

INCREASING OF CRITICAL THINKING SKILLS USING INQUIRY LEARNING MODEL IN SUB MATERIAL SOLUBILITY AND SOLUBILITY PRODUCT IN GRADE XI RSBI SENIOR HIGH SCHOOL 1 BOJONEGORO

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Abstract: *The aims of these research to know the implementation of inquiry learning model to practice critical thinking skills and to know the critical thinking skills improved after the implementation of inquiry learning model . The type of this research is a quasi-experimental research design with one group pretest posttest design. The research was carried out in class XI IPA 5 SMA Negeri 1 Bojonegoro. The instrument used was the observation sheet of implementation of inquiry learning model and critical thinking skills test sheet. Data were analyzed by quantitative descriptive method. The results showed that implementation inquiry learning model in sub material solubility and solubility product at the meeting I accomplished well, with the percentage of 78.46%, implementation in both II and III meeting accomplished very well with the percentage of 82.14% and 81.42%. Increasing in overall critical thinking skills were high with $\langle g \rangle$ value is 0.8, which respectively increased critical thinking skills to formulating questions, formulating hypotheses, designing experiments, reported the results of observation, the ability to reason and draw conclusions based on the facts were high, with $\langle g \rangle$ respectively 0.81, 0.84: 0.75: 0.85: 0.74 and 0.89.*

Key words: *inquiry, critical thinking, solubility, solubility product*

Abstrak: Penelitian ini bertujuan untuk mengetahui keterlaksanaan model pembelajaran inkuiri dalam melatih keterampilan berpikir kritis dan peningkatan keterampilan berpikir kritis setelah diimplementasikan model pembelajaran inkuiri. Jenis penelitian yang digunakan adalah *quasi* eksperimen dengan desain penelitian *one group pretest posttest design*. Penelitian ini dilaksanakan di kelas XI IPA 5 SMA Negeri 1 Bojonegoro. Instrumen yang digunakan adalah lembar pengamatan keterlaksanaan model pembelajaran inkuiri dan lembar tes keterampilan berpikir kritis. Data dianalisis dengan metode deskriptif kuantitatif. Hasil penelitian menunjukkan bahwa keterlaksanaan model pembelajaran inkuiri pada sub materi kelarutan dan hasil kali kelarutan pada pertemuan I terlaksana baik dengan persentase 78,46%, pertemuan II dan III terlaksana baik sekali dengan persentase 82,14%, dan 81,42%. Peningkatan keterampilan berpikir kritis secara keseluruhan termasuk kategori tinggi dengan $\langle g \rangle$ sebesar 0,8, yang mana masing-masing peningkatan keterampilan berpikir kritis merumuskan pertanyaan, merumuskan hipotesis, merancang percobaan, melaporkan hasil observasi, kemampuan memberikan alasan, dan menarik simpulan sesuai dengan fakta termasuk kategori tinggi, dengan $\langle g \rangle$ masing-masing adalah 0,81; 0,84; 0,75; 0,85; 0,74 dan 0,89.

Kata kunci: inkuiri, berpikir kritis, kelarutan, hasil kali kelarutan

INTRODUCTION

Education is an indispensable requirement for every human being and also a very important tool in helping children to develop the ability or potential to be beneficial to life. To improve the quality of national education, the government began preparing for an international learning by organizing international school stubs (RSBI). Pioneering international school is a curriculum that is adaptive and adoptive using SBC as a national curriculum, combined with the Cambridge International Examination (CIE) as a reference the international curriculum. One school which is pioneering international school is a school School I Bojonegoro. The curriculum used in SMA I Bojonegoro is combined with curriculum curriculum curriculum Cambridge or the so-called adaptive and adoptive.

Based on international learning, Cambridge curriculum to inculcate students to think creatively and have the ability to solve problems. Meanwhile, according to the Education Unit Level Curriculum, Graduate Competency Standards (*SKL*) IPA among students were able to develop and implement information and knowledge in a logical, critical, creative, and innovative and able to demonstrate the ability to think logically, critically, creatively, and innovative in making decisions (*Depdiknas*[1]) Cambridge based curriculum and the curriculum curriculum, thinking skills, one of them critical thinking skills is an important factor in education. Chemical education is the education of the sections of the IPA, which is also in studying the chemistry lesson should involve critical thinking skills. Philip and Bond (in Redhana [2]), also revealed that the critical thinking skills is one of the most important goal in all sectors of education.

