The Ability to Understand Spatial Concepts of Disaster Mitigation Materials Through Problem Based Learning Model

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Abstract. The ability of understanding the concept of spatial disaster mitigation is important for students in their daily lives. The problem is that the learning process in the classroom is still less than optimal, which has an impact on the low ability of students to understand spatial concepts. The aim of this study is to analyze the ability of understanding the concept of spatial students through the Problem Based Learning model on disaster mitigation materials in SMA Pondok Modern Selamat Kendal. This research method used is an experiment method using pretest-posttest control and experimental design. The sampling technique is random sampling from XI IPS class. Data collection techniques through test, observation, and questionnaires. The measurement of increasing the ability is obtained from the normalization gain calculation. The results showed an increase in the ability to understand spatial concepts in the experimental class with an average gain score of 62.74% belonging to the medium category and the control class with an average gain score of 20.70% belonging to the low category. In the independent t-test obtained significance value (sig < 0.05) sig 0.00 which means accepted or there is a significant influence between the learning model of Problem Based Learning on increasing the ability of understanding the concept of spatial disaster mitigation materials. The response of students to positive learning and included in the very good category.

Keywords: disaster mitigation; problem based learning; spatial concept.

INTRODUCTION

Indonesia is very vulnerable dealing with natural disasters. Efforts are needed to improve the community in managing and reducing disaster risk (Suharini, Setyowati, & Kurniawan, 2015). Through education, knowledge about natural disasters must be increased (Nurcahyo & Winanti, 2021). Disaster mitigation is one of the materials that need to be implemented in formal education. Disaster mitigation materials must appear and have basic competencies (Suharini et al., 2015). This is intended so that students have knowledge about the disaster so that they have preparedness in the face of disasters, considering that Indonesia is one of the countries prone to disasters (Isnaeni & Tjahjono, 2014).

The problem faced is that learning in the classroom is still not optimal. In the learning process, the classroom tends to focus on the teacher. Whereas the principle of curriculum development in 2013 is that learning is student centered (Nurcahyo & Winanti, 2021). The selection of inappropriate learning models and methods will have an impact on the ability of students to understand learning materials (Susetyo, Sumarmi & Astina, 2017). The teachers should have the ability to determine learning

models based on the characteristics of students so that it has an impact on the ability to process the material being taught and increase student activity (Nurcahyo & Winanti, 2021).

The selection of the right learning model is one way for teachers to deliver material, so that learning objectives can be achieved (Susetyo, Sumarmi & Astina, 2017). One of the learning models that focuses on student centered is a Problem Based Learning Model. Problem Based Learning model is a learning model where the starting point of learning is based on real life problems and it is able to improve students' problem solving abilities (Etherington, 2011). Problem based learning starts from authentic or everyday problems from real and meaningful life (Jonassen & Hung, 2012).

Problem Based Learning is a learning model based on cognitive theory which includes learning theory. According to constructivism theory, thinking and problem solving skills can be developed if students do it by themselves, find and internalize the value or concept of previous knowledge and information that has been obtained (Nafiah, 2014). According to Hosnan (2016) the steps in implementing the Problem Based Learning model are five phases, namely (1)

student orientation to the problems; (2) organize students to learn; (3) guiding individual and group investigations; (4) develop and present the work; and (5) analyze and evaluate the problem solving process. Students are given the flexibility to construct a framework of thinking and are active in developing the reasoning process regarding learning materials.

The learning process of geography, especially on disaster mitigation material has not been conveyed properly (Suharini et al., 2015). Setiawan (2015) says that the study of geography has not been able to maximize problem solving because the science and learning process of geography in schools does not utilize the spatial approach. The ability to understand spatial concepts is a characteristic of geography and it is part of the cognitive aspects that students must possess (Nurcahyo & Winanti, 2021).

Geography is the study of space. Human understanding and skills in utilizing space will provide a direction for how nature is modified for its survival (Maharani, Winda & Maryani, 2015). Understanding spatial concepts is one aspect that is formed in the geography learning process that will contribute to the spatial attitudes and behavior of students (Segara, Pasya, & Maryani, 2012). This ability will be very useful for students in making or determining decisions on simple and complex things that related to space or location (Setiawan, 2015).

