Application of Guided Inquiry Learning Model to Improve Critical Thinking Skills of the Student on 11st Grade with Dynamic Fluid Material

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Abstract

This research aims to know the influence of guided inquiry learning process to improve critical thinking skills of the student on 11st grade with dynamic fluid material. Kind of this research that be used is quasi experimental with pre-test post-test group design where the researcher used one class of implementation and one class of replication. The population of this research is the student on 11st grade of Dharma Wanita High School. The sample of this research is XI-IPA 1 as the implementation class and XI-IPA 2 as the replication class. The variables in this research including manipulation variable is guided inquiry learning model, response variable is critical thinking skills, and control variable are fluid dynamic material, teacher, and learning time allocation. The technique of data analysis that used is normality-test and homogeneity-test as precondition-test, t-test, n-gain, and variant analysis. The result of this research shows that the learning process with applying guided inquiry learning model got a very good categories with the percentage of XI-IPA 1 class is 86,8% and percentage of XI-IPA 2 class is 85,7%. The result of t-test to know the significance results of pre-test and post-test that is 52,35 for XI-IPA 1 class and 51,17 for XI-IPA 2 class with t_{table} is 1,70, it shows H_0 rejected so H_1 accepted because of the $t_{calculate}$ more large than t_{table}, so can be conclude that the results of pre-test and post-test is significance importance. The result of n-gain test to know the increasing of critical thinking skills of the student got the average is 0,72 for XI-IPA 1 class and the average is 0,71 for XI-IPA 2 class with the categories of this two class is high. The result of positive student's response is the percentage between 84% until 92% for each a question, this results from both of class have a very good categories. This research can be concluded that guided inquiry learning process can be increasing the critical thinking skills of the student with the result of the increasing that significance and the positive student's response that very good of the both class.

Keywords: guided inquiry, critical thinking skills, and dynamic fluid.

PRELIMINARY

Globalization is one of the evidences of the times that can't be denied and controlled. The development of this increasingly advanced era demands society to be critical to face the changes that occur. The development of the era also requires education that provides competence that suits the needs of the society. Based on research in various fields such as socio-science it is known that students who graduate from various schools in different countries don't have the ability to compete on a global scale because they lack the ability to think critically. The global challenge demands education to evolve and fill the needs of society. Governments in some countries propose one way to prepare students who are ready to compete is by teaching science that can happen in the real world. Students must to learn how to solve the real problems in the environment and apply the knowledge with creative and innovative way. Students can place themselves and know how to thinking about the problems with creative way that needed critical thinking skills that believe as one of the essential of skills that affecting to academic success and professional. Students are the object that has the skills actively to search, to process, to construct, and to use the knowledge. For that, learning should be concerned with the opportunity given to students to construct knowledge in the cognitive process. In order to truly understand and apply the knowledge the student needs to be encouraged to work to solve problems, find everything for themselves and strive to realize their ideas.

Learning in the Curriculum 2013 uses a scientific approach or a scientific-based approach. The scientific approach can use some strategies such as contextual learning. Curriculum 2013 has the objective of achieving

the assessment. Ministries of Education and culture establishes the Competency Standards of Graduates by emphasizing the competence to attitudes, knowledge, and skills implemented through appropriate learning process, that is learning process that can stimulate students to learn more actively with based on investigation and scientific observation.

Physics as one of the subjects that includes learning materials related to natural phenomena. Physics can be learned through direct scientific investigation and observation. When teaching science (Natural Science) it is very important to present learning that can enhance student curiosity and teach critical thinking skills. Critical thinking skills of students viewed are students have the skills to ask and answer about an explanation, students can observe and consider an observation report, students can create and determine the value of consideration, students are able to have the ability to identify assumptions, and students can determine an action.

A series of learning activities that emphasize critical and analytical thinking processes to seek and find themselves from a questionable problem as revealed by Sutarjo Adisusilo (2012:101) as a sense of inquiry learning strategies. As revealed that one of the learning models that can be applied for scientific investigation and observation is a guided inquiry learning model in which this guided inquiry learning model can create maximum student activity to seek and find their own answers from something in question with the aim of developing the ability to think systematically, logical, and critical. Sanjaya (2008:202) states that the inquiry learning model includes orientation, formulating problems, formulating hypotheses, collecting data, testing hypotheses, and formulating conclusions.

