in direct activities. However, if the student hesitate in his answers, or the given answer is incorrect, a bit off, or silent, the teacher asks other questions that lead on the direction of the expected answer. Then, continued with questions that require students to think at a higher level, until they can answer questions according to basic competencies or indicators. The questions carried out in this step should be asked to several different students so that all students are involved in all PP activities, and 7) The teacher asks the final questions to different students to further emphasize that these indicators have really been understood by all students [8-9].

The PP model can be combined with students' worksheet media (SWS), with the hope that students will understand and remember better the material presented by the teacher. This is because SWS is one of the means to assist and facilitate teaching and learning activities so that effective interaction will be formed

between students as well as enhancing student activity in increasing learning achievement [10] Further research conducted by [11] mentioned that the PP learning model which was applied to the subject of atomic structure showed an increase on student learning outcomes as seen on the posttest scores in the experimental class. Based on the above problems, the researcher will conduct research on "The Effectiveness of Worksheet-Assisted PP Learning Model on Students' Critical Thinking Ability on the Subject of Reaction Rate at MAS Ulumuddin Lhokseumawe".

RESEARCH METHOD

This is a quantitative research in the form of experimental research. The research design used in this study is a Quasi Experimental Design with Nonequivalent Control Group Design. In this design, the study used an experimental group along with a comparison group and is begun with a pretest, followed by treatment and ended with a final test (posttest) which was given to the group leader. The research design is described in Table 1.

Table 1. Research design

Group	Pre-test	Treatment	Post-test
Experimental Group	O ₁	X	O ₂
Control Group	O ₃	X	O ₄

notes:

- X : Treatment in the form of Probing Prompting model
- O₁ : Giving a pretest to the experimental group
- O₂ : Giving posttest to the experimental group
- O₃ : Giving a pretest to the Control group
- O₄ : Giving posttest to the Control group

The population in this study were all students of class XI MAS Ulumuddin Lhokseumawe in the 2019/2020 academic year which cover 5 classes consisting of 154 people. Sample is taken by using the Purposive Sampling technique, with certain considerations that aim to make the data obtained be more representative. In that case, class XI-C is taken as experimental group using PP model assisted by SWS media and class XI-D as control group using PP model, where each class consists of 30 students. The data collection technique in this study was obtained from tests of critical thinking skills through pretest and posttest. The tests used the guideline test questions for critical thinking skills based on indicators of critical thinking skills. The test questions are in the form of multiple choice with as many as 40 items which have been tested its validity, reliability, distinctivity, level of difficulty and distractivity.

Statistical Analysis

Hypothesis testing

The hypothesis test that will be used in this study is the Independent Samples t-Test. This test is used to

determine whether the hypothesis is accepted or rejected. The hypotheses to be tested are:

$H_0: \mu_1 = \mu_2$: There is no effect of the Worksheet-Assisted Probing Prompting learning model on critical thinking skills.

$H_a: \mu_1 \neq \mu_2$: There is an effect of the Worksheet-Assisted Probing Prompting learning model on critical thinking skills.

The decision making criteria for this hypothesis use a significant level of 5% or 0.05 as follows:

1. If sig. > 0.05 then H_0 is accepted and H_a is rejected
2. If sig. < 0.05, then H_a is accepted and H_0 is rejected.

Critical thinking skills analysis techniques

To determine the increase in critical thinking skills between the two classes, an N-gain analysis was carried out. The normalized gain (N-gain) can be calculated by the equation:

$$N - gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

Notes :

- N-gain = normalized gain
- S_{max} = maximum (ideal) score of the initial and final tests
- S_{post} = student's final test score
- S_{pre} = student's initial test score

The levels of N-gain are grouped into three categories of critical thinking abilities which can be seen in the table below:

Table 2. Criteria for the N-gain score

Score range	Criteria
$\langle g \rangle \geq 0,7$	High
$0,7 > \langle g \rangle \geq 0,3$	Medium
$\langle g \rangle < 0,3$	Low

Source: [12]

To determine the achievement of critical thinking skills for each indicator, the following formula is used:

$$NP = \frac{R}{SM} \times 100\%$$

Where,

- NP = percent value sought
- R = total score obtained
- SM = maximum score

The percentage of critical thinking skills are grouped into categories. The category of critical thinking skills can be seen in table 3.

