



Guided inquiry model assisted HOTS-Based Worksheet for critical thinking ability in online learning during pandemic covid-19



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ARTICLE INFO	ABSTRACT
<p>Article history Received August 12, 2021 Revised January 02, 2022 Accepted February 27, 2022</p> <p>Keyword: Critical thinking Guided inquiry HOTS-based worksheets Online learning</p>	<p>21st-century education requires students to have critical thinking skills. This research aim was to analyze the influence of the guided inquiry learning model assisted by student worksheets based on Higher Order Thinking Skills (HOTS) on students' critical thinking skills during online learning at Senior High School 1 Gadingrejo class XI Science Major. This research used a quasi-experiment design with a pretest-posttest non-equivalent control group design. The samples in this study were students of the Natural Science Major class, XI Science Major 2 as the control class, and XI Science Major 7 as the experiment class, which was selected through the purposive sampling technique. The research data consist of quantitative and qualitative. Quantitative data from the average pre-test, post-test, and N-Gain score as a result of critical thinking skills were analyzed by an independent sample t-test ($\alpha=0.05$) using SPSS 25.0 For Windows. The results showed a significant effect of applying the HOTS-based guided inquiry learning model on students' critical thinking skills during online learning (Sig. 0.010 < 0.05). The experiment class N-gain value of 0.65 is classified as a medium category. Qualitative data in the form of a questionnaire on the implementation of online learning with an average percentage result of 64.2% is included in the strong category. 92% of students agree that the difficult questions in the HOTS-based worksheets help improve critical thinking skills. Therefore, the guided inquiry learning model assisted by HOTS-based worksheet students affects students' necessary thinking skills during online learning.</p>
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Introduction

The implementation of 21st-century education affects the quality of human resources produced. The success

indicators of 21st-century students are based on the ability to solve problems, think critically, communicate, and use the information to solve complex problems, adapt and innovate to facing of the

demands of the era by expanding their strength in technology to create new knowledge (Hernawati et al., 2020; Zubaidah, 2016). Critical thinking is a process that aims to make rational decisions about what to believe or do (Ennis, 1996). Critical thinking can be defined as a person's decision-making, analysis, and problem-solving ability to the problem they face (Tüm kaya et al., 2009).

The increasingly widespread digital era makes critical thinking skills indispensable to catch and filter the information explosion that occurs (Changwong et al., 2018). Currently, irresponsible users of social media use it a lot to spread hate speech and unverified information that unsettles society (Redhana, 2019). Critical thinking skills are important for students to collect and assess relevant information, generate conclusions and solve problems for good reasons (Retnowati et al., 2016).

Learning in Indonesia has determined the strengthening of critical thinking patterns through critical learning as an improvement in implementing the 2013 Curriculum (Kementerian Pendidikan dan Kebudayaan, 2018). The results of a preliminary survey in January 2021 to the students of Senior High School 1 Gadingrejo class XI Science Major stated that the teaching materials used were 60% textbooks, 25% modules, and 15% worksheets. However, 65% of students stated that the Assignment usually given in each learning material had not trained critical thinking skills. Critical thinking can improve students' analytical skills, which can assist in implementing the National Assessment, a substitute for the National Examination.

The Covid-19 pandemic, including in Indonesia, resulted in a policy for implementing online learning supported by a platform or Learning Management System (LMS) to assist the teaching and learning process. The results of an interview in January 2021 with a class XI biology teacher at Senior High School 1 Gadingrejo said that during the Covid-19 pandemic, learning was carried out online using the platform Google Classroom. The learning process does not require the active involvement of students because they only receive study material from the teacher, so they cannot train students' critical thinking skills.