Based on observations made by researchers at Dharma Wanita High School, researchers obtained a questionnaire results from 72 students of class XI. From the results of the questionnaire, obtained a number of 32 students revealed that the characteristics of physics lessons interesting to learn, 28 students revealed that the physics lessons are difficult to understand, and 12 students revealed that the physics lessons are mediocre. The difficulties experienced in the study of physics, a number of 42 students revealed that many formulas are difficult to understand, 22 students reveal theoretical physics that is difficult to understand, and 8 students express difficult to understand the concept of physical matter. There are a total of 63 students revealed that when studying physics, students never but seldom do scientific observations and investigations, and 9 students revealed that when studying physics, students never make scientific observations and investigations. Based on the observation of the researcher and the result of critical thinking skills test done by the students, there are some students who already have critical thinking skills in solving a problem with the percentage of 55%, but there are still students who have not sharpened thinking skills when faced with a problem with percentage 30%, and students who do not have critical thinking skills when facing a problem with a percentage of 15%.

Based on the above description, the researcher proposes the title of "Application of Guided Inquiry Learning Model to Improve the Critical Thinking Skills of the Students on 11st Grade with Dynamic Fluid Material". This research proposes to describe the accomplished of learning process that applied by researcher, to describe the critical thinking skills of students, to describe the response by students to guided inquiry learning models, and to describe the activity of students.

METHOD

This research is a quantitative descriptive research in the form of quasi experiment design. The research design used pre-test post-test group design. The sample in this research is the students of class XI-IPA 1 as the experimental class and XI-IPA 2 as the replication class. Pre-test is given to the sample for the purpose of diagnosing early knowledge and students critical thinking skills. Then students are given applying of guided inquiry learning model to improve the critical thinking skills. And the last step is the students given post-test to know how the condition by the students after given that treatment.

Table1. Experiment Design

Category	Class	*Pretest*	Treatment	*Posttest*
Implementation	XI IPA 1	Y_1	X_1	Y_2
Replication	XI IPA 2	Y_1	X_1	Y_2

The instrument of collecting data on this research is a sheet of validation, a sheet of accomplished of learning process, a sheet of knowledge test assessment, a sheet of critical thinking skills assessment, and a sheet of student response. The technique of data analysis is the learning result analysis, accomplished learning process analysis, critical thinking skills analysis, students response analysis, and student activity analysis.

RESULTS AND DISCUSSION

The analysis results by test of validation, reliability, difficulty degree, and matter sensitivity to 30 matter produce 25 matter that will used as pre-test and post-test.

After getting the result of pre-test and post-test, the next step is doing the normality test and homogeneity test as precondition test, t-test, n-gain test, and variant

analysis. The results of homogeneity test show that both of two class as sample is fulfill by predicate that normally distributed and homogeny with signification degree α = 0,05.

1. Learning Result Analysis

1) Knowledge Competence

The data that collected of this research is quantitative data, that coming from pre-test and post-test value. On this research used analysis of t-test to know the significance of increasing the student learning result, n-gain analysis to know the increasing of student assessment, and variant analysis to know the similarity of assessment. The condition to doing all three tests of them is the data result must be doing by precondition test that are normality test and homogeneity test.

a) Normality test

The calculation of normality test is to know the sample that used is normally distributed or not. This test used pre-test and post-test value that conducted to all sample. Sample can be said to normally distributed if $x^2_{calculate} < x^2_{table}$ with the significance degree is 0,05.

Table2. Result of Normality test by Pre-test and Post-test

Class	x^2_{table}	$x^2_{calculate}$ *Pretest*	$x^2_{calculate}$ *Posttest*	Conclusion
XI-IPA 1	11,10	3,82	10,24	Normal
XI-IPA 2		2,02	9,55	Normal

Based on the Table 2 above show that $x^2_{calculate} < x^2_{table}$, can be conclude that the two of that class is normality distributed.

b) Homogeneity test

The calculation of homogeneity test is to investigate that sample that taken is coming from the same population (homogeny). This test used pre-test and post-test value that conducted to all sample. Sample can be said to normally distributed if $x^2_{calculate} < x^2_{table}$.

Table3. Result of Homogeneity test by Pre-test and Post-test

Class	x^2_{table}	$x^2_{calculate}$ *Pretest*	$x^2_{calculate}$ *Posttest*	Conclusion
XI-IPA 1	5,99	0,039	0,008	Homogeny
XI-IPA 2		0,039	0,008	Homogeny

Based on the Table 3 above show that $x^2_{calculate} < x^2_{table}$, can be conclude that the sample that used is homogeny.

c) T-test

The calculation of this t-test used to know is there or not of the average difference of research results between pre-test and post-test. Based on the knowledge aspect to know increasing the critical thinking of students can be obtained by difference of pre-test and post-test value.

