



How is the Relationship between Science Process Skills and Students' Critical Thinking Ability on Optical Instrument Material

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Abstract. This study aims to determine the relationship between Science Process Skills and Students' Critical Thinking Ability on Optical Instruments. This study uses a type of quantitative research obtained from the distribution of observation sheets in schools. The population and sample of this study were taken from grade II students of SMAN 10 Muaro Jambi. The sampling technique used was purposive sampling in 2 science classes with a sample size of 50 students. Data analysis was carried out by looking at student responses and the relationship between Science Process Skills and Students' Critical Thinking Ability on Optical Style Materials using Correlation Test. Based on the results of the correlation test, it is known that there is a relationship between Science Process Skills and Students' Critical Thinking Ability on Optical Instrument Material with a significance value > 0.05 . The implications of this research are expected to help students and teachers understand the importance and relationship between Science Process Skills and Students' Critical Thinking Ability on Optical Instrument Material.

Keywords: Physics · Relationships · Science Process Skills · Students' Critical Thinking Ability

1 Introduction

Physics is closely related to natural phenomena that occur. By understanding physics we can take advantage of natural phenomena that occur in life, but it requires a deeper understanding because physics is abstract and its relation to concrete real life [1] [2] [3]. Physics as one of the natural sciences that becomes a reference in the development of education, because in its application physics is closely related to improving the ability to solve problems in everyday life [4] [5] [6]. So the need for skills and abilities by students, because it can result in not having the ability to understand scientific concepts, principles, and attitudes towards science, especially physics [8] [9] [10]. One of the skills that are expected to be included in learning physics is science process skills.

Science process skills are one of the basic skills of students in dealing with problems. According to [11] students' cognitive processes in analyzing systematically and

specifically the problems encountered and planning problem solving strategies are called science process skills. Science process skills are needed by students to improve students' conceptual understanding and knowledge in making observations [12]. Science process skills develop knowledge and are able to use scientific methods and be scientific to deal with problems [13]. Therefore, students' science process skills need to be considered in learning. In addition to students' science process skills, critical thinking skills are things that must be considered in learning.

Critical thinking can also be said as the ability to think deeply in problem solving by collecting, organizing and analyzing [14]. According [15]. Critical thinking skills tend to shape students to be able to review the opinions obtained by seeking relevant information and assisting in problem solving. This critical thinking ability can train students to learn and be able to apply what they have learned in solving the problems they face [16]. Therefore, critical thinking skills are very much expected of students in learning, especially in learning physics.

This research is in line with research conducted by [17] which states that there is a significant relationship between science process skills and students' critical thinking skills on temperature and heat material. In addition also said that science process skills in students have a strong relationship with students' critical thinking skills. However, the novelty of this research is the research area, the school level used, the indicators used and the data analysis techniques used in this study are also different from previous studies.

The purpose of this study was to examine the relationship between students' science process skills and 11th grade students' critical thinking skills at SMAN10 Muaro Jambi. Physics subject for Optical Instruments. The urgency of this research is to help students and teachers see how the relationship between students' science process skills and the critical thinking skills of 11th graders at SMAN11 Muaro Jambi in the Physics subject matter of Optical Instruments. The problem formulation of this research is how is the relationship between science process skills and critical thinking skills in 11th grade students at SMAN10 Muaro Jambi in the subject of Physics for Optical Instruments.

2 Research Method

The type of research used in this research is quantitative with a correlational research design. Correlation Design is a procedure in quantitative research that is used to measure the relationship between two or more variables using statistical correlation analysis procedures [11]. This study uses two variables, namely the independent variable of students' science process skills and the dependent variable, namely students' critical thinking skills.

The population in this study were students of SMAN 10 Muaro Jambi. The sample in this study was obtained using a random sampling technique. Researchers chose to use a simple random sampling technique because this technique is a random sampling method that provides equal opportunities for each population [8]. Researchers took random samples in 2 classes, namely 11 IPA 1 and 11 IPA 2 with a total of 25 students in each class. So it was found that the number of samples was 50 students.