Responding to the implementation of online learning, to implement a suitable learning model, it is also necessary to use appropriate teaching materials (Maulina et al., 2021). The expectancy of students' critical thinking skills can be trained and built (Fitriani et al., 2020; Irdalisa et al., 2020). One of the teaching materials to help their critical thinking skills is the Student worksheet (Kristianingsih et al., 2016). Student worksheet based on Higher Order Thinking Skills (HOTS) is expected to be able to explore students' abilities related to higher-order thinking skills. HOTS-based student worksheet presentations are directed at presentations with indicators and aspects of scientific creativity, critical thinking, and creative thinking (Astutik et al., 2020; Duran & Sendag, 2012).

The previous research (Ade, 2020) states that the HOTS-based Worksheet could train the students' higher-order thinking skills. Pratiwi and Hariyatmi (2015) suggested that students are given regular training in the form of HOTS questions to have critical and high-level thinking skills and a good understanding of the material. Previous research Fajariyah et al. (2016) revealed that implementing the guided inquiry learning model can improve students' critical thinking skills and learning achievement on the material solubility and solubility product of class XI Science Major 3th in Senior High School Al Islam 1 Surakarta. In addition, HOTS-based learning tools have the advantage of being able to help students differentiate ideas, can argue well, can solve problems, be able to construct explanations, be able to hypothesize, and understand complex things clearly (Widodo & Kadarwati, 2013).

The previous results explained what had been carried out previously stated that the HOTS ability of students during online learning during the Covid-19 Pandemic (Fatimahtuzzahroh et al., 2021). The situation stated that the implementation of HOTS-based learning had not been carried out optimally, with the results of measuring the HOTS ability value in the low category ($p < 0.05$). The study's results revealed that obstacles were encountered during the implementation of the HOTS-based learning process, especially in the achievement of student competencies (Ichsan et al., 2020; Ichsan et al., 2019). Various efforts and efforts have been made; one alternative was implementing discovery learning to stimulate students'

HOTS in learning outcomes (Puspa et al., 2021). Therefore, this study aims to analyze the effect of the guided inquiry learning model assisted by student worksheets based on Higher Order Thinking Skills on students' critical thinking skills during online learning.

In Science, especially in biology subjects, the truth lies in observed facts and empirical evidence (Maulina et al., 2020). Reproductive in Human System Chapter used in this research. The subject matter is used because the topic of biology has complex characteristics and requires contextual implications to understand the material comprehensively. Moreover, the reproductive system chapter is related to daily life, so the student needs critical thinking skills. Delivering deep and contextual material regarding the reproductive system is expected to enable students to relate the material obtained to various phenomena encountered around them and equip themselves to maintain their reproductive health.

Method

This research has used a quasi-experiment research method, with the design being a pretest-posttest non-equivalent control group design where both classes (experiment and control) were used as research subjects. The experiment group set in online learning using a guided inquiry model assisted by HOTS-based worksheets. Meanwhile, as the comparison group, the control group applied the expository model and Worksheet commonly used by teachers.

This research was held at Senior High School 1 Gadingrejo in the even semester of the 2020/2021 academic year. The population of this research was students of class XI Science Major Senior High School 1 Gadingrejo has as many as seven classes. Samples were taken from the population using the purposive sampling technique. The sample in this study is class XI Science Major 2 as a control class by applying the expository model and XI Science Major 7 as an experiment class by applying a guided inquiry model assisted by HOTS-based worksheets. The number of students in each class was 34 for XI Science Major 2 and 30 for XI Science Major 7. Each group was given the same pre-test and post-test. The design of this study showed in Table 1.

Table 1. Research design

Class	Pretest	Treatment	Posttest
E	O ₁	X ₁	O ₂
C	O ₃	X	O ₄

The description of Table 1, experiment class (E), Control class (C), pretest score of critical thinking in experiment class (O₁) while control class (O₃), posttest score of critical thinking in experiment class (O₂) while control class (O₄), experimental treatment using guided inquiry model (X₁) while control treatment using expository model (X).

There are two types of research data: quantitative and qualitative. The data of critical thinking skills tests on reproductive system material obtained through pre-test and post-test were given to students at the beginning and end of learning both in the control class and experiment class, which is processed to see an increase in scores (N-gain). The questions are ten essay questions with five indicators of critical thinking ability. The indicators used are simple explanations, building basic skills, providing further explanations, concluding, and strategies and tactics (Ennis, 1996, 2011). Quantitative data analysis using independent sample t-test with SPSS version 25 for windows.