Table4. Result of T-test

Class	$t_{calculate}$	t_{table}	Hypotheses
XI-IPA 1	53,35	2,032	H_0 rejected
XI-IPA 2	51,17		H_0 rejected

Hypotheses that given is H_0 = gain is not significant and H_i = gain is significant. Based on the Table 4 above show that $t_{calculate} > t_{table}$, so H_i is accepted and H_0 is rejected. Can be conclude that the post-test value is significant increased from the pre-test value. This is show that the knowledge of students is increasing after given the learning process with guided inquiry learning model.

d) N-gain

The calculation of n-gain used to know the improving of student critical thinking. The result that obtained based on pre-test and post-test value by average score of each class before and after applied by guided inquiry learning model.

Table5. Result of N-gain

Class	Average N<g_n>	Category
XI-IPA 1	0,72	High
XI-IPA 2	0,71	High

Based on Table 5 above showed that there is an improving of student critical thinking of each class, that can be seen from n-gain score each class that have a high category. The improving of this critical thinking can be give a positive effect to student progress in solving each question.

e) Variant analysis

Variant analysis (ANAVA) used to analyze how the consistency of improving student critical thinking after given the guided inquiry learning model. This analysis used by gain score from both of class.

Table6. Result of Variant Analysis

$F_{calculate}$	F_{table}
0,14	2,68

Based on Table 6 above showed that $F_{calculate} < F_{table}$, so H_0 can be accepted. From this, can be conclude that critical thinking skills by the student is significant increasingly as an effect of guided inquiry learning process.

2) Attitude Competence

Analysis of student attitude is purpose to know the attitude of the student when learning process are proceed. Student attitude observing with using a sheet of attitude observation proper with the aspect that mentioned on the sheet.

Table7. Result of Student Attitude

Aspect	Class of XI-IPA 1			Class of XI-IPA 2			Aver age
	P1	P2	P3	P1	P2	P3	
Want to know	3,08	3,42	3,50	3,08	3,42	3,50	3,33
Give an opinion	3,08	3,44	4,00	3,14	3,50	4,00	3,53
Opened	3,08	3,50	3,92	3,36	3,44	3,94	3,54
Critic	3,08	3,14	3,47	3,00	3,17	3,47	3,22
Class Average	**3,08**	**3,38**	**3,72**	**3,15**	**3,38**	**3,73**	
Category	**B**	**B**	**SB**	**B**	**B**	**SB**	

Based on Table 7 above, the result of student attitude observing on each class is increasing every meeting from good category to very good category.

3) Skills Competence of Doing Experiment

The assessment of skills competence in this way is doing by researcher that will show how great the skill competence of the students when doing an experiment. The aspect to assess by researcher is preparing the tools and materials, doing the experiment, write the report, and presented the result of experiment.

Table8. Result of Student Skills of Doing Experiment

Class	Aspect	Score Group					
		1	2	3	4	5	6
XI-IPA 1	Preparing tools and materials	4	4	4	4	4	4
	Doing the experiment	4	4	3	4	4	3
	Write the report	4	3	3	4	3	3
	Presented the result of experiment	3	3	3	3	3	3
	Total Score	**15**	**14**	**13**	**15**	**14**	**13**
	Skills Score	**3,75**	**3,50**	**3,25**	**3,75**	**3,50**	**3,25**
	Predicate	**SB**	**SB**	**B**	**SB**	**SB**	**B**
XI-IPA 2	Preparing tools and materials	4	4	4	4	4	4
	Doing the experiment	3	3	3	3	3	3
	Write the report	4	3	3	3	3	4
	Presented the result of experiment	4	3	3	4	3	3
	Total Score	**15**	**13**	**13**	**15**	**13**	**14**
	Skills Score	**3,75**	**3,25**	**3,25**	**3,75**	**3,25**	**3,50**
	Predicate	**SB**	**B**	**B**	**SB**	**B**	**SB**

Based on the Table 8 above, the results of observation by researcher is that the students already preparing the tools and materials, also with very well done preparing to do the experiment. The students also show the good skills when giving the presentation.

2. Accomplished of Learning Process Analysis

A sheet of accomplished of learning process is purpose to know how the accomplished of the learning using guided inquiry learning model to improve critical thinking skills of the student. The aspects that observed is learning operating consist of preliminary, core activities, and closing, then processing time and class situation.

The analysis result by accomplished of learning process can be seen on the table below.

