JPPIPA, Vol. 4 No. 2 2019

Jurnal Penelitian Pendidikan IPA

http://journal.unesa.ac.id/index.php/jppipa

PROFILE OF STUDENTS' PROBLEM SOLVING ABILITY WITH INTEGRATED SCIENCE MODEL BASED ON DISASTER MITIGATION

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Abstract

This study aimed to determine students' problem-solving abilities with an integrated science model based on disaster mitigation. This study used a quasi-experimental method with a nonequivalent control group design. This research was conducted at Benjeng 1 Public Middle School with a population of all students in grade VII and samples in grades VII F and VII G. Data collection using a problem-solving ability test with Polya indicators. Data analysis using the free sample t-test through the SPSS version 20. Based on the results of the study it can be concluded that there is a difference in the problem solving ability between the experimental class and the control class, obtained the results of the free sample t-test with a significance of 0.028 and the test criteria –t-count <t-table <t-count of -2,252 <2,000 <2,252.

Keywords: *Disaster mitigation, Integrated science, problem solving ability*

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p-ISSN: 2527-7537
e-ISSN: 2549-2209

INTRODUCTION

Science is essentially knowledge that investigates the processes of the phenomenon of the universe which is studied in several fields of science namely physics, biology, chemistry, and earth science. The process of natural phenomena in the field of earth science synergizes with the life of living things that occupy their dwellings. Living things directly observe natural phenomena that change and can even interfere with survival so they must know the action to anticipate the situation. Natural disasters are natural phenomena that can disrupt survival and bring harm to creatures around the environment. Appropriate action is needed to deal with natural disasters.

Pursuant to Law Number 24 Year 2007, disasters are classified as natural phenomena that have an impact on social problems that are broad in scope so that there is a need for cooperation from various parties, especially disaster institutions, both at the central and regional levels. The cooperation needs to involve the community which includes four stages, namely the first phase of preparedness, the second phase of emergency response, the third phase of post-emergency, the fourth stage of prevention and mitigation carried out with an active role of the community. The four stages that are most likely to involve the community are the stages of prevention and mitigation. One of the community parties that work together to overcome the problem of disaster is a formal education institution or school. The role of schools in overcoming disaster problems can be applied through teaching and learning activities which include aspects of handling non-structural disasters including education, counseling and community awareness (Priyowidodo, 2013).

Education carried out in schools, especially junior high schools has an important role as a place to channel education knowledge about disasters that aims to provide knowledge to students in order to know the characteristics of a disaster (Sadiqin, 2017). Efforts to facilitate students in learning knowledge need to be done by a teacher in conveying learning. The integrated type integration model combines the science concepts of science with other science concepts that aim to achieve a learning theme. The integrated cohesive model can be applied in learning by raising a learning theme as the target of discussion (Sofiyah, 2017).

Students as the main object of learning are required to be actively involved in learning. Student activeness can be seen from how active the student is in solving problems given by the teacher. Solving problems becomes a basic activity for humans because in life a way is needed to use things properly. If the method used is not right, then all these things cannot be used properly that will cause a problem. Human ability to solve problems can be seen from the way of resolution used. A problem needs to be solved in various ways despite failures, but it takes persistence to find other ways to solve the problem. Problem solving is related to science learning which is a science that studies natural phenomena that are contextual in order to find a theory that can be considered, it requires the ability of problem solving in learning it. Thus that the ability to solve problems is an appropriate learning method to be applied in learning in schools.

Research on problem-based landslide disaster mitigation learning shows the results include effective learning based on indicators of student learning activities, student interest in learning, and teacher performance (Indahwati, 2015). There are also other studies on students' preparedness in facing natural disasters by applying problem solving models that show results that learning can be carried out more effectively than conventional learning models (Mardiana, 2017). Based on this background it is important to conduct further research entitled "The Application of Disaster Mitigation Using Integrated Science Models on Students' Problem Solving Abilities".

METHODS

This research is an experimental research with a quantitative approach. This type of research uses a quasi experiment. The study design uses a non equivalent control group design.

O_1	**x**	**O_2**
O_3		**O_4**

Figure 1. Nonequivalent control group design

This research was conducted for 2 weeks from 26 March to 6 April 2019 in the even semester of the 2018/2019 school year. The research site is located at Benjeng 1 Public Middle School, Gresik Regency in 7F and 7G grades. The population used in this study were all VII grade students of SMP Negeri 1 Benjeng. The sample used in this study was 7F and 7G as the experimental class and the control class. The sampling technique uses purposive sampling technique.