The qualitative data in this research is in the form of questionnaire data on the implementation of guided inquiry learning assisted by a HOTS-based worksheet, totaling 17 questions using google form. Measurement of data using a Likert scale on aspects of attitudes, opinions, and perceptions of students on the implementation of learning and analyzed with descriptive statistics. The procedure for conducting the research can be seen in Figure 1.

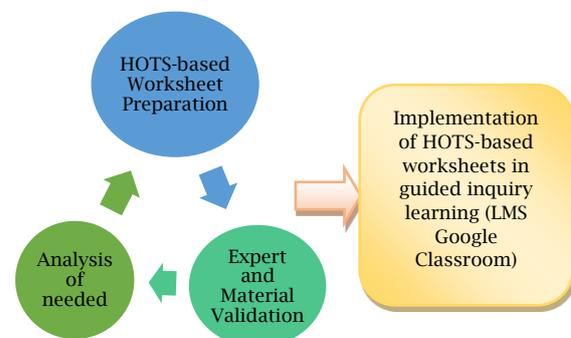


Figure 1. Research procedure

Results and Discussion

The analysis result of students' critical thinking ability tests showed in [Tabel 2](#). The interpretation of [Table 2](#) was that the guided inquiry model assisted by the HOTS-based Worksheet improves students' critical thinking skills at Senior High School 1 Gadingrejo. The analysis of the critical thinking ability test ([Table 2](#)) results in the experiment and control classes showed that the average scores had been improved. However, the increase in experiment classes is higher. Based on the test result of the independent sample t-test using the N-gain score, there was a significant influence from the guided inquiry learning model assisted by the HOTS-based Worksheet on students' critical thinking ability during online learning (Sig. $0.01 < 0.05$). With N-gain of experiment class, 0.65 belongs to the moderate category.

The average score of the critical thinking ability test per item is presented in [Table 3](#). It is visible that each question number consists of indicators of critical thinking ability. The indicators of critical thinking skills assessed are providing simple explanations, providing further explanations, building basic skills, concluding, and strategies and tactics. The higher score increase occurred in the experiment class, which was 47%, compared to the control class, which was 37%.

The results of increasing critical thinking skills through the guided inquiry learning model are also supported by research by [Ilhamdi et al. \(2020\)](#), which states that the guided inquiry learning model has better results on critical thinking skills. Based on the average value of the pre-test and post-test obtained from 48.67, it increased to 77.52 from the low to the medium category.

The difference in the increase in the highest post-test score in the experiment class was found in the indicator providing a simple explanation which increased in value by 54%. In the indicator providing a simple explanation, students were asked to focus on questions and consider possible answers in answering a question that requires a simple explanation ([Ennis, 2011](#)). The increase occurred because the students had been trained in the problem orientation and problem formulation steps using the guided inquiry model during the learning process. So, the students can focus on the questions well, then answer the questions correctly.

The difference in the increase in the lowest post-test score was found in the indicator of building basic skills, which increased in value by 30%. In building a basic skills indicator, the student is asked to consider the observations' credibility and result ([Johnson, 2007](#)). This result is due to the lack of students' cycle or graph reading skills. Research on the interpretation of graphs and data conducted by also shows that students still struggle with reading graphs. This result is shown by [Mustain \(2015\)](#) the Test Of Graphing in Science (TOGS) test, where both students have fewer correct answers than 50%. Students cannot interpret graphs and data ([Mustain, 2015](#)). Although in the learning process using the guided inquiry model, they have been trained to read graphs and menstrual cycles in the Worksheet, the cycle reading skill cannot improve instantly and need to be trained with more examples to improve.

The third indicator, which provides a further explanation, has increased by 48%. Students can answer questions correctly because they have been trained with HOTS questions given through HOTS-based worksheets in the learning process.