Table 3. Categories of critical thinking skills

Category	Percentage (%)
Very Critical	81 - 100
Critical	61 - 80
Quite Critical	41 - 60
Less Critical	21 - 40
Not Critical	0 - 20

Source: [13]

RESULT AND DISCUSSION

The comparison of students' critical thinking skills between the experimental group and the control group was measured by the test questions at the end of the learning process. The mean pretest and posttest scores in the two classes are presented in the comparison diagram as follows:

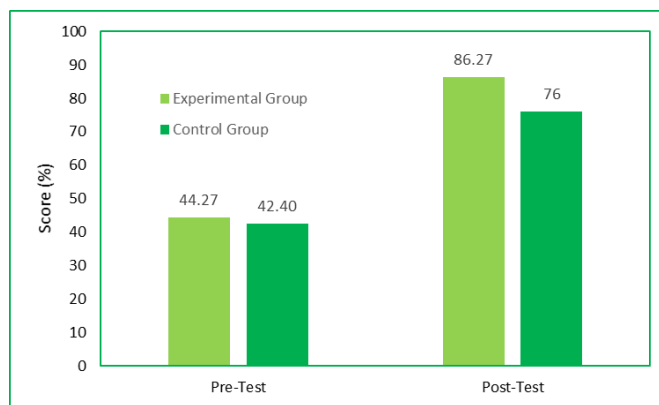


Figure 1. The mean score of pre-test and post-test in experimental group and control group

Based on the results of the data in Figure 1, it can be seen that the results of the average pretest and posttest scores in the experimental group experienced an increase in students' critical thinking skills after using the Worksheet-Assisted PP learning model. The average pretest score obtained was 44.27 and for the posttest, it increased to 86.67. The pretest and posttest mean scores in the experimental class II which also used the PP learning model also experienced an increase in critical thinking skills. The average pretest results were 42.40 and posttest was 75. These data indicated that there was an increase in students' critical thinking skills in the experimental and control classes. The results of research have been conducted by [14] the PP model has a higher average critical thinking ability score compared to the group of students who take part in learning by applying conventional learning models. This review is based on the average score of student learning outcomes. The average score of students' critical thinking skills who took learning with the PP model was 58.70 and the average score of the learning outcomes of students who took learning with the conventional model was 44.58.

Based on the N-gain value obtained between the experimental group and the control group, it is taken from the pretest and posttest scores. The average N-gain score in the two classes is presented in Figure 2.

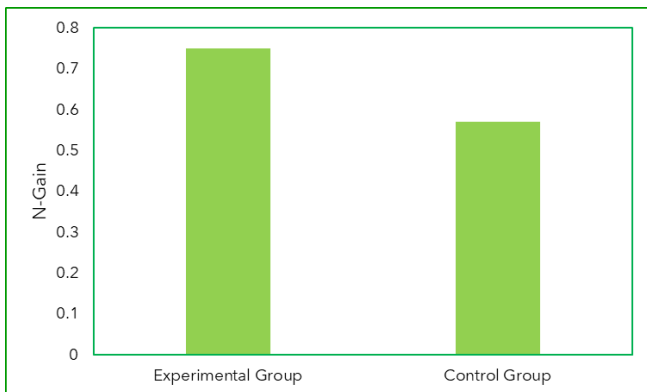


Figure 2. The N-gain value of experimental group and control group

Based on the results of the data in Figure 2, it can be seen that the average result of the N-Gain score in both classes are as follow, the average N-Gain result for the experimental class I is 0.75 with a high classification and the experimental class II gets an average value of 0.57 with moderate classification. The results of research conducted by [15] which were carried out proved that the PP learning model was able to have a good influence on students' critical thinking abilities because in this learning students were invited to solve and find solutions to the problems given. In addition to that, in this learning students can obtain new knowledge about learning and they are also trained and guided to think and find the questions posed.

The increase of critical thinking skills can also be seen from each indicator. Based on the results of the pretest and posttest that have been done, the indicators used here include providing a simple explanation (indicator 1), building basic skills (indicator 2), concluding (indicator 3) and providing further explanation (indicator 4). The difference in the percentage of the four indicators for experimental class I and experiment II can be seen in Figures 3 and 4.

