



THE EFFECT OF GUIDED INQUIRY LEARNING MODEL TOWARD STUDENTS' CRITICAL THINKING SKILLS ABOUT MOMENTUM AND IMPULSE IN SENIOR HIGH SCHOOL

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ABSTRACT

The aim of this research is to know the effect of guided inquiry learning toward students' critical thinking skills about momentum and impulse in class X SMAN 1 Berastagi academic year 2018/2019. The type of this research is quasi-experiment design using pre-test and post-test, with experiment class used guided inquiry learning model and control class used conventional learning. The population is all students of class X SMAN 1 Berastagi which consist of 7 classes, sample of these research was taken with a simple random sampling are two classes, one class that is X MIPA 1 that consist of 36 students as control class and X MIPA 2 that consist of 36 students as experiment class. The instrument of this research is multiple choices as twenty questions. Based on this research the average of pre-test in experiment class is 38.75 and in control class is 37.77, and then the average of post-test in experiment class is 63.88 and in control class is 56.66. Data were analyzed with t-test with significant level 5%. This research was concluded that there was significant effect of guided inquiry learning model toward student's critical thinking skills.

Keywords: *Guided Inquiry Learning Model, Critical Thinking Skills*

INTRODUCTION

Physics is one of the branches of science that attempts to describe how nature works using the language of mathematics. It involves the study of universal laws and the behaviors and relationship among a wide range of physical phenomena (Agarwal, 2012). Physics is one branch of science and a science that was born and developed through steps of observation, problem formulation, formulation hypotheses, testing hypotheses through experimentation, drawing conclusions, as well as the discovery of the theory and the concepts (Lahmita et al, 2016).

Physics lessons in senior high school are intended as a means to train students to be able to master the knowledge, concepts, and principles of physics, have scientific skills, have science process skills, and critical

thinking skills. Seranica et al (2018), Critical thinking skills are required and critical thinking skill is needed to address the problem face in life. Critical thinking skills is also a part of academic success skills (Motlan et al, 2018). So that having the ability to think critically can help us in thinking rationally in overcoming the problems we are facing and seek and develop alternative solutions to the problem. Critical thinking as a well-directed and clear process used in learning activities such as problem solving in learning, decision making, analytical skills and scientific research. Kusuma et al, (2018), with critical thinking, students have the skills to solve the problems of their social life and daily life. One of the most important things students should have, especially in the subject physics is critical thinking. Harefa et al, 2016 said critical

thinking is a must in problem solving, decision making, as an approach to analyzing assumptions and scientific discovery findings.

According to Ennis (1995) shares six basic elements of critical thinking through approach of FRISCO (Focus, Reason, Inference, Situation, Clarity, and Overview) (Kusuma et al, 2018). The important characteristics of students who have the character to always think critically are as follows: Looking for statements or questions that clearly mean or mean, Looking for a basis for a statement, Try to get the latest information, Use and mention sources that can be trusted, Consider the situation as a whole, Trying to be relevant to the subject matter, Try to remember initial or basic considerations, Look for alternatives, Be open, Take a position (or change position) if the evidence and the basics are enough for him to determine his position, Looking for precision as thoroughly as possible, Dealing with parts in sequence to reach the entire complex whole, Use their own abilities or critical skills, Sensitive to feelings, levels of knowledge and the level of complexity of other people's thinking, Using other people's critical thinking skills. Wiyono et al (2009), said that critical thinking skills need to be developed is students because through the critical thinking skills students can more easily understand concept more deeply, be sensitive to the problems that occur so they can understand and solve problems and be able to apply conceptual concepts in different situations.

