The Implementation of Guided Inquiry in the Learning Subject of Virus Based on Multiple Representations toward Students' Critical Thinking

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Article Info	Abstract
	Biology is a subject that involves the scientific process in its teaching and learning activity so that it requires a learning model which can apply that scientific process, one of which is guided inquiry. The learning subject of virus is abstract and is microscopic which requires visual presence, not only verbal explanation so that students can fulfil their basic competence, namely analyzing (C4) which is included in the category of high-level thinking. In the learning model implemented at SMA N 1 Lasem, the teacher has not yet developed students' critical thinking skills. The aim of this research is to determine the effectiveness of the implementation of guided inquiry in the learning subject of virus based on multiple representations toward students' critical thinking skills. This research is experimental research with a pre-test post-test control group design. The sample was class of X MIPA 3 as the experimental class and X MIPA 5 as the control class. The researchers used purposive sampling technique. The data collection methods were tests, observations, and questionnaires. The result showed that the average post-test of the experimental class was higher than control class; that is 80.1 with classical completeness up to 92% and N-gain of 0.46 categorized as medium, while in the control class, the average post-test is 72.5 with a classical completeness of 78% and N-gain of 0.24 categorized as low. These results were strengthened by a questionnaire on students responses 84%, teacher responses 83% and observations of the learning process which gave a positive response with 86% categorized as good. Based on the results of the research, it can be concluded that the implementation of guided inquiry based on multiple representations in the learning subject of virus is effective in improving students' critical thinking skills.

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INTRODUCTION

The world is in shock with the attack of the corona virus, including Indonesia. This affects various fields of science, including the world of education. The main choice at this time is to break the Covid-19 chain with the existing conditions as much as possible, but still strive to fulfill education services. One of the methods that teachers can use is to facilitate students by doing online learning by adjusting the availability of learning facilities.

Currently, the learning used is still teacher centered (Redhana, 2019). Biology learning is not only based on the transfer and memorized of knowledge but must also involve the active role of students in the discovery process to understanding of depth concepts. Biology is a subject that studies living things or the life they have which involves a scientific approach in theories, concepts, and principles (Rustaman, 2013).

Guided inquiry is a learning model that is highly recommended in biology learning because it is based on discoveries made through a series of scientific processes. This scientific process is called the scientific approach (Yuliani et al., 2017). Guided inquiry is a learning process that focuses on the ability to think critically and logically to solve problems through teacher guidance (Murnaka et al., 2019). In 21st century education, the direction of learning can be successful with students being able to think critically (Badan Standar Nasional Pendidikan, 2010).

Virus is an abstract biological material which requires visual presence not only verbal because it cannot be seen directly in everyday life and is microscopic with basic competence in analyzing (C4) which is classified as a high-level ability based on Bloom's taxonomy (Irfana et al., 2017). Therefore, we need an approach that is able to apply basic concepts and demonstrate students' real thinking, one of which is through multiple representations. According to Oktavianty (2012) in his research stated that the implementation of the guided inquiry learning model with a multiple representation approach on the topic of static fluid can improve students' knowledge and critical thinking skills.

The results of observations and interviews with the biology subject teacher for class X SMA N 1 Lasem, learning has not used guided inquiry settings and only uses PPT (Power Point) from the teacher so that students are less active and feel bored. The teachers also have not directed critical thinking skills.

Based on the above conditions, it is necessary to strive for learning renewal through the implementation of strategies, methods, use of teaching materials and innovative learning approaches. Researchers are interested in conducting research entitled "The Implementation of Guided Inquiry in the Learning Subject of Virus Based on Multiple Representations toward Students' Critical Thinking".

RESEARCH METHODS

The method used is a quantitative experiment with a pre-test post-test control group design. The population of this research is all students of class X MIPA SMA N 1 Lasem 2020/2021. The research sample was determined by purposive sampling namely X MIPA 3 as the experimental class and X MIPA 5 as the control class. The data from this research are focused on students' critical thinking skills and are supported by data on student and teacher responses and the implementation of learning. Based on the pre-test and post-test that has been obtained, it is then analyzed by means of a paired t-test. To determine the magnitude of the increase in the pre-test and post-test in the experimental class used N-gain test. Data on student responses and teacher responses were obtained by questionnaires, while data on the implementation of learning were obtained by observation sheets.