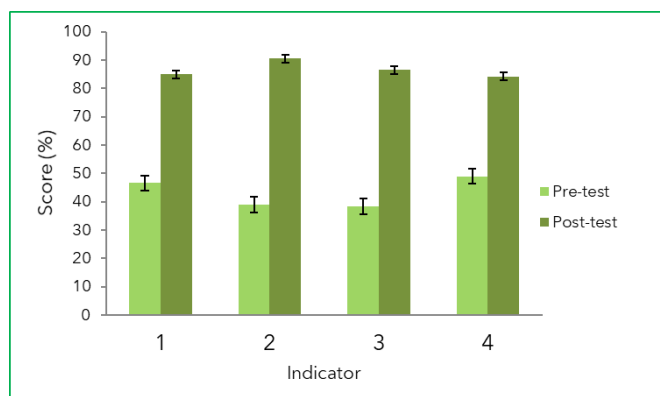


Figure 3. The average percentage of CTS for experimental group on each indicator

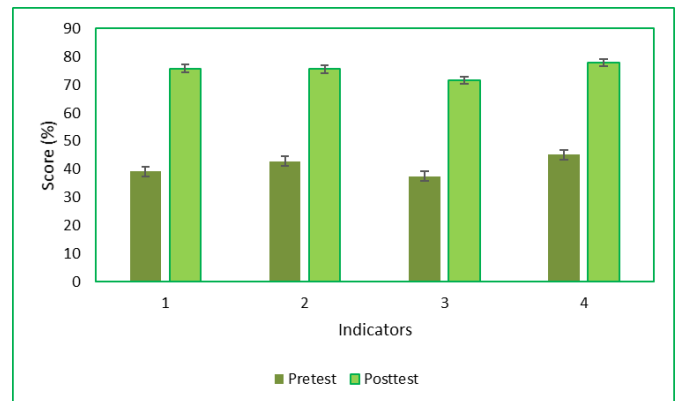


Figure 4. Average percentage of CTS for a control group

Figure 4 shows the percentage of each indicator of critical thinking skills. In indicator 1, giving a simple explanation in the experimental class II is 39.17% which is in the less critical category in the pretest while at the posttest it has increased to 75.83% which is in the critical category. Meanwhile, in the experimental class I, the mastery of indicator 1 from before to after treatment is given experienced a sharp increase where before being treated it was 46.67% which is in the quite critical category and after treatment it was 85% which is in the very critical category. This is because students are able to master the questions logically and give each other feedback according to the learning concept given. This research is in line with [16] that someone who has the ability to think critically has the ability to interpret something that is full of confidence and has good ideas because it is based on logical reasons. Furthermore, [17-18] explain that the indicators of critical thinking provide a simple explanation measured by the ability of students to provide an explanation and analysis of information.

Indicator 2, which is building basic skills, in the experimental class II amounted to 42.78% which is in the quite critical category at the pretest and enter the critical category at 75.56% at the posttest. While the experimental group before being given treatment was 38.89% which is in the less critical category and after treatment it increased to 90.56% which is in the critical category. This is because students can consider each question from each source obtained. This research has been conducted by [19] who stated that people who think critically are people who quickly identify relevant information and separate it from irrelevant information. Furthermore, [17-18] mentioned that indicators of build basic skills are measured by the ability of students to observe and consider a report on the results of observations.

From the results of the analysis obtained in indicator 3, it is concluded that the experimental class II obtained 47.50% which is in the quite critical category at the pretest and increased to 71.67% which is in the critical category at the posttest. While the experimental class I got 38.33% which is in the less critical category at

the pretest and increased to 86.67% which is in the very critical category at the posttest. This is because students are able to conclude the experiment, both in considering the results of the induction and determining the results of the consideration. In accordance with the opinion of [19] one stage to teach or train students to be able to think critically is concluding skills. Students are required to be able to describe and understand various aspects gradually in order to arrive at a new formula, namely a conclusion. Furthermore, [17-18] stated that indicators of concluding is measured by the ability of students to conclude thoroughly and in accordance with existing concepts. This is because they can carry out the identification process and formulate an explanation of the information or material that has been provided by the teacher. By carrying out the data collection process properly, they can draw conclusions by relating to existing concepts based on the results of data collection.

The last indicator, providing further explanation, in the experimental class II got 45.15% which is in the quite critical category at the pretest and increased to 77.88% which is in the critical category at the posttest. While the experimental class I got 49.39% which is in quite critical category at pretest and increased to 84.24% which is in critical category at posttest. This is because students are able to master a definition in each question and are able to identify an assumption in each question. This is in line with the research of [19] who said that effective critical thinking requires a person to monitor when he is trying to really understand an idea, realizing when he needs new information, and how he can easily collect and study the information. .

Based on the results of the calculation of each indicator, it can be stated that the PP learning model assisted by SWS increases the value of students' critical thinking skills compared to only using the PP learning model.

Hypothesis testing

Hypothesis testing is carried out to make a decision whether the research hypothesis is accepted or rejected. The criteria for decision making are: (1) If sig > 0.05 then H₀ is accepted and H_a is rejected. (2) If sig. < 0.05 then H_a is accepted and H₀ is rejected.