In Physics subjects, the learning conditions of students who focus on material, writing and memorizing must be changed to share knowledge, act in question, think critically and actively find knowledge to improve student learning outcomes especially for students' critical thinking skills. Some information about this problem raises the thinking of instructors to find solutions that require strategies and innovative approaches that are centered on student loyalty. Therefore to form learning that can shape critical thinking, learning is needed that supports this goal. Inquiry learning can train the skills of

critical thinking when studying, students material becomes critical and analytical to whatever information is acquired if it does not fit their reasoning (Fuad et al, 2017). Inquiry learning process not only acts as a receiver lecturer lessons through verbal explanation, but the role is to find their own core of material. Inquiry method can develop thinking skills of students. Thus this learning method in addition to results-oriented, it will also improve learning process (Motlan et al, 2016).

Through guided inquiry learning, the teacher invites students to be active in learning. Students are invited to actively think about recognizing problems, expressing problem solving ideas, designing their own experiments to answer the problems faced, conducting experiments to find answers, analyzing to interpret data, finding answers and discussing results until concluding the results. Guided inquiry is capable of practicing intellectual skills, critical thinking and being able to solve problems scientifically (Masitoh et al, 2017). Activities in Guided Inquiry Learning process that require students to be actively involved in the problem solving process can improve student's critical thinking ability (Nasution et al, 2018).

Research of models with the type of guided inquiry has been made by solihin et al, (2018) in SMA Negeri Plus Sukowono, the result showed that the average value of critical thinking skills through post-test 67 in the experimental class and 62.5 in the control class. Amijaya et al, (2018) The critical thinking ability showed that of experiment class who learned by guided inquiry learning model increased 27.49 point (38.14 to 65.63) while critical thinking ability of control class increased 18.56 point (36.03 to 54.59).

Inquiry learning model is a learning model that based on constructivism that considered student must be active to build their own knowledge in order to understand the theory and concept. Inquiry learning model invite students to explore their understanding through inquiry. Therefore in this study the writer will compare the improvement of

critical thinking skills between students who get a guided inquiry learning model, and students who get a conventional learning model. Then the author feels the need to conduct research to know The Effect of Guided inquiry Learning Model toward Students' Critical Thinking Skills about Momentum and Impulses in Senior High School.

METHOD

Research carried out quasi experimental study with two group design pretest and posttest. The sampling used was simple random sampling. The population is all students of class X SMAN 1 Berastagi which consist of 7 classes, sample of these research are two classes, one class that is X MIPA 1 that consist of 36 students as control class and X MIPA 2 that consist of 36 students as experiment class. This research conducted in experimental design and divided into two groups, experimental group which is applying guided inquiry learning model and control group which is applying conventional learning. This research is to know the student critical thinking skills using guided inquiry learning. The test of critical thinking skills consist of 20 problems in multiple choice with indicators, including (1) inference, (2) know basic assumption, (3) deduction test, (4) interpretation test, (5) argument and evaluation (Rusyna, 2014). Data in form of students' critical thinking skills that have been collected and analysis in hypothesis testing using One tail t test on $\alpha = 5\%$. N-gain is used to determine the level increase in critical thinking skills after learning Momentum and impulse using guided inquiry learning.

Critical thinking skills score is calculated using formula (Purwanto, 2008).

$$score = \frac{\text{amount of score get}}{\text{maximum score}} \times 100\% \quad (1)$$

While the N-gain is calculated using the formula (Hake, 1998):

$$gain = \frac{S_{post} - S_{pre}}{100 - S_{pre}} \quad (2)$$

Where:

S_{post} : Final score of critical thinking skills

S_{pre} : Initial score of critical thinking skills

The amount of profit can be categorized as:

$gain \geq 0.7$: High

$0.3 \leq gain < 0.7$: Medium

$gain < 0.3$: Low

RESULT AND DISCUSSION

a. Resultt

From the use of learning materials that have been designed and given to the experimental group can be seen the difference in average critical thinking skills that is different than the group with conventional learning shown in Figure 1. In figure 1 shows a clear difference in the two groups where the average critical thinking skills in the experimental group better than control group. Data of pre-test and post-test in experiment and control class can be seen in Figure 1.