RESULTS AND DISCUSSION

The effectiveness of the learning model applied in the viral material is measured by achievement based on the established effectiveness indicators, namely (1) classical completeness percentage (KKM≥70) critical thinking ≥85%, (2) student response questionnaires that meet good criteria ≥75%, (3) the teacher's response questionnaire meets the criteria for both ≥75%, (4) the learning implementation observation sheet

meets the percentage ≥75%.

Differences in Critical Thinking Skills in Virus Materials between Control and Experiment Class

Based on the results of the pre-test and post-test, an analysis was carried out to determine the student results between the control class and the experimental class.

Table 1 Results of the pratest of the pre-test and post-test scores for control class and the experimental class

	Class	*Sig.* Normality	*Sig.* Homogenity	Keterangan
Pre-test	Control	0.200	0.617	
	Experimental	0.200	0.617	Homogen
Post-test	Control	0.51	0.121	
	Experimental	0.56	0.121	

The results of the analysis showed that the data of the pre-test and post-test scores of the two classes had the same variance or were homogeneous and normally distributed. After completing the pratest, it is continued with the paired t-test which can be seen in table 2.

**Table 2** Results of paired t-test pre-test and post-test control class and experimental class

Class	Mean	Df	α	T_{result}	Sig. 2-tailed
Student Learning Outcomes and Learning Models	11,63889	71	0.05	8,444	0,000

From the results of the paired t-test that the value of sig. (2-tailed) of 0.000 < 0.05. This proves that the application of guided inquiry in multiple representation-based viral learning provides a significant difference to students' critical thinking skills. The post-test results obtained are closely related to the guided inquiry based on multiple representations that have been applied. This learning activities can develop students' critical thinking skills because students play a more dominant role in carrying out the discovery process by digging information independently so as to increase students' understanding (Rafiqa et al., 2017). In guided inquiry, students not only memorize facts and existing concepts but also discover the results by themselves (Dewi et al., 2017). Actively making their own discoveries can help students increase their knowledge with new words or sentences. The implementation of online learning is carried out using zoom meeting and google forms. The use of gadgets and laptops through several portals and online learning applications by adjusting the availability of learning facilities can help learning to be carried out optimally during the Covid-19 pandemic in the form of knowledge transfer from teachers to students into student centered learning.

In learning using guided inquiry based on multiple representations, the teacher plays a role in providing guidance when students experience difficulties and in discovery activities. According to Martin (2009) in guided inquiry the teacher can accommodate the discovery method and student focus by choosing a topic and giving instructions to encourage students to express or conduct further investigations. The teacher acts as a facilitator who provides questions as bait through a student book that can be used by students to provide further solutions to the stage of formulating conclusions (Isnaeni & Yuniastuti, 2017). In addition to helping students who have difficulty, the teacher also provides opportunities for students to build their own knowledge through the process of problem formulation to the stage of formulating conclusions.

Learning carried out in the control class tends to be teacher centered, meaning that students gain knowledge from the transfer of knowledge conveyed by the teacher through power points so that they have not applied students' critical thinking exercises. The use of traditional learning methods or lectures tends to make the quality of the learning process low (Rahmat & Chanunan, 2018). This method also makes students bored, low interest in learning and poor perception (Haviz, 2015). This is one of the causes of the low critical thinking skills of students in the control class. The success of the application of guided inquiry in multiple representation-based virus learning is also evidenced by the classical mastery of the experimental class that exceeds the classical mastery standard presented by Trianto (2011) that a class is said to be complete if ≥85% of students in the class have completed learning with classical completeness

(KKM ≥70). The results of classical student learning mastery can be seen in graph 1 below.