Table 4. Posttest Hypothesis Test Results for Experiment Class I and Experiment II

Table 4. Post-test hypothesis test results for experimental group and control group

Group	N	Mean	SD
Experimental	30	86,27	3,886
Control	30	76,00	3,484

p < 0.05

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	MD	SE D	95% CID	
								Low	Up	
CTS	EVA	1.5	.21	10.7	58	.000	10.2	.95	8.36	12.
	EVN	9	2	75			67	3		
	EVNA			10.7	57.	.000	0.26	.95	8.35	12.1
	A			75	3		7	3	9	74

MD= Mean difference, SED=Std. ErrorDifference, CID=Confidence Interval of the Difference, CTS=Critical Thinking Skills, EVA= Equal variances assumed, EVNA= Equal variances not assumed

Based on the data in the table above, it is found that the significant value (2-tailed) of students 'critical thinking skills is 0.000 < 0.05, then H₀ is rejected. H_a is accepted, which means that the increase in students' critical thinking skills using the Probing Prompting model assisted by SWS is better than those taught using the PP model model without the assistance of SWS on the subject of Reaction Rate in class XI of MAS Ulumuddin Lhokseumawe. This is in accordance with the research conducted by [20] that the PP learning model improves student learning outcomes and student learning interest in answering questions raised by teachers and added teaching materials such as SWS to expand information in seeking information, answering questions and understand the material discussed, and can improve students' thinking skills in the learning process.

There are several factors that can influence the improvement of students 'critical thinking skills in experimental class I better than the critical thinking abilities of control group students. One of them is each phase in the PP model with the help of SWS has contribution in increasing students' critical thinking skills in the experimental class compared to using the PP model without SWS assistance in control group. The description is as follow: The stages of learning using the Probing Prompting model include the first stage where the teacher describes the basic potential and reads the indicators to be studied. Students listen and pay attention to the teacher. This plays a role in starting the student's focus in learning. [20] stated that the initial step of critical thinking is to focus on the material being studied and critical thinking skills are included in higher-order thinking skills.

The next stage, the teacher asks a problem or question about the relationship with the material being discussed. Students' critical thinking skills begin to develop at this stage when they are able to solve these problems or questions. At this stage students are able to describe the problems given by the teacher. Students are divided into several heterogeneous groups of 4-5 people, student activities are to discuss problems about the factors that affect the rate of reaction that have been described and the groups solve these problems appropriately, this is included in the indicators of critical thinking.

The third stage is monitoring and guiding, where each group carries out learning activities according to the direction of the teacher. Students observe the picture regarding the material reaction rate (factors that affect the reaction rate) and then the group of students first formulates a temporary answer (hypothesis) which becomes a reference in the problem to be presented. This activity is included in the indicators of critical thinking skills to build basic skills, where students are able to be skilled in argumentation. As stated [20-21] solving a problem requires the ability to think, especially in finding solutions.

The fourth stage is the assessment of the problem where the teacher provides a worksheet which contains a series of questions according to the learning indicators. Furthermore, the fifth stage is a follow-up question where the teacher waits for a while to give students the opportunity to formulate answers. This spurs students to be sensitive to information or situations. As stated by [21-22] someone who is being faced with critical thinking tends to be sensitive to the information or situation he is facing, with the ability to conclude the right one.

The sixth stage is the presentation activity where after having a small discussion, the teacher appoints a group of students to explain the results of the discussion that has been carried out. After that the students presented the results of the discussion and were responded to by the other groups. The teacher provides directions so that all groups make different assumptions. This is included in the indicators of critical thinking skills to provide further explanations, where students can be skilled in providing broader explanations or ideas about what they know. Presentations is carried out with one group as an example to be used as discussion material. It will make students more focused on conveying ideas or broader ideas about the material. The results of the conclusions obtained are far more complete and focused so that students' memory about the material will be better. [23] in his research mentioned that during the presentation stage, student learning creativity will emerge. The ideas that are conveyed has new combinations which are created based on information and observed data, and it is conveyed with language that are easy to understand.

The seventh stage is that the teacher and students discuss the results of the discussion from the presentation group, then students who do not understand are asked the same questions so that students are able to give different opinions from other students. The PP learning model improves students' thinking skills in answering the questions raised by teachers. Adding teaching materials such as SWS is necessary to expand the ability in seeking information, answering questions and understanding the material discussed. It can also improve students' thinking skills

in the learning process. This is related to the theory put forward by [24-25] we stated that SWS functions as a tool to provide enrichment for learning outcomes because the work created can expand and enrich the material.

CONCLUSION

Based on the formulation of the problem in classroom research, the influence of the Worksheet-Assisted Probing Prompting learning model on Students' Critical Thinking Ability on the subject of Reaction Rate in Class XI at MAS Ulumuddin can be concluded as follows (1) There is an increase in students' thinking skills where the N-gain of experimental group is 0,75 which categories are high while the N-gain value of control group is 0.57 which is in the moderate category. This proves that the Worksheet-Assisted Probing Prompting learning model on the Reaction Rate Material can motivate students to take part in learning and it is easy to understand the material.

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