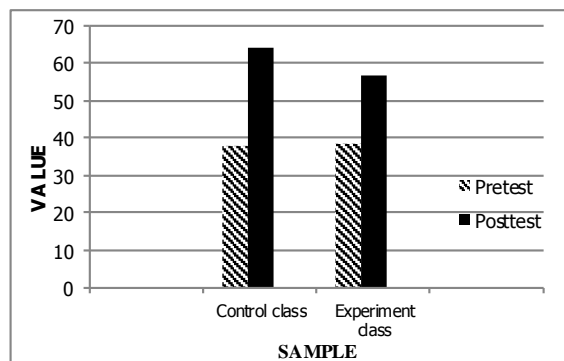


Figure 1. Students critical thinking skills pretest and posttest in experiment and control class

The average initial critical thinking skills of the experimental class is 38.75 and in the control class is 37.77, it shows the students' critical thinking skills is very low including the bad category and the average is almost equal in value. The average students' critical thinking skills after applying the guided inquiry learning model is the experimental class was 63.88 and the control class that using conventioanal learning model is 56.66 . The average critical thinking skills in the experimental class taught by the guided inquiry learning model has increased over pre-test and has increased critical thinking skills higher than the control class. Based on the

result of data analysis, it is found that students who are taught with guided inquiry learning model is better than students who are taught by conventional learning. The result of one tail t-test can be seen in Table 1.

Table 1. Result of one tail t-test

Hypothesis Test	t_{count}	t_{table}
		3.14

Based on the Table 1 of t-test above is obtained t_{count} is 3.14 where as t_{table} is 2.00. The value of $t_{statistic}$ is greater than t_{table} (of $t_{statistic} > t_{table}$) then H_a is accepted and H_o is rejected. So we can conclude that guided inquiry learning model has significant effect in learning process toward students critical thinking skills. Calculate each member of experimental class taught by guided inquiry learning model the data gain as Table 2.

Table 2. Data level N-Gain in Experiment Class

Level N-Gain	Total students
High	1
Medium	35
Low	0
Total	36

The improvement of student's critical thinking skills in experiment class taught by guided inquiry learning model and in control class taught by conventional learning model can be seen on Table 3.

Table 3. Data level N-Gain

Class	Mean	Mean difference	Percentage (%)
Experiment	0.41	0.12	41
control	0.29		30

Based on the table 2 and table 3 there is 1 students increased the critical thinking skills on high level and 35 students increased the critical thinking skills on medium level, and in experiment class taught by guided inquiry learning model increasing 41.4 % that means greater than control class 29.70 %, so the conclusion of N-gain is there is significant

increasing of critical thinking skills. This is supported by research by Nisa et al (2017) to conclude that guided inquiry model is effective in improving critical thinking skills of high school students.

b. Discussion

Fuad et al (2017), Inquiry learning model that is implemented in the class during the research has proven to contribute significantly to the scores of critical thinking skills. The contribution of inquiry learning model to the critical thinking skills of students is actually due to the fact that the syntax of inquiry is in line with the nature of the critical thinking skills. As presented by proulx critical thinking skills is process that is based on a series of steps to analysis, to assess, and evaluate argument. Inquiry learning is a series learning activities that emphasize the process of critical and analytical thinking to look for and find out for yourself the answer to a problem questioned (Hosnan, 2014). Through the activities that exist in guided learning are indirectly students train and develop thinking skills critical in them. Judging from the inquiry syntax of learning guided, trained critical thinking skills so that the ability in question increase it can be explained as follows.

The students' critical thinking skills have been measured by giving the students multiple choice of critical thinking skills. The test is given before giving treatment (pre-test) and after giving treatment (post-test). The pre-test results demonstrate students' early critical thinking skills before applying inquiry learning models in experimental classrooms and conventional learning in control classes, and tests result after applying guided inquiry models and conventional learning. The average initial critical thinking skills of the experimental class is 38.75 and in the control class is 37.77, it shows the students' critical thinking skills is very low including the bad category and the average is almost equal in value.