This research was then conducted a hypothesis test that is a free sample t test using the SPSS 20. This test was conducted after it was found that the data obtained from the normality test were normally distributed and the homogeneity test had homogeneous variance. The free sample t test formula is in Formulas 1 and 2.

$$t_{hitung} = \frac{\overline{x_1} - \overline{x_2}}{S_{gabungan} \cdot \sqrt{\frac{n_1+n_2}{n_1 . n_2}}} \text{..........................(1)}$$

$$S_{gabungan} = \sqrt{\frac{(n_1-1)S_1^2+(n_1-1)S_2^2}{n_1+n_2-2}} \text{................(2)}$$

Testing the hypothesis of the free sample t test is as follows:

1) $H_0 : \mu_1 = \mu_2$ (there is no difference in problem-solving ability between the experimental class and the control class)
2) $H_1 : \mu_1 \neq \mu_2$ (there is a difference in problem-solving ability between the experimental class and the control class)

The hypothesis testing criteria are as follows:

H_0 is rejected : $t_{hitung} > t_{tabel}$

H_0 is accepted : $-t_{tabel} \leq t_{hitung} \leq t_{tabel}$

sig ≥ 0,05 means H_0 is accepted and H_1 is rejected

sig < 0,05 means H_0 is rejected and H_1 is accepted

(Siregar, 2014)

RESULTS AND DISCUSSIONS

Science learning is carried out in an integrated manner aimed at directing students to think broadly and thoroughly in seeking and understanding the conceptual relationship of science subject matter. The scope of science subjects emphasizes the observation of natural phenomena as well as their application in the daily lives of students (Ekapti, 2016). Natural phenomena that continue to experience changes have different disasters in each region of Indonesia. Local people in disaster prone areas must try to understand and have the skills to minimize the impact of disasters that might occur. Knowledge, understanding, preparedness, and skills to detect and anticipate early on various types of disasters are known as disaster mitigation (Agustiana, 2013). Disaster mitigation activities implemented in schools require students' skills to solve problems in an emergency and make appropriate decisions. Problem solving ability is used when searching for information to decide on a solution to a problem faced in certain conditions (Oktaviani, 2017).

Data analysis of problem solving ability can be calculated by several stages namely statistical descriptive analysis, normality test, homogeneity test, and hypothesis testing.

The results of descriptive statistical data were obtained to determine the difference in the pretest and posttest values of the experimental and control classes. The results of the pretest and posttest descriptive statistics of the experimental class can be seen in Table 1 and the results of the pretest and posttest descriptive statistics of the control class can be seen in Table 2.

Tabel 1. Descriptive statistics of experimental class

	Minimum	**Maximum**	**Mean**		**Std. Deviation**
	Statistic	**Statistic**	**Statistic**	**Std. Error**	**Statistic**
Pretest	20,00	87,00	48,16	3,013	16,777
Posttest	30,00	93,00	74,55	2,730	15,203

Tabel 2. Descriptive statistics of control class

	Minimum	**Maximum**	**Mean**		**Std. Deviation**
	Statistic	**Statistic**	**Statistic**	**Std. Error**	**Statistic**
Pretest	10,00	83,00	43,19	3,507	19,525
Posttest	33,00	93,00	64,97	3,262	18,159

Descriptive statistical analysis for the results of the pretest and posttest values in the experimental class contained in Table 1 and the control class contained in Table 2 shows that the average value of the pretest and posttest problem solving abilities obtained different results. The pretest value in the experimental class obtained an average value of 48.16 and a control class of 43.19. The results of the pretest obtained show a small difference in value between the experimental class and the control class because there is no difference in treatment between the experimental class and the control class. While the posttest value in the experimental class obtained an average value of 74.55 and 64.97 for the control class. The acquisition of posttest scores showed that there were differences in the average value of the problem-solving ability of the experimental class students higher than the problem-solving ability of the control class students. Learning in the experimental class applies disaster mitigation using the integrated science model, whereas in the learning control class using the conventional learning model.

The results of the calculation of the posttest normality test for problem solving ability in the experimental and the control classes can be seen clearly in Table 3. Homogeneity test was carried out on the posttest value of the experimental and the control classes. Homogeneity test calculation results can be seen in Table 4.

Tabel 3. Normality test

	Kelas	Kolmogorov-smirnov[a]			Ket.
		Statistic	Df	Sig.	
Posttest	Eksperimen	0,124	31	0,200	Normal
	Kontrol	0,155	31	0,057	Normal

Tabel 4. Homogenity test

		Levene Statistic	df1	df2	Sig.	Ket.
Posttest	**Based on Mean**	2,352	1	62	0,13	Homogen

Based on Table 3 the significance value of the posttest in the experimental class and the control class is 0.200 and 0.057. Normality test results in both classes showed a value greater than the testing standard of 0.05, meaning that the problem solving ability data was normally distributed. Furthermore, the posttest value data is tested for homogeneity which can be seen in Table 4. Postest significance value of 0.13 means that it has a value greater than the testing standard of 0.05. These results indicate that the problem solving ability in the form of posttest values in the experimental class and the control class have homogeneous data variance.

The research hypothesis test was conducted to test the level of students' problem-solving abilities towards learning disaster mitigation with the integrated science model. Hypothesis testing can be done based on the results of normality and homogeneity test obtained that the posttest value of problem solving in the experimental class and control class is normally distributed and has a homogeneous variance. The results of the calculation of the hypothesis test problem solving ability can be seen in Table 5.