The instrument used to obtain quantitative data in this study was an observation sheet. Observation sheets were distributed to students with statements according to the

indicators and Likert scale used. The Likert scale used in this study is strongly agree (SS) with 5 points, agree (S) with 4 points, neutral (N) with 3 points, disagree (TS) with 2 points, and strongly disagree with 1 point.

The grid of observation sheets for science process skills and students' critical thinking skills in the Physics subject of Optical Instrument Material are as follows (Table 1 and 2):

The research procedure begins by submitting an application for an observation permit to the school after obtaining permission for the researcher to distribute questionnaires

Table 1. Sheet Grid Observation Skills Process science

No	Indicator	Statement
1	Observation	1.2
2	Classification	3.4
3	Communication	5.6
4	Measure	7
5	Prediction	8
6	Identification Variable	9.10
7	Make Hypothesis	10
8	Make Chart	11
9	Describe Connection Between Variable	12
10	Define variable by Operational	13
11	designing Investigation	14
12	Analyze investigation	15
13	Do experiment	16.17
14	Gather & organize data	18
15	Compile table data	19
16	Conclusion	20

Table 2. Observation Sheet Grid Student on the subjects Physics of Optical Instruments

No.	Indicator	Statement
1	Formulate the problem	1,2,3,4
2	Giving arguments	5.6
3	Doing deduction	7,8,9
4	Doing induction	10,11,12
5	Carry out evaluation	13,14,15,16
6	Making decisions and taking action	17,18,19,20

and conduct observations. Furthermore, the result data from the observation sheet is then processed by using assumption tests and hypothesis testing consisting of correlation tests. Before conducting the Hypothesis Test, the data analysis begins by looking at the results of the assumption test used in this study, namely the normality test and linearity test. In the test assumption test used by the researcher, namely the normality test with the provisions of the sig value. > 0.05 means that the data is normally distributed and the linearity test is provided with the value of sig. < 0.05 means that the data is linear. Prerequisite test is conducted to see whether the data is normally distributed and to see whether the data is linear or not using SPSS. Then after the prerequisite test is done, the hypothesis test can be carried out, namely the correlation test. Correlation test serves to find out how the relationship between variable X to variable Y with the provision that it has a relationship if the value of sig. < 0.05 .

3 Result and Discussion

Result

Normality Test

The results of the normality test of science process skills and critical thinking skills of grade 11 students at SMAN 10 Muaro Jambi in the Physics subject of Optical Instruments are shown in Table 3:

Based on the Table 4, the normality test of science process skills and critical thinking skills of grade 11 students at SMAN 10 Muaro Jambi in the subject of Optical Instrument Material Physics obtained results based on the Kolmogorov-Smirnov test with a significance value of > 0.05 , so it can be concluded that the data is normally distributed.

Linearity Test

The results of the linearity test of science process skills and critical thinking skills of grade 11 students at SMAN 10 Muaro Jambi in the subject of Optical Instrument Material Physics are shown in Table 4:

Based on the table, the results of the linearity test of science process skills and critical thinking skills of grade 11 students at SMAN 10 Muaro Jambi in the Physics subject of Optical Instruments are obtained, namely Sign Significance < 0.05 , it can be concluded that there is a linear relationship between science process skills and students' critical

Table 3. Normality Test Results of Science Process Skills and Critical Thinking Skills for Grade 11 Students at SMAN 10 Muaro Jambi Subjects in Physics Subjects for Optical Instruments

Class	Variable	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
11 IPA 1	Students' science process skills	.085	50	.200*	.874	50	.596
11 IPA 2	Critical thinking skills	.142	50	.200	.852	50	.685

Table 4. Results of the Linearity Test for Science Process Skills and Critical Thinking Skills for Class 11 Students at SMAN10 Muaro Jambi Subjects in Physics Subjects for Optical Instruments

Class	Variable	Kolmogorov-Smirnova	Deviation from linearity
		Sig.	Sig.
11 IPA 1	science process skills	0.035	0.042
11 IPA 2	Critical thinking skills	0.039	0.033

thinking skills. 11th grade at SMAN 10 Muaro Jambi in the subject of Physics for Optical Instruments.