The average students' critical thinking skills after applying the guided inquiry learning model is the experimental class was

63.88 and the control class that using conventional learning model is 56.66 . The average critical thinking skills in the experimental class taught by the guided inquiry learning model has increased over pre-test and has increased critical thinking skills higher than the control class. Based on the result of data analysis, it is found that students who are taught with guided inquiry learning model is better than students who are taught by conventional learning. It can be seen that t_{count} is 3.14 is bigger than t_{table} 2.00 . so, the average critical thinking skills students in the experimental class is greater than the control class influenced by the treatment. This shows the hypothesis test is accepted that guided inquiry learning model have significant effect of students' critical thinking skills.

Based on the N-gain results shows that the improvement of students' critical thinking skills effect of the experimental class is greater than the control class. The average increase in critical thinking skills in the experiment class taught by guided inquiry learning model is 0.41 it means an increase in critical thinking skills about 41.4 % greater than in the control class increased by approximately 29.70%. Based on the normalized gain show the effect of guided inquiry learning model to students' critical thinking skills is better than conventional learning. This is supported by research by Nisa et al (2017) to conclude that guided inquiry model is effective in improving critical thinking skills of high school students.

Guided inquiry learning model does show a students centered learning process, where students are given the opportunity to become more active in learning. Guided inquiry learning activities allow students to construct knowledge collectively in group work activities undertaken and the results found so that they can practice to think like scientist. Guided inquiry learning too provide opportunities for students to can work together in groups. With thus the guided inquiry learning model can improve the ability of students to argue in solving common problems the group and have learning experience so it's easy to understand the current concept he learned. The level of understanding obtained

students are more in-depth because of students directly involved in the process of finding answers against existing and direct problems practice it (Amijaya, 2018).

In accordance with the research (Nasution, 2018) who said that activities in Guided Inquiry Learning process that require students to be actively involved in the problem solving process can improve student's critical thinking skills. This study also in accordance with research conducted (Seranica, 2018) that guided inquiry learning model has advantages in terms of growing critical thinking skills. In guided inquiry learning model students will be involved in learning, always train to solve problem related to environment. In guided inquiry learning, students will be involved in learning, always trained to solve problems related to the environment. The results of this study are in line with the research undertaken by suggesting through the inquiry model of learning, the critical thinking ability of the students develops in each step/step in the learning. Guided inquiry can build the knowledge that students will acquire through the discovery process in the classroom, so that the answers to the proposed problem are found directly by the students more clearly.

When doing research, the activity of guided inquiry learning model that most influenced to students critical thinking skill is the third stage. Students conduct experiments (activities experiment) to prove the hypothesis and obtain information. Trial activities carried out to solve problems and prove hypotheses, then students are able to build and find own concept of knowledge. In the process of activities experiment, students make observations and obtain observational data. Experimental activities involve students actively. Active involvement of students in activities learning makes learning meaningful. Learning process meaningful happens if students are able to assimilate the knowledge he has with knowledge new.

The stage of conducting trials can give opportunity for students to practice and develop analysis skills. This is in accordance with the statement Hackling (2005) that practices field investigations or conducting

experiments gives students the opportunity to practice and develop skills investigate and get real experience about natural phenomena as a basis for learning conceptual. Through student learning activities independently to find a concept. On experimentation activities students obtain data experimental results. There is a possibility of different results data experiment with theory, so students must analyze it. Learning activities accompanied trial activities if carried out continuously can lead to guided inquiry.

And the sixth stage, students make conclusions from the results trial and analysis of data in accordance with the results of evidence hypothesis. Students analyze the conclusions of the results observation with the purpose and hypothesis that has been formulated guided by the teacher. Conclusion made by identifying the elements needed to make reasonable conclusions by paying attention to relevant data and information obtained. Then students write conclusions on LKS. Students make conclusions according to their goals which has been formulated by each group, so that each groups may have different conclusions. Students present conclusions of work results groups, while other groups can deliver opinions or questions. But after the presentation completed, students ask questions or submit opinion only at the presentation of the initial three groups. After all group presentations are finished, the teacher invites students conclude the material.

