

Research Article

The Effect of Inquiry Learning on the Critical Thinking Skills of Students in the Era of the Industrial Revolution 4.0

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Abstract.

Competition in the 21st century demands that human resources have excellence in both academic and non-academic fields. The quality of human resources can be seen based on the attitude, character, and critical behavior possessed by each individual. Education is the first step in efforts to improve the quality of human resources in order to compete in the 21st century. One of the education that must be mastered is science and technology, so that in its completion teachers must be able to educate their students to be able to think at a high level or high order thinking skill (HOTS). This includes aspects of critical thinking skills, which are abilities needed by students to be able to survive in the 21st century. The goal that is carried out in this journal is how to improve students' critical thinking skills. This research is a quasi-experimental study with a posttest-only control group design, this research was conducted at SMAN 1 Panawangan. The appropriate learning model to improve critical thinking skills is the inquiry learning model because the inquiry learning model is a process of obtaining information by observing and experimenting. The results obtained after the research proves that students who are taught to use the inquiry learning model have higher critical thinking skills than students who are taught to use the conventional model.

Keywords: inquiry learning, critical thinking skills, industrial revolution

1. Introduction

Competition in the 21st century demands that human resources have excellence in both academic and non-academic fields. The quality of human resources can be seen based on the attitude, character, and critical behavior possessed by each individual. Education is the first step in efforts to improve the quality of human resources in order to compete in the 21st century. One of the educations that must be mastered is education about science and technology. Biology is part of learning science. Biology examines living things that exist in nature so that it requires reasoning, analysis and thinking that is more complex in understanding biology. To solve this problem, it is necessary

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to have high order thinking skills (HOTS) which include aspects of critical thinking skills which are abilities needed by students to survive in the 21st century, because critical thinking skills play an important role in the process of learning. a combination of new knowledge with the initial knowledge possessed by students, so that students' reasoning on a problem will be more scientific and also critical. One of the demands that the millennial generation needs to have in the industrial era 4.0 is the ability to think critically. Critical thinking is a thinking process that involves mental activity in terms of solving problems analytically and reflectively, making accurate decisions and conducting inquiries in science learning [1].

Critical thinking is not only done to find answers, but also questions the truth regarding facts or information obtained before using it as an alternative solution in solving problems. Critical thinking ability is a high-level thinking ability that will make it easy for students to make decisions that can be trusted and can be accounted for [2].

The appropriate learning model to improve critical thinking skills is the inquiry learning model because the inquiry learning model is a process to obtain information by observing and experimenting to find answers or solve problems using critical and logical thinking skills. There are several syntaxes or steps in the application of the inquiry learning model, one of which is according to [3] in which there are 6 stages, namely, (1) identification and determination of the scope of the problem, (2) formulation hypotheses, (3) data collection, (4) data interpretation, (5) conclusion development, and (6) analyzing the inquiry process.

The inquiry learning model has several advantages, including: students can be actively involved in developing knowledge, obtaining information, solving problems, and seeking the truth of knowledge, rather than just memorizing knowledge without first finding out about the truth. Inquiry can develop higher order thinking habits, be skilled in scientific work, and develop students' scientific character. Inquiry syntax can be integrated with other learning syntax in its implementation in the classroom, so that it can develop a better understanding of the material [3].

The development of the potential of students can be achieved by creating a well-planned learning atmosphere. Based on the results of observations at SMAN 1 Panawan-gan that the learning process still tends to be centered on educators, especially in class XI. This causes students to tend to be passive and only accept material from what has been conveyed by the educator without developing it independently so that students are unable to develop their thinking skills and their learning outcomes are low.

Based on the description above, the researcher felt compelled to conduct a study entitled "The Influence of Inquiry Models to Improve Critical Thinking Skills in the

Industrial Age 4.0 on the Structure and Function of Animal Tissue Materials at SMAN 1 Panawangan.

