The Effectiveness of Problem-Based Learning on the Hoax Information to Improve Students' Critical Thinking Skills

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ABSTRACT: The hoax information that spread through social media had a negative impact on society. Therefore, research had been conducted in Gedongtataan Upper Secondary School No.1 to describe the effectiveness of problem-based learning model on hoax information in improving students' critical thinking skills. This study was used the matching only pretest-posttest control group design. The sample in this study was the 11th grade of IPA 4 (experimental class) and the 11th grade of IPA 5 (control class) which was obtained by using purposive sampling technique. The results showed that the average n-gain in the experimental and control classes was 0.7 and 0.6, respectively. Based on this, it could be concluded that the problem based learning model on the hoax information was effective in improving students' critical thinking skill.

Keywords: critical thinking skills, hoax informations, problem-based learning

INTRODUCTION

The development of science in the 21th century is no longer centered on acquiring new knowledge, but on increasing skills. One of the prominent features of the 21th century is the increasingly intertwining between the world of science and technology, so that the synergy of both becomes faster [1], [2].

The development of technology and information has become part of the entire community, especially since the time the internet emerged. The presence of the internet provides many possibilities for exchanging information from various parties and can be accessed quickly and easily [3]. The ease of internet access and the development of search engines that deliver social media such as Facebook, Twitter, Instagram, Line, etc are the main attraction for internet users.

Social media offers many conveniences to obtain and disseminate information, both true and useful information or even false and misleading information [4]. Based on a survey conducted by the Indonesian Telecommunications Society (MASTEL) in 2017, social media became the highest channel for disseminating information, while the hoax content received was at most 26% social politics, 25% SARA, 12% health, 9% food and beverages, 7% of financial fraud, 7% of science and technology, and 14% of others [3].

The existence of hoax information problems can have a negative impact on the community and its environment. One of them has an impact on psychology and also causes paranoid (excessive fear) for the people of Indonesia [3]. For example, cases of hoaxes circulating regarding instant noodles and carbonated drinks. In the issue of hoaxes, instant noodles are said to be toxic because they contain dangerous preservatives. If instant noodles are given droplets of iodine, the instant noodles will turn purple. Whereas carbonated drinks are said to be dangerous because there is an acid content that can clean latrines, rust, and dissolve bones and teeth. As a result of the hoax information that circulated, it caused unrest for consumers and caused losses to the producers (companies) of instant noodles and carbonated drinks which are thought to result from competition in trade [5].

Related to the issue of hoaxes circulating, media literacy requires four abilities to examine information hoax problems, including the ability to analyze, the ability to compare / contrast, evaluate and ability to abstract. Besides this, skills are also needed that can be used to research hoax information. One of the skills to examine the hoax information is critical thinking skills [4].

Critical thinking is thinking rationally and reflective by emphasizing decision making about what to

believe or do [6]. Rational in terms of collecting, interpreting and evaluating information to obtain decisions. Reflective means that students actively consider all alternative things before making a decision [7]. According to Norris and Ennis in [8]. there are several stages in critical thinking, among others, namely 1) clarifying the problem by asking critical questions; 2) collect critical information related to the problem; 3) start to give reasons through several sides or several points of view; 4) collect further information to do further analysis when needed; 5) make and communicate decisions.

So that students can consider between correct and wrong information and can make decisions, students must face problems. To be able to solve these problems can be used problem based learning model (problem-based learning) [9]. the stages of the problem-based learning model consist of student orientation to the problem, organizing students to learn, guiding individual and group investigations, developing and presenting the work, and analyzing and evaluating problem solving processes. The problem-based learning model is designed based on real life and ill-structured problems [10]; [11]; [1-12].

In learning that uses problem-based learning models related to hoax information, students automatically practice to think critically in order to solve the problem, then the stages of the series of activities that will be carried out include students being asked to observe phenomena information about instant noodles and carbonated drinks, Furthermore, students carry out basic clarification on the hoax problem by way of students being required to understand various chemical concepts such as acid base, pH, hydrolysis salt and buffer solution and understand the problem, then students are asked to analyze it. Information related to hoaxes that have been collected by students will be reconsidered from the various sources of information they have explored.

After information is collected from trusted sources, students can conduct investigations. Students make inferences and clarify further, after conducting an investigation related to the right solution to overcome hoax information, then students will conclude by determining what is the right action to overcome the hoax information problem and communicate to others. Thus, the acquired chemical knowledge will become more meaningful and critical thinking skills develop [11,]; [13].