Correlation Test

After the results of the Assumption test were found, the hypothesis was tested, namely the Correlation Test. The results of the correlation test between science process skills and critical thinking skills of grade 11 students at SMAN 10 Muaro Jambi in the Physics subject of Optical Instruments are as follows (Table 5):

Based on the Table 5, it is obtained, the results of the correlation test, namely the value of sig. (2-tailed) < 0.05 , it can be concluded that there is a relationship between students' science process skills and critical thinking skills in grade 11 students at SMAN 10 Muaro Jambi subjects Physics Subjects Optical Instruments.

Discussion

After doing the Assumption Test consisting of Normality Test and Linearity Test. In the Normality Test of science process skills and critical thinking skills of grade 11 students at SMAN10 Muaro Jambi in the Physics subject of optical instrument material, the results were obtained based on the Kolmogorov-Smirnov test with a significance value > 0.05 , it can be concluded that the data is normally distributed. Then on the linearity test, the results of the linearity test of science process skills and critical thinking skills of grade 11 students at SMAN 10 Muaro Jambi in the Physics subject of Optical Instruments, namely Significance < 0.05 , it can be concluded that there is a linear relationship between science process skills and thinking skills. Critically grade 11 students at SMAN 10 Muaro Jambi on the subject of Physics for Optical Instruments. After testing the assumptions meet the requirements, then hypothesis testing is carried out. The hypothesis test that the researcher uses is the Correlation Test, while the results of the correlation test found by the researcher are the sig. (2-tailed) < 0.05 , it can be concluded that there is a relationship between students' science process skills and 11th

Table 5. Correlation Test Results

School	Variable	Pearson Correlation	Sig.(2-tailed)	N
11 IPA 1 & 11 IPA 2	Skills and processes of science and ability think critical	0.634	0.010	50

grade students' critical thinking skills at SMAN 10 Muaro Jambi in Physics subjects, especially Optical Instruments.

Based on the results of hypothesis testing that has been carried out by researchers, it appears that this research is in line with research conducted by Fitria (2020) which states that there is a significant relationship between science process skills and students' critical thinking skills on temperature and heat material. In addition, [4] also said that science process skills in students have a strong relationship with students' critical thinking skills. However, the novelty of this research is the research area, the school level used, the indicators used and the data analysis techniques used in this study are also different from previous studies.

The purpose of this study was to see the relationship between students' science process skills and 11th grade students' critical thinking skills at SMAN 10 Muaro Jambi. Physics subject for Optical Instruments. Implications This research is expected to help students and teachers identify the relationship between students' science process skills and the critical thinking skills of 11th graders at SMAN 10 Muaro Jambi, especially in the Physics subject of Optical Instruments. With the relationship between the variables of science process skills and critical thinking skills, it is expected to be a guide for teachers or students in implementing learning, besides that based on the importance of science process skills and the importance of critical thinking skills in students, it is hoped that teachers and students can realize how important it is to develop skills. Scientific processes and critical thinking skills. This research certainly has shortcomings, therefore the researcher recommends doing further research.

4 Conclusion

The conclusions of the research results are the relationship between students' science process skills and critical thinking skills of 11th graders at SMAN 10 Muaro Jambi in the Physics subject of optical instruments with a sample of 50 students. After analyzing the hypothesis test data using correlation analysis techniques to determine the relationship between variables, it was found that the correlation test results showed that the significance of the correlation test was the sig value. (2-tailed) < 0.05 , so it can be concluded that there is a significant relationship between students' science process skills and 11th grade critical thinking skills at SMAN 10 Muaro Jambi in the Physics subject of Optical Instruments. Implications This research is expected to assist students and teachers in identifying the relationship between students' science process skills and class students' critical thinking skills, especially in the subjects of Physics of Optical Instruments.

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