2. RESEARCH METHOD

This research is a quasi-experimental study with a posttest only control group design. This research was conducted at SMAN 1 Panawangan in the odd semester of the 2021/2022 academic year. The population in this study were all class XI MIPA with a total population of 93 people spread over 4 classes. Sampling was done by purposive sampling technique so that 2 sample classes were selected, namely class XI MIPA 1 as the experimental class using an inquiry model and class XI MIPA 4 as a control class using conventional learning models. The test data of learning outcomes and critical thinking skills obtained were analyzed using statistical tests. Data analysis begins with normality and Wilcoxon tests. In carrying out this research, we conducted it at SMAN 1 Panawangan XI MIPA with a total population of 93 people spread over 4 classes. Sampling was done by purposive sampling technique so that 2 sample classes were selected, namely class XI MIPA 1 as the experimental class using an inquiry model and class XI MIPA 4 as a control class using conventional learning models

3. results and discussion

The discussion in the research that has been carried out with the application of the inquiry learning model to the structure and function of animal tissue at SMA Negeri 1 Panawangan class XI IPA 2 as an experimental class and class XI IPA 4 as a control class shows an influence on students' critical thinking skills. In testing critical thinking skills, of course, there are several indicators that accompany it, so that the questions/tests conducted can be said to have the ability to

test students' critical thinking skills. In this case the researcher uses six indicators of critical thinking skills according to [4] the six indicators are interpretation, analysis, evaluation, inference, explanation, and self regulation. The following are the types of questions that the researcher uses and the indicators that become the benchmark for the posttest items.

The research design used is Posttest-Only Control Design where in this research design only posttest activities are carried out at the end of learning. The results of the posttest in the control class and the experimental class can be seen in Table 2.

TABLE 1: Distribution of indicators on items.

No	Aspects and Indicators	Number of Item
1	Interpretation Can write down what is being asked about clearly and precisely	1 and 6
2	Analysis Can write down what must be done in completing question	2, 5, 7, and 10
3	Evaluation Writing problem solving	3
4	Inference Can draw conclusions from what is being asked Logically	4 and 8
5	Explanation Can write down the final results, and can give reasons for the conclusions drawn	
6	Self Regulation Can review the answers given / written	

TABLE 2: posttest average score.

Variable	Controll Class	Experiment Class
	Posttest	Posttest
Total Student	25	22
Average Critical Thinking Skills Score	4.50	4.95
Standard Deviation	2.06	1.80

Based on the posttest average value, there are differences in students' critical thinking skills between the control and experimental classes. It can be seen that the control class has an average value of 4.50 and the experimental class of 4.95 where the average value in the experimental class has a higher value than the average value in the control class. These differences, of course, occur because of the application of different learning models in the two classes. Furthermore, after calculating the average posttest results, we then conducted a normality test to find out whether the data we got were normally distributed or not. The normality test that the researchers carried out was using the Shapiro-Wilk normality test, where this test was used to treat small amounts of data which can be seen in Table 3 as the results of the normality test.

TABLE 3: Normality results.

	Class	Saphiro-Wilk Significance
Posttest Results	Controll	0.047
	Experiment	0.479

Table 3 shows that the significance for the control class is 0.047 and for the experimental class it is 0.479. Where to see if the data is normally distributed, the significance value of the data that must be obtained is > 0.05 . If it is seen from the data listed for the data from the control class the data are not normally distributed because the

significance value of the control class < shapiro-wilk significance value = 0.047 < 0.05. Meanwhile, for the experimental class the data is normally distributed because the significance value of the experimental class > the shapiro-wilk significance value = 0.479 > 0.05.

Because the data are not normally distributed, the non-parametric Wilcoxon test was carried out which can be seen in Table 4, where the significance value for the Wilcoxon test is <0.05. In the table it is stated that the significance value of the Wilcoxon test is 0.000 which indicates that H_0 is accepted, there is an influence on the use of the inquiry model to improve students' critical thinking skills on the structure and function of animal tissue.

TABLE 4: Wilcoxon test results.

	Posttest Results
Asymp. Sig. (2-tailed)	0.000

Based on the data in Tables 1 to 4, it shows that there are differences in post-test results from the control class and the experimental class. However, the difference obtained is not in accordance with the prediction where the difference is very thin. Even so, when the test results state that H_0 is accepted, even though it is only a little, there is still an effect. The difference in the post test results, of course, occurs because of the use of the inquiry learning model where this model is an innovation in learning that is able to make students have more in-depth knowledge. This can happen because in learning that uses this inquiry model, students are more involved. The learning process requires students to directly participate actively and take a role during learning activities. With the syntax that supports student centered learning, students are able to work on their own and build their own knowledge so as to produce an understanding of the material being studied [5].