One of the subject matter of chemistry is the solubility and solubility product. Based on the characteristics of the material, the material should be taught. Involve critical thinking skills, so students are not only taught in lectures. With critical thinking skills, can help students develop an understanding and concepts that will be obtained for longer stored in the memory because students are actively involved in learning to find a concept in madiri. Learning is not stressed to the development of critical thinking skills, such as learning lectures, tends to condition students into rote learning. Students are very easy to forget previously learned material because it is not directly involved to find a concept.

In order critical thinking skills can be involved in learning, the learning paradigm should shift from conventional learning that emphasizes the learning of low-level thinking skills towards learning which emphasizes learning higher-level thinking (in RedhanaTsapartis&Zoller [2])

Many experts expressed about critical thinking, one of them is to think critically according to Ennis. According to Ennis [3], critical thinking is reflective thinking that makes sense or by reason, which is focused on determining what to believe and do.

Ennis [4] proposed twelve indicators of critical thinking skills that are grouped in five groups of critical thinking skills, namely: (1) provide a simple explanation, (2) build basic skills, (3) concluded, (4) provide further explanation, (5) set the strategy and tactics. The fifth critical thinking skills are divided into indicators and each descriptor. The twelve indicators of critical thinking skills, among others, focus on the question; analyze the question; asking and answering of an explanation or challenge; consider whether the source is reliable or not; observe and consider a report of observations; deduce and consider the results of deduction; induce and consider

the results induction; create and specify the value consideration; define the terms and definitions in the three-dimensional considerations; identifying assumptions; determine action; interact with others. Each of the indicators of critical thinking skills, has a descriptor. Indicators of critical thinking skills descriptors under study is to formulate questions, formulating hypotheses, designing experiments, reported the results of observation, the ability to reason, draw conclusions in accordance with the facts.

Redhana [5] research chemistry teachers' views on teaching critical thinking to the program found that 47.50% of chemistry teachers do not know about learning critical thinking skills, 85% of teachers had never designed a chemical state model or a program of learning to think critically. This suggests that the critical thinking skills have become the main goal in learning. Data were also obtained based on interviews with high school chemistry teacher in N 1 Bojonegoro on December 5, 2011 which states that critical thinking skills have been taught and assessed, teachers also expressed have not used a model of learning that can enhance critical thinking skills.

Based on the questionnaire the students, learning methods are often used in teaching chemistry, including the material solubility and solubility product of the lectures and discussions. Although he was using the method of discussion, the discussions are focused to achieve the indicator products in the study, but the indicator process that involves critical thinking skills have never trained. So that the activities of students who demonstrate critical thinking skills such as formulating the problem, making hypotheses, analyze, and conclude, no. One of the factors causing the lack of critical thinking skills to the attention of the chemical study performed on SMA N 1 Bojonegoro is the teachers are more focused on solving

problems in the book to pursue the target of the National Exam and prepare olimpiade-Olympics. Therefore, teachers are more likely to explain complex material to students so that its delivery is fast and can discuss all the problems that exist, no invites students to engage in finding the concept of thinking independently.

According to the Zohar (the Redhana, [5]) critical thinking skills students will not develop without serious effort (intentional) and explicitly embedded in its development. Therefore, critical thinking skills should be trained in intentional learning. To melatihkan critical thinking skills, teachers have an important role in learning. Teachers have a strategic position and determine the learning activities. Therefore, the teachers as educators are obliged to condition the learning so that students are able to develop intelligence and thinking skills

Efforts are made to condition the learning so that teachers can develop students' thinking skills by designing one appropriate learning models. The design model of learning is an important option to improve the quality of processes and outcomes of critical thinking skills which are the parameters to be observed. Design learning model in question refers to the views of constructivism.