Experimental Class
8%

92%

- Complete
- Not Complete

Control Class
22%

78%

- Complete
- Not Complete
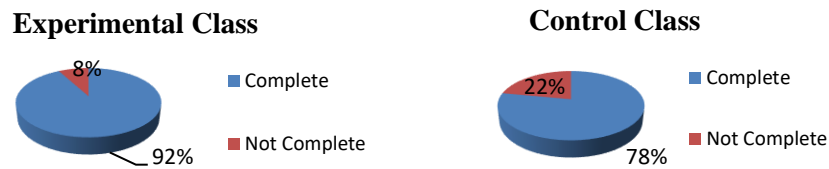
Graph 1 Student Classical Completeness Results

The classical completeness of the experimental class in learning viral material reached 92% of 36 students, meaning that 33 students in the experimental class could reach the KKM (≥ 70), but in control class classical completeness only 78% of 36 students, meaning that 28 students in the control class could reach the KKM (≥ 70). The factor that causes some students to not complete is because when they collect it is not in accordance with the time so that they work are not optimal. In addition, the factor that causes the lack of student scores is that some students still do not understand the steps for working with student's book. This is because the previous habit of only using PPT where learning takes place only transfers knowledge from teachers to students. The diverse habits of students make lesson plans not always run well and affect learning outcomes (Sumaryati & Hasanah, 2015).

Assessment activities use the written test method in the form of description questions using a minimum of C4 (analyzing) questions which include high-level abilities. Based on Bloom's taxonomy level on the ability to analyze (C4), synthesize (C5) and evaluate (C6) are classified as higher order thinking (Zohar & Dori, 2003). Assessment of critical thinking skills is carried out at the beginning and end of learning. Aspects of critical thinking skills assessed include (K1) identifying conclusions, (K2) identifying or formulating questions, (K3) identifying and formulating criteria to consider possible answers, (K4) look for similarities and differences, (K5) why?, (K6) defining strategy, (K7) ability to give reasons, (K8) identifying implicit reasons, (K9) identify explicit reasons, (K10) make assumptions based on statement, (K11) selecting criteria for making solutions, (K12) considering alternatives. Based on the results obtained, there was an increase in students' critical thinking skills. This can be seen in Figure 1
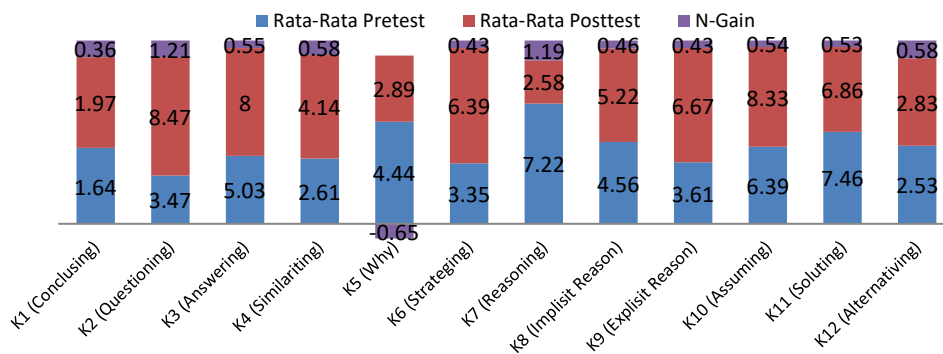
- Rata-Rata Pretest
- Rata-Rata Posttest
- N-Gain

	K1 (Conclusing)	K2 (Questioning)	K3 (Answering)	K4 (Similariting)	K5 (Why)	K6 (Strateging)	K7 (Reasoning)	K8 (Implisit Reason)	K9 (Explisit Reason)	K10 (Assuming)	K11 (Soluting)	K12 (Alternativing)
N-Gain	0.36	1.21	0.55	0.58	2.89	0.43	1.19	0.46	0.43	0.54	0.53	0.58
Posttest	1.97	8.47	8	4.14		6.39	2.58	5.22	6.67	8.33	6.86	2.83
Pretest	1.64	3.47	5.03	2.61	4.44	3.35	7.22	4.56	3.61	6.39	7.46	2.53
					-0.65							

Figure 1 Critical Thinking Ability of Experimental Class Students

Based on the graph, almost all aspects experienced an increase in the number of students in each grade as evidenced by N-gain due to the presentation of viral material through visualization of images, tables, schematics and videos so that students were directly involved in observing objects and finding relevant facts. According to research Handayani et al., (2016) Direct learning experience will be more memorable for students in building their knowledge.