Several studies related to problem-based learning models. Based on the results of research conducted by [14], it was shown that the problem-based learning model was effective in improving the critical thinking skills of junior high school. Then Sari's research results [15] state that problem-based learning models are able to be applied to improve students' critical thinking skills in class VIII science learning in SMP Negeri 5 Sleman. In addition, there is a study by [16] which states that the problem-based learning model has a significant effect on the ability to solve student problems in environmental pollution material. Furthermore, the results of a study conducted by [17] showed that problem-based learning models of pollution by detergent waste were effective in improving students' critical thinking skills in Chemistry learning in the XI MIA class at Bandar Lampung 14th 2nd semester Senior High School.

METHODS

The method used in this study is quasi experimental with matching only pretest and posttest control group design [18].

TABLE 1. The Matching-Only Pretest-Posttest Control Group Design [18]

Class	Treatment			
Control	M	O	C	O
Experiment	M	O	X	O

Information: M is matching, O is the pretest / posttest, X is the treatment in the form of the application of the problem-based learning model, C is the control class with the application of conventional learning.

The population in this study were all students of class XI IPA in Gedongtataan 1 Senior High School academic year 2018/2019 spread in six classes with 200 students. Sample using purposive sampling technique and obtained samples of class XI IPA 4 as the experimental class applied problem-based learning and XI IPA 5 as a control class applied conventional learning.

The instrument used in this study is the test instrument in the form of pretest and posttest, each consisting of 3 open description questions that measure critical thinking skills. The pretest / posttest score data is changed to a value using the formula:

$$\sum x = \frac{\text{student score}}{\sum \text{max score}} \times 100\%$$

Information: x is the value of students

Next, calculate the average pretest and posttest:

$$\bar{x} = \frac{\sum x \text{ student}}{n}$$

information: *n* is the number of students

To test the similarity of the two averages, do the test of normality first to find out whether the sample comes from a population that is normally distributed or not.

In addition, homogeneity tests were also conducted to determine whether the study sample had homogeneous variance or not. After that, two similarity tests were conducted on average using the Independent Sample T Test with the help of SPSS version 16.0. Furthermore, for the posttest value a two-difference difference test was performed with the help of SPSS version 16.0.

N-gain Calculation

From the pretest and posttest scores, the increase is calculated for each student with the normalized gain formula (Hake, 1998):

$$\langle g \rangle = \frac{\% \text{ posttest score} - \% \text{ pretest score}}{100\% - \% \text{ pretest score}}$$

This value is then calculated as the average n-gain in each research class using the formula:

$$\langle \bar{g} \rangle = \frac{\sum \langle g \rangle}{n}$$

The results of calculation of n-gain averages are then interpreted using the criteria from [19] presented in Table 2.

TABLE 2. Criteria *n-gain*

<g>	Category
≥ **0,7**	High
0,7< g ≥0,3	Medium
< 0,3	Low

RESULT AND DISCUSSION

The results of this study are in the form of pretest and posttest scores related to students' critical thinking skills. The average pretest and posttest scores in both experimental and control classes are presented in Figure 1.

Figure 1 shows that the pretest scores of students' critical thinking skills in the control class are not different. Then to ascertain whether the two research sample classes have the same initial ability of critical thinking, then the average value of critical thinking pretest of students in the two research classes was tested using two average similarity tests. Before the two similarity tests were carried out, the normality test and homogeneity test were conducted on the students' average critical thinking pretest. The results of the normality test using the Kolmogorov-Smirnov Z test, can be presented in Figure 2.

Some common challenges found in the problem that asked the students to draw resonance structures involved movement of electrons, arrow drawings, usage and placement of charge, number of resonance structures to draw, following octet rule, and the stability and contribution to the hybrid of each structure. This shows that the students did not possess a developed conceptual understanding of resonance theory and that they face several challenges learning it.

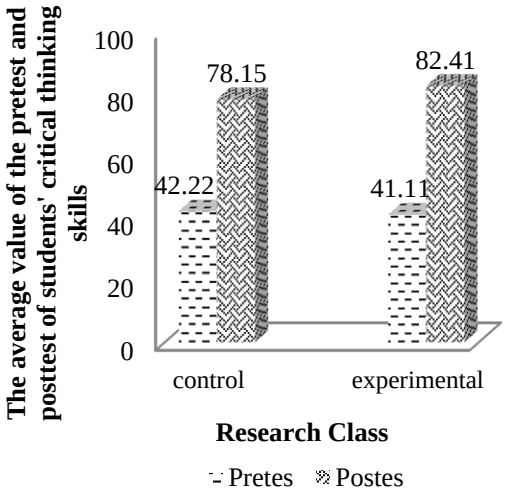

FIGURE 1. Average value of pretest and posttest critical thinking skills.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
experimental	.151	30	.079	.943	30	.109
control	.157	30	.058	.938	30	.080

a. Lilliefors Significance Correction

FIGURE 2. the result of the normality test

In Figure 2, the sig. values obtained for the experimental class and the control class> 0.05. Based on the test criteria, the experimental class and the control class come from populations that are normally distributed. Then the homogeneity test using the One Way ANOVA test presented in Figure 3.