Constructivism learning theory is an attempt to do the students to construct their own knowledge in his mind. Constructivist learning requires teachers not only as the person who forwarded the idea that a concept, principle, or theory, but also as someone who can lead and develop the ideas that already exist on students. So it is more centered to student learning (student centered) (Nur and Retno [6])

One model of learning in accordance with constructivist learning is inquiry learning model, because the inquiry involves the most of learning throughout the students' ability to search and investigate in a systematic, critical,

logical, analytical, so that they can formulate their own inventions with aplomb (Gulo in Trianto [7]). With the inquiry learning model students critical thinking skills can be developed (Llewlyn [8]), because the inquiry learning model involves formulating the problem, making hypotheses, designing experiments, conducting experiments to obtain information, gather and analyze data and make conclusions to find a concept are studied. The purpose of this research was to know the implementation of inquiry learning model to practice critical thinking skills and to learn critical thinking skills improved after the implementation model of inquiry learning.

METHOD

Types of research is quasi experiment. Target in this research is students of senior high school 1 Bojonegoro with a sample class XI IPA 5 by the number of 30 students . The research design is one group pre-test post-test design (Sugiyono [9]). Pretest conducted before the sample is given treatment inquiry learning model. The purpose of the pre-test is to determine the ability of students in this early is critical thinking skills. Once given the treatment, carried out post-test in the study sample. The purpose of the post-test was to determine the critical thinking skills improved after the implementation of inquiry learning model.

The research was carried out through the planning, implementation, and data analysis. In the planning phase, researchers conducted a field survey, preparation of learning material, and preparation of research instruments. In the implementation phase begins with the provision of the pretest, then the application of inquiry learning model, and posttest administration after the application of inquiry learning model. At this stage of data analysis carried out an analysis of implementation learning and

improvement critical thinking skills. Instruments used in this research is the observation sheet of inquiry learning model implementation and critical thinking skills test sheet. Learning implementation were analyzed using the formula:

$$\% \text{ Keterlaksanaan Pembelajaran} = \frac{\text{rata - rata } \sum \text{ sintak yang terlaksana}}{\sum \text{ sintak keseluruhan}} \times 100$$

Criterion of learning implementation is presented in Table 1 as follows:

Table 1 Criterion of Learning Implementation

Percentage	Category
0% - 20%	Very poor
21% - 40%	Less
41% - 60%	Enough
61% - 80%	Good
81% - 100%	Very good

Riduwan [10]

Improved critical thinking skills were analyzed using the n-gain score with the following equation:

$$\langle g \rangle = \frac{\% \langle G \rangle}{\% \langle G_{maks} \rangle} = \frac{(\% \langle S_f \rangle - \% \langle S_i \rangle)}{(100\% - \% \langle S_i \rangle)}$$

Description:

$\langle g \rangle$ = increase critical thinking skills

$\langle S_f \rangle$ = The average score of the final test

$\langle S_i \rangle$ = Average initial test scores

Interpretation of the normalized gain values are presented in Table 2 as follows:

Table 2 Interpretation of n-gain score

Value $\langle g \rangle$	Interpretation
$\langle g \rangle \geq 0,7$	High
$0,7 > \langle g \rangle \geq 0,3$	Enough
$\langle g \rangle < 0,3$	Low

Hake [11]

RESULT AND DISCUSSION

The results of this research include data of inquiry learning model implementation and improving critical thinking skills.

Implementation of inquiry Learning Model

Implementation of inquiry learning model consist of opening, core activities, and

cover. The opening consists of aspects linked with the previous material, communicate goals and motivate learning. Aspects of the core activities consist of dividing the students in groups, formulate guiding questions, provide an opportunity to formulate a hypothesis, the hypothesis guiding determine a priority investigation, giving the opportunity to determine the variables and experimental procedures, guide to determine the variables, guide to determine the experimental procedure, leading to experiments, allowing each group to present the experimental results, and guide to make conclusions. Consists of an end cover aspects of learning by checking whether the learning objectives have been achieved or not. Purpose of clearing activities conducted on the aspects linked with the previous material to prepare students to learn new material to remember little about the matter earlier. By considering the previous material relating to the new material, students will be more familiar with the new material is learned. Purpose of delivering aspects of the learning objectives to focus on what students learned at the time, so that students know the goals that he learned. By knowing the learning objectives, learning will be more meaningful than to not know the purpose of the study. Motivational aspects of goal to arouse students' interest in learning, so students are more enthusiastic about the learning process.