Table 2. Analysis of students' critical thinking ability test

Data	Class	$\bar{x} \pm Sd$	Normality test	Homogeneity test	Independent sample t-test
Pretest	E	25.23 \pm 16.78	Sig. 0.145 > 0.05	Sig. 0.366 > 0.05	Sig. 0.035 < 0.05
	C	25.00 \pm 19.69	Sig. 0.200 > 0.05		
Posttest	E	73.07 \pm 16.05	Sig. 0.060 > 0.05	Sig. 0.471 > 0.05	Sig. 0.010 < 0.05
	C	63.60 \pm 17.86	Sig. 0.200 > 0.05		
N-gain	E	0.65 \pm 0.17	Sig. 0.200 > 0.05	Sig. 0.471 > 0.05	Sig. 0.010 < 0.05
	C	0.52 \pm 0.18	Sig. 0.200 > 0.05		

Table 3. Average score of critical thinking ability test

Critical thinking ability indicators	Experiment class average rating (%)		N-gain (%)	Control posttest average value (%)		N-Gain (%)
	pretest	posttest		pretest	posttest	
Provide a simple explanation	25 (very less)	79 (good)	54	20 (very less)	68 (enough)	48
Building basic skills	19 (very less)	49 (less)	30	21 (very less)	49 (less)	28
Provide further explanation	31 (very less)	79 (good)	48	32 (very less)	69 (less)	37
Conclude	25 (very less)	74 (enough)	49	25 (very less)	62 (enough)	37
Strategies and tactics	20 (very less)	73 (enough)	53	24 (very less)	57 (enough)	33
Average	24	71	47	24	61	37

The fourth indicator is concluding, and this indicator has an increase of 49%. The condition is because, at the stage of implementing learning using a guided inquiry model, students are invited to think coherently, starting from problem orientation, formulating problems, formulating hypotheses, collecting data, testing hypotheses, and finally formulating conclusions. With this model, students are invited to make conclusions by thinking in an organized and scientific manner. To formulate explanations or arguments that support conclusions, students must look for evidence that outlines the reasons so that conclusions can be accepted (Zubaidah et al., 2015). The possibility of a well-organized argument relates to how students solve the main problem, make decisions, consider all possible aspects, study and conclude logically.

The fifth indicator is managing strategies and tactics, which increased by 53%. Students are asked to define the problem, choose criteria, and formulate a solution (Emmis, 2011). Students can answer well because in the learning process using HOTS-based worksheets; they are trained with questions or problems that require strategies and tactics to solve them.

The increase in students' critical thinking skills in this study was because students in the experiment class had been trained with questions during the learning process through HOTS-based worksheets, which had an impact on the careful and thorough behavior of students (Suprpto et al., 2020). In answering questions, experiment class students have been accustomed to reading or observing the stimuli presented in the questions, either in the form of pictures or data or facts. This situation causes students to think constructively by connecting the stimulus

with the theoretical concepts they already have (Mukti et al., 2021). Constructivist thinking activities participate in developing students' critical thinking skills. The syntax of the guided inquiry learning model supports the implementation of scientific thinking activities in learning through the stages of problem orientation, formulating problems, and hypotheses, collecting data, analyzing data, and concluding (Sanjaya, 2015).

This statement is supported by the research of Barnett and Francis (2012), which shows that questions at the HOTS level encourage students to think in-depth about the learning material. Students seek and find answers based on the existing stimulus. Thus, the learning process using a guided inquiry model follows Piaget's theory (as cited in Sanjaya, 2011), that knowledge will be meaningful when students seek and find them themselves. Therefore, Pratiwi and Hariyatmi (2015) suggests that students are given regular training in the form of HOTS questions. Thus, they can think critically and at a high level and understand the material being taught.