Test of Homogeneity of Variances

critical thinking skills

Levene Statistic	df1	df2	Sig.
.055	1	58	.815

FIGURE 3. The result of the Homogenity test

Obtained sig value of 0.815. Based on the test criteria, the experimental class and the control class have a homogeneous variant. Because the data are normally distributed and homogeneous, the test used is the two average similarity test using the Independent Sample T Test which is presented in Figure 4.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
critical thinking skills	Equal variances assumed	.055	.815	-.282	58	.779	-1.110	3.940	-8.997	6.777
	Equal variances not assumed			-.282	57.941	.779	-1.110	3.940	-8.998	6.778

FIGURE 4. The result of average similarity

Based on the results of the SPSS 16.0 output, the sig (2-tailed) value of 0.779 was obtained. Based on the test criteria, the average score of students' critical thinking pretest in the experimental class is the same as the average value of the critical thinking pretest of students in the control class.

Figure 1 also shows that after learning has taken place an increase in students' critical thinking skills in the experimental class and the control class. Judging from the posttest value, the experimental class was higher than the control class. To ensure that the two research classes have different critical thinking skills, the two difference test is carried out. Before the two difference test is carried out on average, a normality test and a homogeneity test are conducted before the students' critical thinking posttest scores. The results of the normality test using the Kolmogorov-Smirnov Z test, can be presented in Figure 5.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
experimental	.132	30	.195	.952	30	.192
control	.159	30	.052	.920	30	.027

a. Lilliefors Significance Correction

FIGURE 5. the result of normality test

In Figure 5, the sig values obtained for the experimental class and the control class > 0,05. Based on the test criteria, the experimental class and the control class come from populations that are normally distributed. Then the homogeneity test using the One Way ANOVA test presented in Figure 6.

Test of Homogeneity of Variances

critical thinking skills

Levene Statistic	df1	df2	Sig.
3.373	1	58	.071

FIGURE 6. The result of the Homogenity test

Obtained a sig value of 0,071. Based on the test criteria, the experimental class and the control class have a homogeneous variant. Because the data are normally distributed and homogeneous, the test used is the two-mean difference test using the Independent Sample T Test which is presented in Figure 7.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
critical thinking skills	Equal variances assumed	3.373	.071	2.094	58	.041	4.270	2.039	.188	8.352
	Equal variances not assumed			2.094	53.331	.041	4.270	2.039	.181	8.359

FIGURE 7. The result of two-mean difference test

The test results of the difference in two mean state that the value of sig. (2-tailed) < 0.05. That is, accept H_1 or in other words the average value of posttest critical thinking skills of students in the experimental class using the PBM model is higher than the average posttest value of the control class using conventional learning. Thus, a problem-based learning model is effective for improving students' critical thinking skills related to some foods and drinks.

Then calculate the n-gain in the experimental class and the control class presented in Figure 8. In Figure 2, the average n-gain of the experimental class is 0,7 and the control class is 0,6. This is shows that the value of n-gain of students' critical thinking skills in the experimental class is categorized as high, while in the control class it is medium.

Differences in n-gain averages and categories in the experimental class and control class can be explained based on the activities of students in each stage of learning.