Table9. Result of Learning Process Analysis

No	Aspect that Observed	XI IPA 1			XI IPA 2		
		1 (%)	2 (%)	3 (%)	1 (%)	2 (%)	3 (%)
1.	Preliminary	83,3	91,6	83,3	75,0	83,3	75,0
2.	Core Activities	90,0	90,0	95,0	85,0	90,0	90,0
3.	Closing	87,5	93,8	87,5	87,5	93,75	87,5
4.	Processing Time	75,0	75,0	100,0	75,0	100,0	100,0
5.	Class Situation	83,3	87,5	91,6	75,0	95,8	87,5
	Average	83,8	87,8	91,5	79,5	92,6	88,0
Total Number		**87,5**			**86,7**		
Category		**Very Good**			**Very Good**		

Based on Table 9 above, knows that on the first meeting on each class, the value is much low than the next meeting. The increasing of this value is because the students already adapted to class situation with using guided inquiry learning, when the students must be an active learner to reach an important information so they can improve their critical thinking skills. Meanwhile, the teacher's role is leading and facilitated the students so they can learn to critical thinking and find the solving problems. By that explanation, can be conclude that application of guided inquiry learning model to improve the critical thinking skills already carried out with very good results with the total number of class XI-IPA 1 is 87,5 and total number of class XI-IPA 2 is 86,7.

3. Critical Thinking Skills Analysis

Based on the result of pre-test and post-test value by the both of class, can be related by this graphic below:

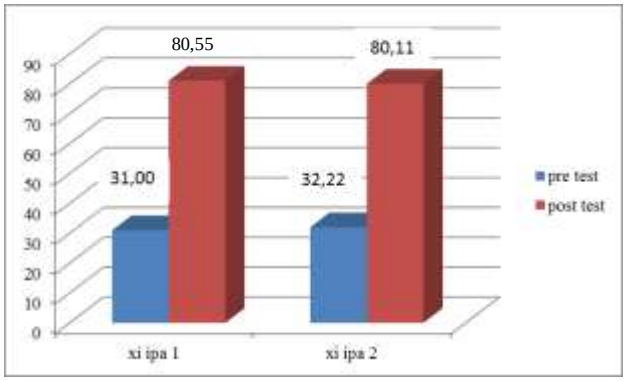

Figure1. Graphic of Improving Critical Thinking Skills Average

Based on Figure1 above, knows that he result of student critical thinking skills from the pre-test and post-test value have increasing. That can be show by the result of class XI-IPA 1 has pre-test value 31,00; and post-test value 80,55; then the result of class XI-IPA 2 has pre-test value 32,22; and post-test value 80,11. Critical thinking skills by Bloom that describe three of cognitive domain that have a high order thinking skills, there are Analysis (C4), Synthesis (C5), and Evaluate (C6) used to show the student critical thinking skills. That can be showed by this graphic below:

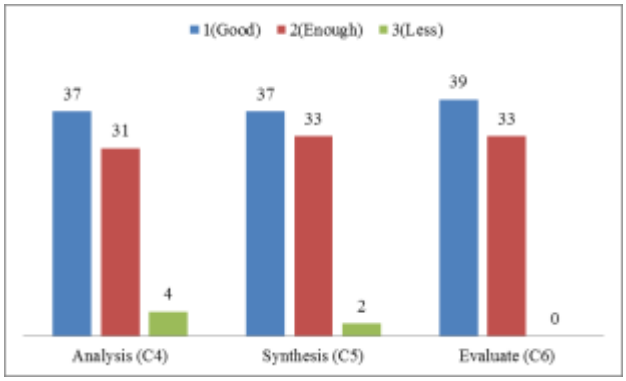

Figure2. Graphic of Critical Thinking Skills

Based on Figure 2 above, the aspects of critical thinking skills by Bloom to dynamic fluids material with using guided inquiry learning model get the good category on each aspect. On analysis aspect, 37 students get a good value, 31 students get an enough value, and 4 students get a less value. On synthesis aspect, 37 students get a good value, 33 students get an enough value, and 2 students get a less value. On evaluate aspect, 39 students get a good value, 33 students get an enough value, and 0 students get a less value. The calculate result that get from all of the sample class have increasing that significant.

4. Students Response Analysis

Analysis of students response is purpose to know the response by the students about the applied learning model that called guided inquiry learning model. To analyze the students response, researcher using survey method that given to students after applied the guided inquiry learning model.