However, there are indicators whose graphs have decreased, such as the graph on the why indicator and conclusioning. In K5 there was a decrease because students' knowledge about virus material was still lacking so that students had difficulty to interpret a statement in order to be able to answer the question. Meanwhile, the indicators for formulating student conclusions have decreased because students must be able to connect between variables to make conclusions. Formulation of conclusions is a process involving relationships between variables and finding trends in available information (Qualter & Harlen,

2014).

However, the indicators of identifying or formulating questions have improved quite well. This is because at the first meeting until the last meeting students tend to be active in learning activities through asking questions and also at each meeting students are trained in formulating questions through a student book with a guided inquiry model based on multiple representations.

The Effectiveness of Application of Guided Inquiry Based on Multiple Representations on Students' Critical Thinking Ability

The effectiveness of discovery-based learning on students' critical thinking skills can be analyzed through the results of the pre-test and post-test of the control class and the experimental class using the N-Gain test. The results of the N-Gain test for the experimental and control classes are presented in table 3.

Table 3 Number of control and experimental class students based on N-gain category

Class	N	Category N-Gain			Mean N-Gain	Enhancement N-Gain
		High	Medium	Low		
X MIPA 5 (Control)	36	0	17	19	0,18	23%
X MIPA 3 (Experimental)	36	8	22	6	0,42	

Based on table 3, the experimental class N-gain is better than the control class. The results of the N-gain test showed that the increase in understanding of virus material in the experimental class was better than the control class. This means that the application of discovery-based learning on virus material has an effect on increasing students' critical thinking skills. Critical thinking ability is not something innate, but it can be taught to the students (Fahim & Hajimaghsoodi, 2014). Increasing students' critical thinking skills with discovery-based learning because this learning with student book makes it easier for students to find virus concepts. One of the advantages of the multiple representation-based guided inquiry learning model is that it allows students to find and develop concepts systematically (Annafi, 2016).

The supporting data contained in this study is in the form of student responses to discovery-based learning that has been carried out. Based on the results of the questionnaire, the students' responses in experimental class showed that students had felt the positive aspects of the learning process. This is shown in discovery-based learning to get the average percentage of student responses, which is 81.1 in the good category. The learning that has been done makes the learning atmosphere more fun, makes students motivated, challenged and enthusiastic in learning. In addition, it also attracts interest in learning, makes you not sleepy, and can increase learning activities. This is because the learning model applied helps students develop their abilities and allows students to learn actively, being braver to express the opinions that are in their minds so that learning can be successful. Success in learning science may be attributed to several factors such as interest, motivation, student engagement (Zhu, Y., & Leung, 2010).
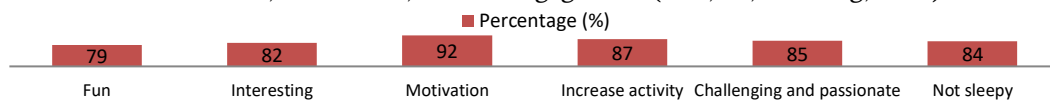

■ Percentage (%)					
79	82	92	87	85	84
Fun	Interesting	Motivation	Increase activity	Challenging and passionate	Not sleepy

Fig 2 Recapitulation of Student Response Results

Based on the student response questionnaire, 94% of students stated that the guided inquiry model based on multiple representations was more fun so that the material was easier to understand. This statement is in line with research (Azizah et al., 2016) that learning with the guided inquiry learning model is very fun, not boring and easier to understand concepts. The data from the teacher's responses obtained a percentage of 83% which was included in the good category with the teacher stating that learning made students challenged to be more active and demanded students to be creative and work hard in participating in learning. This is because the learning model implemented requires students to actively make discoveries to get concepts with the encouragement given by the teacher through various questions contained in the student book supported by the results of the percentage of learning implementation 75% per meeting.

Students will more easily understand the concept because they carry out the discovery process through self-investigation.

CONCLUSION

Based on the results of the research and discussion, it was concluded that the application of guided inquiry in multiple representation-based viral learning was effectively applied to students' critical thinking skills at SMA Negeri 1 Lasem.

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