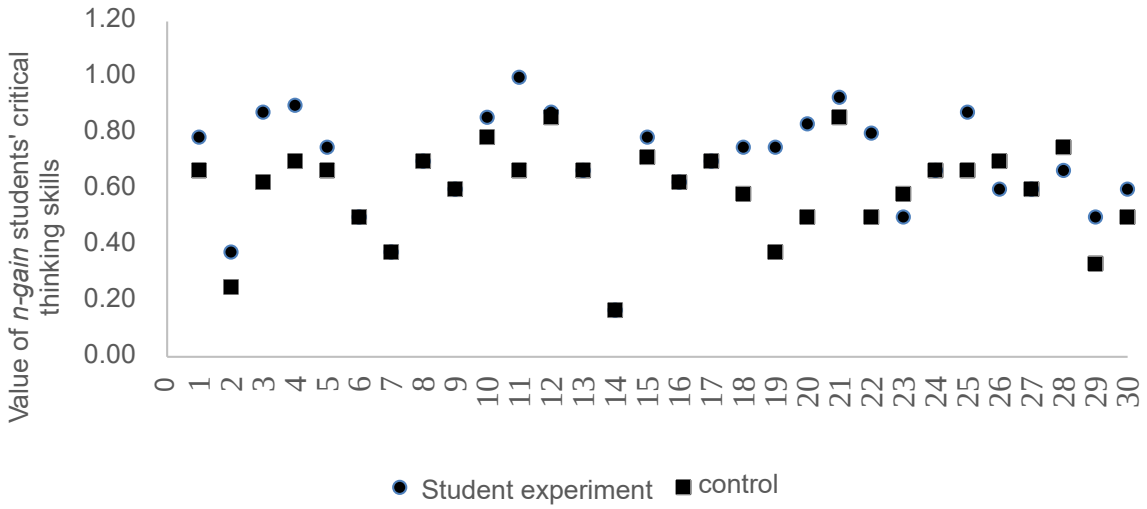

FIGURE 8. Value of n-gain critical thinking skills of students in the experimental class and the control class

Stage I Student Orientation to Problems

At this stage, students are faced with a problem related to hoax information presented in the discourse based on the discourse, students are asked to write the main questions. The following are some of the statements written by students:

Student 1: why are carbonated drinks still sold on the market?

Student 2: Why can carbonated drinks be used to clean the toilet?

Seeing a few students is not appropriate in formulating the main questions, the teacher directs how to determine the main questions that are in accordance with the discourse. The result is they are able to improve the main question statement.

Student 1: Is it true that information on carbonated drinks can clean the toilet?

Student 2: what are the ingredients in carbonated drinks?

Stage II Organizing Students for Learning

At this stage there are 2 activities, namely defining problems and organizing learning tasks related to discourse, as well as collecting appropriate information so as to obtain initial conclusions and can hypothesize. Students in groups are given 3 days to define problems, and gather information. After that students must include sources of information / references.

In addition to these activities, students periodically report the results of assignments to the teacher. The teacher evaluates the task and gives direction if there is information that is less relevant, and the source is not credible. On this suggestion, students make improvements and obtain information, including: (1) the content contained in carbonated drinks, (2) acidity of carbonated drinks, (3) buffer solution in blood, and (4) metal corrosion, from sources who have high credibility.

Stage III Guides Individual and Group Investigations

At this stage, students are guided to collect data by carrying out investigations and experiments to prove rust cleaning and pH testing in a solution or drink that has a pH similar to carbonated drinks. This investigation activity requires students to be actively involved and train students in their opinions to get explanations and problem solving. From the experiments they did, students could gather further information to strengthen the hypothesis, determine the purpose of the experiment, design experimental procedures, tools and materials, and be able to determine the variables involved to create their own ideas then consult the teacher. Based on the direction given by the teacher, students improve the experimental design.

Stage IV Develops and Presents Works

After designing the experiment correctly, for four days students were asked to make research reports related to solving hoax information problems related to some foods and drinks. Reports that have been made are then submitted to the teacher. In this stage students write down experimental results, then answer challenging questions related to experimental data to develop ideas or ideas by linking the results obtained during the experiment with the various information they have obtained from various previous sources. , and report the solutions obtained as a work.

Stage V Analyze and Evaluate the Problem Solving Process

At this stage, student learning outcomes are evaluated related to the material that has been learned and ask each group to communicate their work. In this way students will ask questions about the results of work between groups so that they will come up with various opinions, ideas such as using used plastic cups instead of beakers, as well as ideas from friends, so that they will understand the problem more deeply and can develop broader ideas.

Students are trained to be able to formulate the main questions. Students must also gather information needed to confirm the truth of the information circulating based on discourse. In searching for information, students are trained to choose relevant and credible sources, so that the information they obtain can be trusted and students can make temporary conclusions (inference) When making research reports, it means that students can determine what actions should be taken to confirm the truth of information circulating based on discourse. In presenting the work, various ideas can be raised such as the use of used plastic cups instead of beakers. Students are also able to communicate their work to others. With this learning stage, it can be ascertained that students' critical thinking skills can be trained.

CONCLUSION

In problem-based learning, students ask the main question, gather information needed to solve the problem, consider the credibility of the source of information, make temporary conclusions (inference), decide actions to resolve the problem and communicate it to others. Students have made a research report to overcome hoax information problems. Based on the average pretest, posttest and n-gain values obtained, it can be concluded that the problem-based learning models is effective for improving students' critical thinking skills: (related to some foods and drinks).

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