The improving critical thinking skills are also supported by a questionnaire on student responses to learning using a guided inquiry model assisted by HOTS-based worksheets. Figure 2 shows that the students agree that difficult questions in LKPD help improve critical thinking skills (92%). Students agree that they prefer to learn with the guided inquiry model compared to the usual model (76%). Students enjoy learning online using the guided inquiry model (76%). Students agree that using the guided inquiry learning model increases learning motivation (88%) and is not boring (92%).

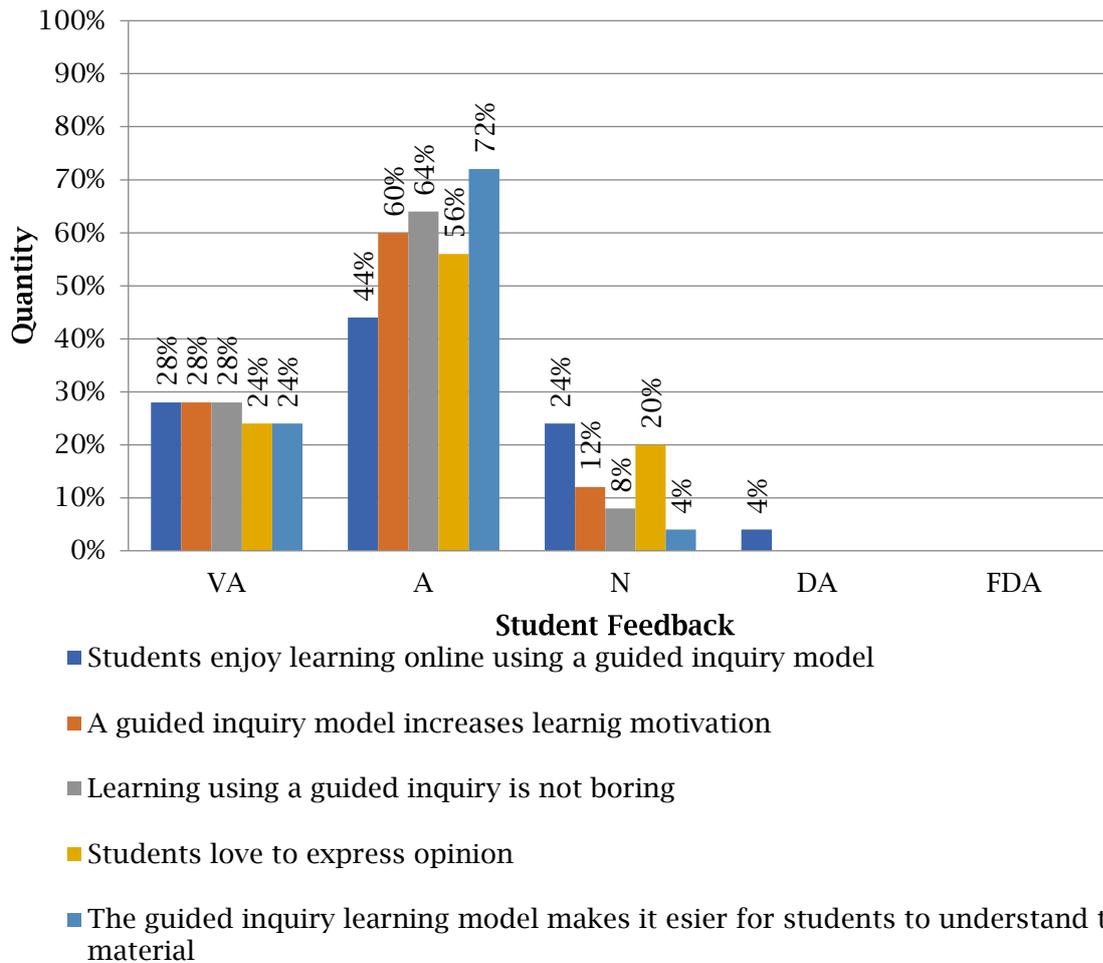


Figure 2. Benefits of Implementing the guided inquiry model

Improving students' critical thinking skills using the guided inquiry learning model assisted by the HOTS-based Worksheet is also inseparable from students' activeness in presenting the worksheet results and exchanging opinions on the Worksheet answers through google meet. Because during the learning process, students look enthusiastic in expressing their group opinions (Figure 3). Therefore, implementing the guided inquiry learning model improves the student's understanding of biology material. Hamalik (2004) statement that to be active, the student, as long as the learning process should be do something according to their learning objectives, give an opinion on an event that occurs and experience or share something.