The inquiry learning model is able to train students to think at higher levels so as to hone students' abilities. In this case, the ability of students to be involved in learning to the fullest is to be able to search and analyze systematically, critically, logically and analytically. Thus, this inquiry learning model is very suitable to help students build critical thinking skills. Critical thinking itself is one part of the higher-order thinking skills that students must have in facing the era of industry 4.0 and society 5.0. The syntax that exists in inquiry learning has a correlation with critical thinking skills so that in this study it was proven that students who were taught by the inquiry learning model had higher critical thinking skills than students who were taught by conventional models

where conventional learning was only dominant in the role of the teacher. In learning so that it tends to make students not active in the learning process [6].

Learning with the inquiry model can make students think critically where students are encouraged to make observations so as to bring up a conclusion that ultimately allows students to find their own scientific concepts. Thus, the cognitive aspects of students can be built properly. Not only that, the inquiry learning model is also able to train the affective and psychomotor aspects of students. This can happen because the existing syntax requires students to think critically, namely by analyzing problems to find a solution and determining its relationship with concepts in biology subjects [7].

In practice, the inquiry learning model is inseparable from a weakness where the learning process that has been carried out in the experimental class at SMAN 1 Panawangan shows that the teacher's skill in allocating time has a considerable influence on learning success. This is because in the syntax of inquiry learning there are stages that require students to study literature to obtain information related to learning materials which can take quite a long time. Good learning planning can support good learning outcomes as well.

As for the research that has been done that the learning time is only 20 minutes in 1 lesson hour, making it difficult for researchers to allocate time for each syntax of the inquiry learning model. Thus, the steps chosen and recommended in the emergency curriculum during the COVID-19 pandemic are to provide learning materials in outline only. However, in the implementation of learning, especially by using this inquiry learning model, the time allocated for learning 2 hours of lessons, which is 40 minutes, is not enough to build students' knowledge. So that the results obtained as described above are that both in the experimental class and in the control class, the post test results did not reach the minimum completeness criteria. This also shows that students' critical thinking skills are still low although in this case there is also a difference between the control class and the experimental class [8].

The implementation of learning using this inquiry learning model has other weaknesses. Apart from the time to implement the inquiry learning model which is quite long, it makes it difficult for researchers to adjust to the allotted time, there are also difficulties in controlling the activities and success of students. Designing learning with an inquiry model, it will collide with the habits of students [8]. In line with this statement, students at SMA N 1 Panawangan are accustomed to conventional learning models carried out by teachers so that when research is carried out with the application of this inquiry learning model, it is quite surprising for students. This results in students not being too focused on learning which in the end makes their learning outcomes low.

Moreover, in this case the evaluation tool used in analyzing student learning outcomes is a question based on critical thinking skills so that students are also less able to answer these questions.

This research only focuses on one independent variable, namely the inquiry learning model. However, in practice there are still other variables that affect the dependent variable in the form of students' critical thinking skills. Among other things, namely the initial ability of students, the ability of teachers and students' learning motivation. As the results of [9] where students' initial knowledge has an influence on student learning outcomes with a percentage of 28.8%. Thus, the low post-test results which indicate the low critical thinking skills of students at SMA N 1 Panawangan class XI are strongly influenced by the students' prior knowledge. Initial knowledge itself can be built during reflection on learning at the previous meeting so that students will prepare for the next learning. In this study, the researcher only entered during the implementation of the research, namely learning the structure and function of animal tissue. While at the previous meeting the learning was carried out by the subject teacher so that the researcher could not control or instruct students to build their initial knowledge to learn on the material being studied [9].

4. Conclusion

Based on the results of research and discussion, it can be concluded that the inquiry learning model applied at SMAN 1 Panawangan is very suitable to help students build critical thinking skills. Critical thinking itself is one part of the higher-order thinking skills that students must have in facing the industrial era 4.0. The syntax that exists in inquiry learning has a correlation with critical thinking skills so that in this study it was proven that students taught by the inquiry learning model had higher critical thinking skills than students taught by conventional models. The syntax or steps in the application of the inquiry learning model, one of which is according to [3] in which there are 6 stages, namely, (1) identification and determination of the scope of the problem, (2) formulation of hypotheses, (3) data collection, (4) data interpretation, (5) conclusion development, and (6) analyzing the inquiry process. Our research and writing results may still contain errors. Therefore we ask for suggestions and inputs that are very helpful for the results of our writing in the future so that it will be better.

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