The difference in the guided inquiry model towards critical thinking skills in physics subject at SMAN 3 Kota Bengkulu

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Abstract. This study aims to describe whether there are significant differences in students taught with guided inquiry models towards critical thinking skills in physics subjects. The research sample was students of class X MIPA 3 and X MIPA 4 in SMA Negeri 3 Kota Bengkulu even semester 2018/2019 on the concept of work and energy. This research is a study of quasi experiment with a design of non-equivalent control group design. For testing data used instruments of critical thinking skills, which are in the form of essays totalling six questions. The results of the descriptive analysis, the average score of critical thinking skills increased in the experimental class with guided inquiry models and control classes with the direct instruction model. The result of inferential analysis shows that guided inquiry learning has a significant effect on students critical thinking skills. So it can be concluded that there are significant differences in learning with guided inquiry models towards critical thinking skills in physics subjects’ students of SMA N 3 Bengkulu city.

1. Introduction
The education process is the implementation of the curriculum used at school. Education is rooted in the nation's own culture, so a curriculum can be implemented that can cover this. 2013 curriculum is an educational curriculum that is used thoroughly in Indonesia. One of the contents in the 2013 Curriculum is that it requires students to be able to have higher-order thinking skills / Higher Order Thinking Skills (HOTS). In the scientific approach students are encouraged to think critically so that they are able to understand the concepts, facts and theories that exist in learning. This 2013 curriculum is a new government policy in the field of education that is expected to be able to answer the challenges and problems that will be faced by the Indonesian people in the future and to changes the quality of education in Indonesia.

The working environment wants a change in competence. the ability to think critically, solve problems, and collaborate are important competencies in entering the life of the 21st century. Schools are required to be able to prepare students to enter the 21st century [1]. One of the subjects that needs to be developed is physics. Physics is knowledge that can develop reasoning power, analysis, so that almost all problems related to nature can be understood. Therefore it is necessary to increase the mastery of concepts through meaningful learning. One of them is to apply critical thinking skills [2].

According to the results of observations that have been made and the results of interviews with physics teachers of the X IPA class, it was found that:

- Physics learning in SMA N 3 Kota Bengkulu has used the 2013 curriculum
Students tend to be passive and less enthusiastic in learning. The lack of curiosity of students towards the material to be delivered by the teacher causes students to find it difficult to express their opinions in asking material that they do not understand or answer questions from the teacher.

The lack of frequency in conducting experiments/lab work. Though by conducting experiments, the concept of physics will be stored longer in the memories of students.

Low student physics learning outcomes happen because the students are not accustomed to developing their thinking potential in school.

Guided inquiry models can involve students to find concepts directly, so that students are expected to develop and emphasize the process of high-level thinking skills to find solutions to any existing problems based on the knowledge students get themselves. Students will tend to be more active in learning especially in expressing their mind. When students have high critical thinking skills, it also has an impact on high learning outcomes [3,4].

Based on the description of the background above the formulation of the problems taken is Are there significant differences in the guided inquiry model towards students' critical thinking skills in physics subjects at SMA Negeri 3 Kota Bengkulu?

2. Methods
This type of research is Quasi Experiment Design. This research design has 2 classes namely control class and experimental class. The learning model used in the experimental class is the Guided Inquiry model and the Direct Instruction learning model in the control class to measure students' critical thinking skills.

Samples were taken based on Purposive Sampling technique which is a technique of determining samples based on certain considerations, mostly based on normality and homogeneity tests of the sample. In order to obtain class X MIPA 3 as a class that uses the Direct Instruction model or control class and class X MIPA 4 as a class that uses a guided inquiry model or an experimental class.

Data collection techniques in this study by conducting 2 tests namely, pre-test and post-test critical thinking skills. With the pre-test and post-test questions are the same questions and form six essays. In each class 2 tests were conducted per meeting, namely O1 and O2 for the experimental class and O3 and O4 in the control class which in this study conducted two learning meetings.

Before testing the data, we look for the average value of the data. According to Arikunto [4] to calculate the mean (average) the following formula is used.

\[
\bar{X} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{N}
\]

Where \( \bar{X} \) is the mean, \( X_n \) is the data available, and \( N \) is the number of data or samples.