Stage making conclusions exercises ability students' critical thinking on aspects of inference and selfregulation. When making conclusions students are located in the process of thinking, students apply skills and use the knowledge possessed within analyze and evaluate self-abilities within draw conclusions either with the form of the question, confirmation, validation or correction. Activities performed by looking back at all dimensions of critical thinking and check it again. Students can test and improve conclusions that have been described, reviewed and reformulate one of the explanations already put forward and can test

and justify the ability to test and improve yourself. Students make conclusions by identifying elements needed to make conclusions reasons by paying attention to data and information relevant. Conclusions from the results of experiments and data analysis in accordance with the results of the customized hypothesis with the intention of.

The role of the teacher is very important in supporting the implementation of the learning process. The teacher guides students and evaluates the results of student activities so that the learning process continues to lead to concepts that must be mastered by students. This is supported by research by Howard & Miskowski (2005) to conclude that guided inquiry can improve student understanding and develop critical thinking skills and problem solving. students are able to construct the concept of knowledge without involving the teacher directly through guided inquiry syntax. The teacher gives students the opportunity to discover and apply their own ideas and strategies for learning as a process of forming knowledge. Guided inquiry learning gives students the opportunity to discuss with friends and teachers. design and make your own experiments, communicate ideas with groups so students are more active. In accordance with the research (Nasution, 2018) who said that activities in Guided Inquiry Learning process that require students to be actively involved in the problem solving process can improve student's critical thinking skills.

Another case with the in the model class conventionally, students are not guided by various questions for analyzing data and concluded but given a direct explanation by educators so that participants in the school listen to the educator's explanation or learning is centered on the educator causes thinking skills not to develop maximally. Conventional learning model is glued to the dogmatic stages. The learning process is oriented towards the opening, presentation, and closing stages. The teacher attempts to transfer the knowledge she has to the students. Learning situation tend to make passive students in receiving lessons so

that thinking skills does not develop optimally. Conditions such as this make students are not motivated to follow the learning, understanding the concept is not so deep that the achievement of students lack of improvement. This is what makes students more reluctant to learn and causes why students are unable to develop the skills to think more critically.

Different treatment between guided inquiry learning model and conventional learning makes students' critical thinking skills different, that students' critical thinking skills taught by guided inquiry learning model are better than the critical thinking skills of students taught through conventional learning. Differences in critical thinking skills between experimental class and control class caused because the experimental class uses a model guided inquiry learning. This is because guided inquiry learning model provides opportunity for students to think in solving problems found in learning process, so students can develop the ability to think through independent problem solving activities. Thus, based on the above explanation and the results of the study decided that guided inquiry learning model has a significant effect on students' critical thinking skills. The statement supporting the hypothesis in this study begins that there is significant effect of the guided inquiry learning model on students' critical thinking skills about momentum and impulse in Senior High School.

CONCLUSION

The conclusion was there is Significant effect in the critical thinking skills conducted by guided inquiry learning to conventional learning about momentum and impulse at senior high school. In other words guided inquiry learning model gives a better effect than conventional learning model.