Purpose of the main activities carried out on aspects of the divide students in groups so that students learn through discussion with the group. By studying a more intelligent discussion of students can teach other students who are less intelligent. By learning to fellow peers would make them hesitate to argue, and ask the tough stuff compared to argue or ask the teacher. The purpose of formulating the question is to train critical thinking skills to formulate questions so that students can understand a

phenomenon by determining the issues to be investigated. Purpose of giving an opportunity to formulate hypotheses and guide to determine the priority hypothesis in experiment is to train critical thinking skills to formulate hypotheses so that students can provide a temporary answer of phenomenon or problem further examined whether the answer given as appropriate or not.

The next activity is giving opportunity to determine the variables and experimental design and guiding to determine the variables and experimental design. The aim of giving opportunity and guiding to determine variables of experiment are to know what factors are investigated and how they affect. These activity can deepen students' understanding of concepts learned. The aim of giving opportunity and guiding to determine experimental design are to train the critical thinking of determine the experimental design so that by engaging actively in determining the experimental design can help students understand the concepts being studied. The next teacher's activity is guiding the experiment process. The aim of guiding experiment process is to involve student directly in observation process to find concept being studied so that students understand the concepts easier.

After determining the variables experimental design, and do the experiment, the teacher gave each group an opportunity to present the results of experiments and data processing results of the experiment. The aim of the activity of giving opportunities for each group to present the results of the experiment is to exercise critical thinking skills to report the results of observations in table form so easily understood by others. Communicating of the results of data processing has purpose to train critical thinking skills the ability to give a reason, because the processing of data, students are involved in explaining the

experimental results so that students can infer concepts derived from experimental results. In the conclusion stage to train critical thinking skills of conclude the

experimental results based on the facts. The figure of inquiry learning model implementation can be seen at figure below.

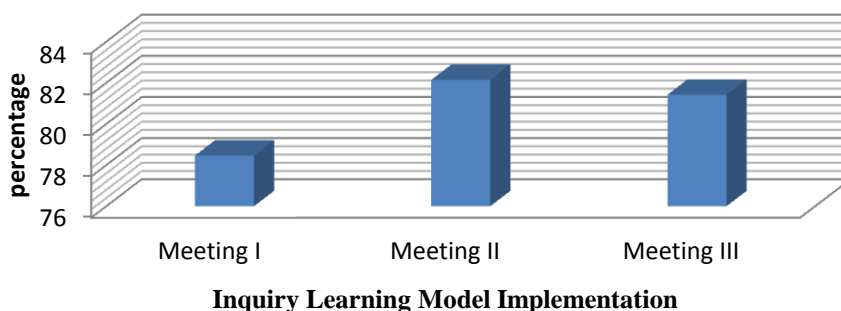


Figure 1 Inquiry Learning Model Implementation

Inquiry learning model implementation at the meeting I was 78.46% with good category, inquiry learning model implementation at the meeting II is 82.14% with very good category and inquiry learning model implementation at the meeting III is 81.42% with very good category. Based on these results, the application of inquiry learning model at the meeting I, II, and III can be used to practice critical thinking skills as well. Critical thinking skills to formulate questions trained on a learning phase of inquiry (prepare questions or problems), critical thinking skills to formulate hypotheses trained in Phase 2 (make the hypothesis), critical thinking skills to design experiments drilled in Phase 3 (design experiments), critical thinking skills to report observations and the ability to reason drilled in Phase 5 (collecting and analyzing data), critical thinking skills draw the conclusion follows based on the fact is trained in Phase 6 (make a conclusion).