Table10. Result of Students Response Analysis

No	Statement	Average	
		Percentage	Predicate
1	Guided Inquiry Learning very interesting and not boring.	84%	SB
2	Guided Inquiry Learning teach me to search the solving problem with may way.	88%	SB
3	Guided Inquiry Learning giving me a chance to deliver my opinion to solving problem.	92%	SB
4	Guided Inquiry Learning teaching me to try a new way to solving problem.	89%	SB
5	Guided Inquiry Learning teaching me to develop a new problem from the existing problem and solve them.	92%	SB
6	Guided Inquiry Learning making me much easy to understanding the material.	91%	SB
7	Guided Inquiry Learning making me much easy to work out the problem by teacher.	86%	SB
8	Guided Inquiry Learning making me more active when learning process.	91%	SB
9	Guided Inquiry Learning teaching me to be more self confidence to solving problem.	87%	SB
10	Guided Inquiry Learning can increase my critical thinking skills when learning process.	88%	SB

Based on Table 10 above, it shows on point one about interest and positive response has an average percentage 84% with very good category as a lower result of this response analysis. On point three and five about give a chance to deliver an opinion to solving the problems and teach to develop a new problem from the problem that exist then solve them, have a higher result with percentage that is 92% with very good category. The average of students response from two class have very good predicate (SB) on each question. It shows that guided inquiry learning model to improve critical thinking skills of the students on 11st Grade with Dynamic Fluid Material very interesting and not boring, students more active and brave to deliver their opinion, and students can solving any problems that exist.

5. Students Activity Analysis

The analysis of student activity is used to know the activity of the students when learning process is happen. This activity is observed by observer that is the researcher when meeting in the class.

Table11. Result of Students Activity Analysis

No	Aspects	Class XI-IPA 1		Class XI-IPA 2	
		Average	Predicate	Average	Predicate
1	Do the observation or investigation.	75%	B	75%	B
2	Listen with active (show the response, such as ask, give an opinion, etc).	75%	B	83,3%	SB
3	Give an opinion based on problems in the learning process.	83,3%	SB	75%	B
4	Critical thinking (try to give a solution to solving problem)	75%	B	83,3%	SB
5	Presenting the report and discussion.	91,7%	SB	91,7%	SB
6	Commented and conclude the learning process.	75%	B	83,3%	SB
7	Fix the problem or a lack of learning process.	75%	B	75%	B
8	Conclude the material by themselves.	91,7%	SB	91,7%	SB

Based on Table 11 above, overall the aspect of student activity when the learning process are proceed by using guided inquiry learning model is good predicate. This is because every student already adapted to guided inquiry learning model. Based on that result, on class XI-IPA 1, get the average for aspect one, two, four, six, and seven is 75% as good category. Meanwhile for aspect three is 83,3% as very good category, and for aspect five and eight is 91,7% as very good category. On class XI-IPA 2, get the average for aspect one, three, and seven is 75% as good category. Meanwhile for aspect two, four, and six is 83,3% as very good category, and for aspect five and eight is 91,7% as very good category.

CLOSING

Conclusion

Based on the result and discussion and the analysis that have be done, can be concluded that:

1. The result of accomplishing of learning process with applied a guided inquiry learning model to improve the critical thinking skills on dynamic fluids material by the 11st grade on both class is a very good category.
2. Guided inquiry learning that applied to dynamic fluids material on class XI-IPA 1 as implementation class and class XI-IPA 2 as replication class have critical thinking skills that significant increasingly. The average result of n-gain on each class has a high category. The increasing of critical thinking skills is consistent on both of the class.
3. Guided inquiry learning on dynamic fluids material that applied reach a positive response from all of the students on each aspect.
4. The student activity when guided inquiry learning on dynamic fluids material has a good category.

In this case, can be conclude that guided inquiry learning model can be improve the critical thinking skills of 11st grade on dynamic fluids material in Dharma Wanita High School, Surabaya. This is supported with the accomplishing of guided inquiry learning that proceed very good, increasingly of critical thinking skills by students that consistent, a positive response by students to guided inquiry learning, and the student activity that has done very well.

Suggestion

After doing a research, researcher get a few suggest as a consideration to the next research that almost have a same purpose as like on below:

1. Prepare all of the needed to teach with very well before execute on learning proceed. Pay close attention to time allocation when learning process and experiment happen so all of the information and learning purpose can be delivered very well.
2. As good as possible, the teacher can be applied this guided inquiry learning model on other physics material, because this learning model can help the student to improve the learning result and students critical thinking skills too, beside that the guided inquiry learning model can make a student as a self-sufficient learner and an active learner so they can search any information and give an opinion that can be a problem solving.

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