REFERENCES

- Agarwal, A. (2012). Use Of Multimedia As A New Educational Technology Tool-A Study. *International Journal of Information and Education Technolog*,2 (5): 167-168.
- Amijaya, L. S., Agus, R. And Wayan, M. (2018). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar dan Kemampuan Berfikir kritis Peserta Didik. *Jurnal Pijar Mipa*, 13 (2).
- Asmawati, E. Y. S. (2016). Lembar Kerja Siswa (LKS) menggunakan Model Guided Inquiry untuk Meningkatkan Keterampilan Berfikir Kritis Dan Penguasaan Konsep Siswa. *Jurnal Pendidikan Fisika*, 3 (1): 2-3
- Azizah, H. N, Asep. K. J, dan Diah.G. 2016. Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Kemampuan Berpikir Kritis Siswa Pada Materi Energi Bunyi. *Jurnal Pena Ilmiah*. Vol 1, No.1, Hal 51-60.
- Fuad, R., Siti, Z., Susriyati, M. And Suarsini, E. (2017). Improving Junior High Schools Critical Thinking Skills Based on Test Three Differents Models of Learning. *International Journal Of Instruction*, 10 (1). 101-116.
- Hackling, M. W. (2005). *Working Scientifically: Implementing and Assessing Open Investigation Work in Science*. Western Australia Department of Education and Training.
- Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*,6 (1): 65
- Harefa, E., Motlan, S., and Eva, M. G. (2016). Pengaruh Pembelajaran Inquiry Training dan Keterampilan Berfikir Kritis Terhadap Pengetahuan Ilmiah Siswa Kelas X. *Jurnal Pendidikan Fisika*
- Hosnan, M. (2014). *Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21*. Bogor: Ghalia Indonesia.
- Howard, D.R. & Miskowski, J.A. (2005). Using a Module-based Laboratory to Incorporate Into A Large Cell

- Ibe, and Helen, N. N. (2013). Effect of Guided-Inquiry and Expository teaching methods on senior secondary schools students' performance in Biology in Imo State. *Journal of Education Research and Behavioral Science*, 2 (4): 51-57
- Kusuma, E. D., Gunarhadi, G., & Riyadi, R. (2018). The Strategies To Improve Critical Thinking Skills Through Problem Based Quantum Learning Model At Primary School. *International journal of Multicultural and Multireligious Understandin*, 5 (4): 124-124.
- Lahmita, K. P., Sardianto, M., and Fathurohman, A. (2016). Development of Student Worksheets (LKS) Based Learning cycle 5e on Main Material Elasticity And Hooke's Law Class X High School. *Proceedings of the 2nd SULE IC*, 10 (2): 631.
- Masitoh, I. D., Marjono, and Joko, A. 2017. Pengaruh Model Pembelajaran Inkuiri Terbimbing terhadap Kemampuan Berfikir Kritis Siswa Kelas X MIA pada Materi Pencemaran Lingkungan di Surakarta. *Bioedukasi*, 10 (1): 73
- Motlan, Karya. S., and Hanok, S. (2016). Inquiry and Blended Learning Material Development for Improving Students Achievement on General Physics I of Mathematics and Natural Science of State University of Medan. *Journal of Education and Practice*, 7(28) :171-176.
- Motlan., Jurubahasa. S., Karya, S., and Satria, M. (2018). Report on Academic Success Skills Indicators with Scientific Methods in Learning Development. *Journal of Education and Practice*, 9 (33): 146-148.
- Nasution, K. N., Edi, S., and Mulyono. (2018). The effec of Guided Inquiry Learning Model Based on Deli Malay Culture Contex toward Student's Mathematical Critical Thinking Ability. *American Journal of Education Research*, 6 (2): 1414-1420.
- Nisa, E. K., Koestari, T., Habibulloh, M., and Jatmiko, B. (2017). Effectiveness of guided inquiry learning model to improve students' critical thinkg skills at senior high school. *Journal of Physics*, 6.
- Purwanto. (2008). *Metodologi Penelitian Kuantitatif*. Yogyakarta: Pustaka Pelajar.
- Rusyna, A. (2014). *Keterampilan Berfikir*. Yogyakarta: Ombak.
- Seranica, C., Agus, A. P., and Aliefman, H. (2018). Influence of Guided Inquiry Learning Model to Critical Thinking Skills. *Journal of Research and Education*, 8 (1): 2-3
- Solihin, M.W, Sri. H. B. P, dan Supeno. 2018. Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Kemampuan Berpikir Kritis Siswa SMA. *Jurnal Pembelajaran Fisika*. Vol 3, No.3, hal 299-306.
- Wiyono, K., Agus, S., and Suhadi. (2009). Model Pembelajaran multimedia Interaktif relativitas khusus untuk meneingkatkan keterampilan generik sains siswa SMA. *Jurnal pendidikan Fisika Indonesia*, 3 (1) : 71-82