Tabel 5. Hypothesis test

	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	T	Df	Sig. (2-tailed)	Mean difference	Std. Error difference
Equal variances assumed	2,352	0,13	2,252	60	0,028	9,581	4,254

Based on Table 5 the results of hypothesis testing using the free sample t test obtained a significance value of 0.028 which is smaller than 0.05 meaning H0 is rejected and H1 is accepted. So it can be concluded that there are differences in problem solving abilities between the experimental classes applied in disaster mitigation learning using integrated science integrated models and the control classes applied in conventional learning. Learning outcomes that become aspects of cognitive assessment on the application of problem based learning learning models are more effective than conventional learning models (Mardiana, 2017). Research on problem solving methods to develop mathematical problem solving skills also shows results that there are significant differences between before given the problem solving method according to Polya and after given the problem solving method according to Polya with an average value of learning outcomes increasing means that the problem solving method can make the results learn better (Hadi, 2014).

Tabel 6. Hypothesis test

Category	**Experiment**		**Control**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**
Very Good	1	87	2	82
Good	9	65	7	62
Adequate	10	49	8	48
Inadequate	11	30	12	27
Not Good	0	0	5	12

The pretest results of students' problem solving abilities on average were dominated by the poor grades (20% ≤ P <40%) with 11 students in the experimental class and 12 students in the control class. The pretest is indeed intended to find out the level of students' initial problem solving abilities so that few students get grades in the excellent category. Students work on pretest questions individually without beginning with learning activities or discussion of the material layers of the earth and its structure. These results are due to students' initial knowledge of the material layers of the earth and their structure is very less.

Tabel 7. The results of posttest category

Category	**Experiment**		**Control**	
	Frequency	**Percentage (%)**	**Frequency**	**Frequency**
Very Good	15	87	9	85
Good	12	65	11	69
Adequate	3	49	8	48
Inadequate	1	30	3	34
Not Good	0	0	0	0

The results of the posttest problem solving ability in table 4.7 is dominated by the average category of very good grades (80% ≤ P ≤ 100%) in the experimental class with 15 students and good (60% ≤ P <80%) in the control class with 11 the student. These results are very inversely proportional to the results of the pretest, there are only 1-2 students whose grades are categorized very well, even the results of the posttest of the experimental class and the control class, no grades are categorized as not good. Based on the acquisition of the average value that is categorized shows that there is a significant difference between the experimental class and the control class that is the frequency of the experimental class value is dominated by very good category while the frequency of the control class is dominated by good category which makes a large enough difference in the value of the post test. The posttest results obtained an average percentage value in the experimental class by 75% and in the control class by 65%, both of which are still in the good value category. The treatment given to the experimental class and the control class seemed to produce improved posttest results than the pretest results. Integrated learning places more emphasis on the process of integrating cognitive, psychomotor and affective domains so that changes in the correct way of thinking in solving problems are accompanied by scientific attitudes of students before and after learning to find concepts rather than student outcomes (Rosidi, 2015).

Tabel 8. Average completeness of problem solving indicators

No.	Polya Indicators	Experiment		Control	
		Pretest	Posttest	Pretest	Posttest
1	Understanding problem	73	89	56	74
2	Planning solution	54	72	18	55
3	Conducting solution	51	75	45	66
4	Evaluating solution	25	66	49	65

The results of the pretest and posttest problem-solving abilities can be analyzed through the implementation of indicators of problem-solving abilities according to Polya consisting of indicator 1 understanding the problem, indicator 2 planning for resolution, indicator 3 implementing the plan, and indicator 4 re-checking the resolution. Based on Table 8 the results of completeness of the problem solving indicators obtained by the experimental class and the control class as a whole increased when given a pretest followed by posttest. These results are influenced by the treatment given to the experimental class and the control class so that students better understand the process of solving the correct problem contextually and applicatively. The completeness of the indicators in the experimental class is also higher than in the control class because the treatment given is different. Differences in the achievement of components of problem solving ability show that students in understanding problems reach 100% revealed that students can formulate problems correctly. Problem solving planning concluded that students could almost all formulate hypotheses, determine variables, and design experiments. The component that states that students are able to implement problem solving based on a plan (collecting data, analyzing and concluding) is quite good category, because there are students who make mistakes in making tables and graphs (Nurita, 2017).

CONCLUSION AND SUGGESTIONS

Conclusion

The conclusion of the research is the application of disaster mitigation using integrated science models to the problem solving abilities of students analyzed with the hypothesis test in the form of a free sample t obtained a significance value of 0.028 with the test criteria tcount> ttable of 2.252> 2,000, then it can be concluded that H0 is rejected and H1 is accepted which shows the differences in problem solving skills between the experimental class and the control class.

Suggestions

Research on disaster mitigation that is applied in the learning process should better involve students individually related to events that have been experienced by students to be re-examined and can be analyzed through relevant questionnaires. Research on disaster mitigation that is applied in the learning process should better involve students individually related to events that have been experienced by students to be re-examined and can be analyzed through relevant questionnaires. The use of integrated science models can be developed in the form of integrated learning tools when implementing disaster mitigation activities so that the learning presented by teachers is more structured and easy for students to understand

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