Then the data obtained in this study were tested for normality and homogeneity, then the data were tested for differences with the t test (parametric analysis). The magnitude of the effectiveness of learning by using guided inquiry models of students' critical thinking skills is measured by Cohen's criteria in Darmadi [5]. The formula used is:

\[
t = \frac{X_1 - X_2}{\sqrt{\frac{n_1-1}{S_1^2} + \frac{n_2-1}{S_2^2}} 
\frac{1}{n_1} + \frac{1}{n_2}}
\]

where \( X_1 \) is the average of data 1, \( X_2 \) is the average of data 2, \( n_1 \) is the number of sample groups 1, \( n_2 \) is the number of sample groups 2, and \( S_2 \) is the variance of each group. If the value of \( t \) count> \( t \) table at the level of significance (\( \alpha \)) = 0.05 and degrees of freedom (\( dk \)) = \( n_1 + n_2 - 2 \), then \( H_a \) is accepted while \( H_0 \) is rejected. If the price of \( t \) count< \( t \) table then \( H_a \) is rejected while \( H_0 \) is accepted. Based on the results of the analysis of these data it can be concluded whether the hypotheses proposed in this study were accepted or rejected.
3. Results and discussion

At each meeting students were given a critical thinking skills test in the form of a test item containing elements of critical thinking FRISCO, which are Focus, Reason, Inference, Situation, Clarity and Overview [6]. Elements of critical thinking FRISCO is also placed in the step of guided inquiry experiments. Tests are carried out 2 times each meeting, namely at the beginning of learning (Pre-test) and at the end of the meeting (Post-test) with the same test questions totalling six questions. Based on the results of the pre-test and post-test data that have been done in the experimental class the following data are obtained:

![Figure 1](image1.png)

**Figure 1.** Pre-test and post-test data bar graph scores of critical thinking skills for experimental classes.

Figure 1. Showing the average pre-test and post-test scores of the experimental class can be seen that an increase in students' critical thinking skills. This indicates that learning using the guided inquiry model is influential and can improve students' critical thinking skills. The results of the pre-test and post-test research were also carried out twice in the control class. For more details can be seen in the following graph:

![Figure 2](image2.png)

**Figure 2.** Pre-test and post-test bar graph score of critical thinking skills in control class.

Figure 2. Showing the average pre-test and post-test value of the control class in the picture can also be seen an increase in students' critical thinking skills in the control class but not yet fulfilling the KKM at school. From the calculations that have been done, the difference between the average pre-test and post-test is 63.9. This can be obtained because at the time of giving pre-test students there is no preparation for learning at all, so they have trouble answering and many are not answered. At the time of the post-test, students have been given learning and are still warm in the heads of students so that they can easily answer the test instrument questions, so that an increase in the score of critical thinking skills.

Based on these data, the results obtained with the t test for the post-test value of the experimental class and the control class were 7,1 (tcount) with a table obtained 1,7. So that it can be seen that the
average post-test score of critical thinking skills between the experimental class and the control class is 

tcount > ttable, the average post-test score of the experimental class increases drastically higher than the 

control class, Ha: μ1 ≠ μ2. This shows that the conclusions obtained are significantly different or there 

are significant differences in the critical thinking skills of learning with the guided inquiry model with 

learning with the Direct Instruction model on the Business and Energy concept of the even semester of 

class X in SMA.

In learning in the experimental class follow the steps of learning that already exists. The learning 

steps used in the experimental class using the guided inquiry model according to Abidin [7] namely 1) 

Pre-learning, 2) Setting the problem, 3) Formulating hypotheses, 4) Conducting experiments, 5) 

Processing and analysing data, 6) Making conclusions, 7) Present the results of the experiment, and 8) 

Post-learning. Then to grow the critical thinking skills of students added aspects of critical thinking 

skills elements in the steps of guided inquiry learning in the experimental class.

When learning takes place, the teacher first asks for attendance and provides a 20-minute pre-test. 

Followed by giving aperception and remembering previous learning using video media. After the video 

presentation is finished, the teacher asks students the contents of the video as material to remember 

the previous learning. From what they notice is called the pre-learning stage.

In the second stage, the stage of determining the problem combined with aspects of critical thinking 

Focus. Students are divided into six groups, one group containing six students, which is given a 

worksheet of three groups each discussing sub concepts. From the illustrations that have been given at 

the beginning and the problems that are in LKS students are required to be able to find, identify and 

analyse problems properly with the guidance of the teacher. This is in accordance with research 

Nurmayani et al. [8] which states that at this stage students are required to be able to analyse the opinions 

expressed by identifying the reasons for certain concepts. Students begin to be able to develop ideas and 

mindsets in solving problems given at worksheets.