The results showed a significant effect of applying the guided inquiry learning model assisted by the HOTS-based Worksheet on students' critical thinking skills during online learning (Sig. 0.010 < 0.05). The experiment class N-gain value of 0.65 is classified as the medium category. The improving critical thinking skills are also supported by a questionnaire on student responses to learning using a guided inquiry model assisted by HOTS-based worksheets. 92% of students agree that the difficult questions in the HOTS-based worksheets help improve critical thinking skills. This research shows that the guided inquiry learning model can enhance students' critical thinking skills, enthusiasm for learning, motivation, and activeness in online learning.

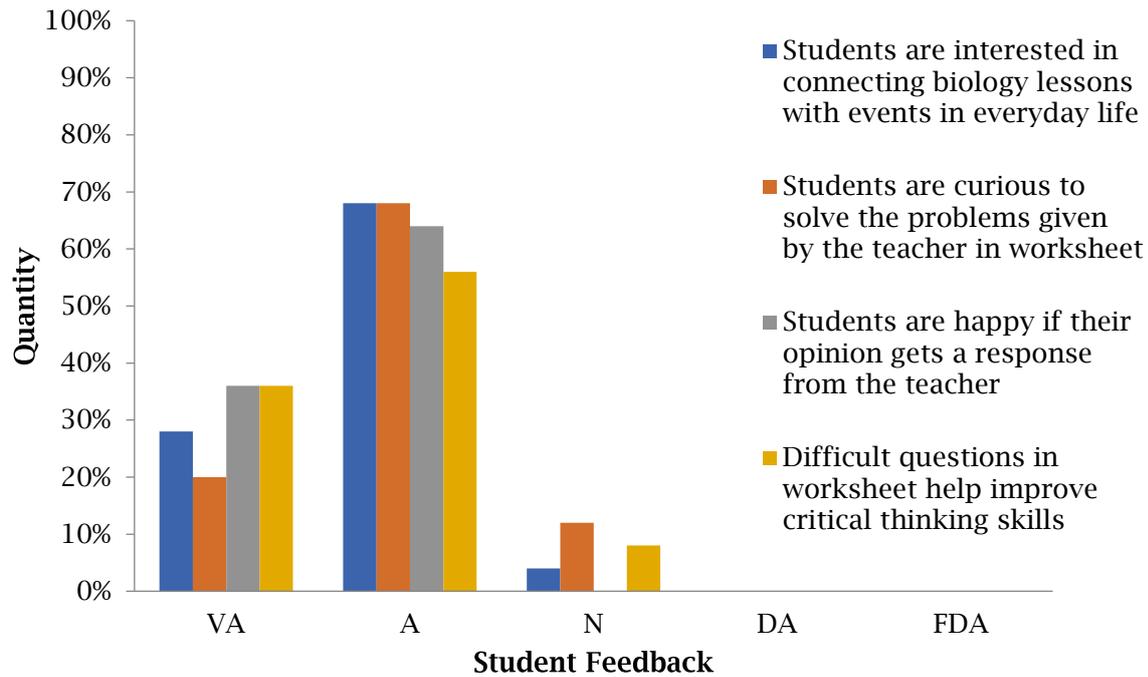


Figure 3. Learning supporting factors

Conclusion

The guided inquiry learning model assisted by the HOTS-based Student Worksheet has a significant effect ($\text{Sig. } 0.010 < 0.05$) in improving students' critical thinking skills during online learning on the human reproductive system material during online learning at Senior High School 1 Gadingrejo class XI Science Major 7.

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