Improved Critical Thinking Skills Overall

Critical thinking skills include formulating questions, formulating hypotheses, designing experiments, reported the results of observation, the ability to reason and draw conclusions

based on the fact. The average pretest value of critical thinking skills by an average of 19.80 and the posttest after the inquiry learning model is applied at 84.17. The differences average value of pretest with the average value of posttest is very significant. Differences value were analyzed using a score increase of the normalized gain $\langle g \rangle$. $\langle g \rangle$ Value obtained was 0.8 with an increase in the category of high critical thinking skills. This is caused by the critical thinking skills can be trained in inquiry learning in which students can formulate questions, make hypotheses, design experiments, carry out experiments to obtain information, gather and analyze data, and conclude. This statement is in accordance with the opinion of Gulo (in Trianto [7]) which states that the inquiry involves the most of learning throughout the students' ability to search or investigate in a systematic, critical, logical. This statement is also in accordance with the opinion Llewellyn [8] which states that the inquiry learning model, students' critical thinking skills can be developed.

Improved Critical Thinking Skills Each Component

Improved critical thinking skills for each component can be seen in Table 3 as follows:

Table 3 Average of Increasing Each Component of Critical Thinking Skills

Component	Average Pretest	Average Posttest	<g>	Categori
Formulating question	52,1	91,07	0,81	High
Formulating hypothesis	29,77	88,83	0,84	High
Designing experiment	8,9	76,8	0,75	High
Reporting the observation result	11,3	86,73	0,85	High
Ability to give reason	7,7	76,17	0,74	High
Drawing conclusion based on the fact	11,1	90,01	0,89	High

Formulate a question include critical thinking skills because students must understand in advance the problem or phenomenon by identifying the factors that be a problem on an issue or phenomenon that occurs. <g> value of critical thinking skills to formulate questions is 0.81. This indicates an increasing of critical thinking skills to formulate questions were high. In formulating hypotheses, students need to know the question formulation of the problem or phenomenon that occurs and the student must use logic to determine the answer while he thinks that makes sense of the proposed formulation of the problem where the answer is verifiable through practical activities. Therefore, formulating hypotheses, including categories of critical thinking. <g> Value critical thinking skills to formulate hypotheses of 0.84. This indicates an increase in critical thinking skills to formulate hypotheses were high. For designing the experiment, students should understand the purpose of inquiry by first the formulation of the problem and formulation of hypotheses. Students should be able to predict that the experimental design that can be used to test the hypothesis, so that students get the data from experiments that can be used to find concepts being studied. Therefore, designing experiments, including categories of critical thinking skills. Improved critical thinking skills to design experiments with high value of 0.75 <g>.

Reported the observation of the critical thinking skills because students must understand first the experimental results obtained by classifying the data and the results of the experiment were able to present data in a form suitable to the data presented easily understood by others. Improved critical thinking skills to report the results of observation were high with values of 0.85 <g>. The activity gives reason to the results of an experiment, involving the understanding of the theory, application of the theory, as well as to understand the experimental results obtained by linking the results of experiments with the underlying theory. Ability to give reasons requires more thinking that includes critical thinking skills. <g> Value critical thinking skills the ability to give reasons by 0.74. The increase was included in the high category. Draw conclusions skills are critical thinking skills because students must understand in advance the formulation of the problem under study, to understand the results of the experiment and processing the results of the experiment, and be able to connect between the formulation of the problem with the results of experiments that can be given a conclusion that can provide the solution of the proposed formulation of the problem. Improved critical thinking skills draw conclusions in accordance with the facts, including the high category with a value of 0.89 <g>. Improved critical thinking skills that are high on each

component indicates that an inquiry learning model is effective to train critical thinking skills to formulating questions, formulating hypotheses, designing experiments, the ability to give a reason, and draw conclusions based the facts.

CONCLUSION

From the results of research and discussion can be concluded that the inquiry learning model implementation in sub material solubility and solubility product of the meeting I is realized well by the percentage of 78.46%, implementation in both meeting II and III are realized very well with the percentage of 82.14%, and 81.42 %. Increase in overall critical thinking skills were high with $\langle g \rangle$ of 0.8, which respectively increased critical thinking skills to formulating questions, formulating hypotheses, designing experiments, reported the results of observation, the ability to provide reason, and draw conclusions based on with facts were high, with $\langle g \rangle$ respectively 0.81, 0.84: 0.75: 0.85: 0.74 and 0.89.

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