The next stage is to formulate a hypothetical experiment from the problems that have been 

established with a combination of aspects of critical thinking skills namely Reason. At this stage, the 

teacher guides students to formulate hypotheses from the goals and problems that have been made by 

students before. Students then fill in the steps of the experiment one by one and conduct experiments 

with the guidance of the teacher by identifying assumptions and finding solutions to problems from 

hypotheses that have been formulated previously. This stage is called the stage of experimenting by 

combining aspects of Clarity's critical thinking skills. In accordance with the research [8] which states 

that in the experimental class students are accustomed to learning with integrated reasoning because in 

guided inquiry learning is emphasized to think in discussion in problem solving, and thinking habits that 

encourage students to explore so as to find meaningful concepts.

The next stage is the stage of processing and analysing data combined with aspects of critical thinking 

skills namely Situation. In this case the teacher guides students to process data and analyse the results 

of the results of experiments that have been conducted by comparing the existing theories in student 

books so that students' critical thinking skills increase with the experience of finding their own material. 

According to Nurmayani et al. [8], at this stage students are assigned to compare practicum results with 

theory so that students have Situation critical thinking skills. According to Nurmayani et al. [8] at this 

stage it is strongly supported by the activeness of students, because if students are less active it will 

cause difficulties in mastering concepts and developing students' critical thinking skills.

The next stage is making conclusions that are combined with elements of critical thinking skills 

inference. At this stage the teacher guides students to make conclusions in accordance with previously 

developed reasons in making conclusions made by students themselves in this case the critical thinking 

skills students use in the way students process data into conclusions. According to Solihin et al. [9] in 

this stage students in the experimental class are trained to conclude in their own conclusions through the 

group after conducting practical activities and also when the lesson ends students and teachers conclude 

the learning outcomes, so students become skilled.

The next stage is to present learning outcomes that are integrated with elements of critical thinking 

skills Overview. In this case the teacher guides students in describing the results of the experiments they
have gotten from the experiment by checking the results that have been concluded and that students have found. In describing the results of experiments that have been carried out from the six groups will be represented by one group that advances to the front of the class to explain the results of experiments and new knowledge obtained by students in learning and confirmed again by the teaching teacher. The last stage in learning with the guided inquiry model is post-learning in this case the teacher uses it to carry out a post-test for 30 minutes then concludes the learning outcomes.

With the guided inquiry learning in the experimental class the teacher's role is only as a facilitator, mostly providing guidance to students, as well as being a discussion partner in clarifying and finding alternative solutions to problems. Whether or not active students are more emphasized on learning. The activeness of students can be seen when students conduct experiments and discussions with their groups when formulating problems to explain the results of experiments that they get themselves with the guidance of the teacher. Students can come up with ideas and develop their own critical mindset in answering worksheets and apply them when answering post-test questions.

In each phase of laboratory activities, teachers continue to give direction to students through the questions that are guiding. Students have the opportunity to use the ideas and opinions of laboratory operations are carried out. Research guided inquiry with peer instruction has succeeded in developing students ‘critical thinking skills [10].

In the control class, students are taught using the DI model/direct learning with the lecture method so that student learning is limited to what is conveyed by the teacher. Students are not guided by various questions for data analysis and conclude but are given a direct explanation by the educator so that the students listen to the educator's explanation or are teacher centered so that critical thinking skills do not develop optimally [11].

Learning with the DI model in this control class has several weaknesses, mostly about learning in the mastery of student concepts. The role of the teacher in learning is very dominant, so the teacher is required to be an attractive model for students so that students are less able to develop students’ critical thinking skills in learning.

The amount of test results in the experimental class shows students have high critical thinking skills [11]. This is in accordance with research [12] which states that there are significant differences between the ability of students being taught with Guided learning models and students who are taught with direct learning models on the subject matter of Temperature and Heat in class X SMA Negeri I Batang Kuis TP 2014/2015 with conventional learning (direct).

4. Conclusion

Based on the results of research data analysis and discussion, conclusions that can be drawn from this study are There are significant differences in the Guided Inquiry learning model towards students' critical thinking skills on the work concept and energy at SMA N 3 Kota Bengkulu.

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