According to Permendikbud No. 20 of 2003 that the main purpose of learning geography is to get students to be able to think spatially which is contained in the overall basic competence in geography material. Learning geography is expected to be able to build and develop students' ability to understand spatial concepts about physical and social aspects in the scope of space and time and their distribution on earth (Maharani, Winda & Maryani, 2015). The ability to understand spatial concepts is the basis for geographic competence (Oktavianto, Sumarmi & Handoyo, 2017). According to the Association of American Geographers, indicators of spatial concepts that can be studied include: comparison, aura, region, hierarchy, transition, analogy, pattern, and association.

Nurcahyo & Winanti (2021) stated that spatial understanding skills are very important to be developed in students, especially in geography subjects. Learning geography can be a weapon to solve environmental problems that occur and change behavior so that the knowledge gained can increase human spatial insight or behavior

(Segara, Pasya, & Maryani, 2012). The difficulty of students in understanding spatial concepts is the lack of activities during learning that are not directly involved in making learning products and using media that can develop students' cognitive abilities and skills (Maharani, Winda & Maryani, 2015).

Several studies that are relevant and serve as references and considerations in the preparation of this article, the first by Susetyo, Sumarmi & Astina (2017) which states that Problem Based Learning based on Outdoor Adventure Education has an effect on geographic spatial intelligence. There is a significant difference between the experimental class and the control class. Research by Lestari, Suharini, & Banowati (2018) results in the finding that the use of the Problem Based Learning model is more effective, students are more active and creative. Meanwhile, from the research results of Istifarida, Santoso, & Yusup (2017) that there is a significant increase in spatial thinking skills based on pretest and posttest scores after learning with the Problem Based Learning model. Jairina, Handoyo, & Astina (2020) conducted a study on an effective learning model on the problem-solving ability of disaster mitigation materials. The results of the research indicate that the Problem Based Learning model is effective for improving the problem solving ability of students' disaster mitigation materials.

In order for students to have the ability to understand spatial concepts, it is necessary to use a Problem Based Learning model in the classroom. Through Problem Based Learning, it is hoped that students will obtain appropriate and more effective methods that are useful for improving students' ability to understand spatial concepts (Nurcahyo & Winanti, 2021).

The application of the spatial thinking ability test is appropriate for use at the high school level through a spatial thinking ability test (Oktavianto, Sumarmi & Handoyo, 2017). A spatial concept understanding test needs to be developed in measuring the relationship between knowledge and skills that integrate with the material in geography learning (Saputro, Setyowati, & Hardati, 2019). To grow and improve the ability of students to understand spatial concepts in disaster mitigation materials, an appropriate and effective learning model is needed. A test of the ability to understand spatial concepts of disaster mitigation materials needs to be developed in measuring the relationship between students' knowledge and skills. Based on the background above, this paper aims to analyze the ability to

understand spatial concepts in disaster mitigation through the Problem Based Learning model at SMA Pondok Modern Selamat Kendal.

METHOD

Research Goal

This study aims to analyze the ability to understand the spatial concept of disaster mitigation materials through the Problem Based Learning model at SMA Pondok Modern Selamat Kendal.

Sample and Data Collection

The sample in this study was selected using a simple random sampling technique based on the consideration that in the population there is no superior class so that each class is relatively the same in academic ability. Class XI IPS1 as the experimental class as many as 28 students and XI IPS2 as many as 28 students as the control class. The data collection technique used in this research is a test of the ability to understand spatial concepts, observation, and questionnaires. The test instrument that used is multiple choice questions. The indicators that used in the preparation of the test instrument for understanding the spatial concept of disaster mitigation include comparison, aura, region, hierarchy, transition, analogy, pattern, and association. To get the results of the study, pretest and posttest were carried out.

Analyzing of Data

Data analysis in this study used independent t-test, difference test and gain normalization with the help of SPSS 22.0 for windows.

RESULTS AND DISCUSSION

Understanding the Spatial Concept of Disaster Mitigation Materials Through Problem Based Learning

The ability to understand spatial concepts is the ability for the students in understanding, defining concepts, identifying, and giving examples of spatial phenomena and their problems as well as developing the ability to relate various ideas that are interrelated with each other. This study analyzes the ability to understand the spatial concept of disaster mitigation materials of students before and after learning by using the Problem Based Learning model. The spatial concept understanding ability test is used to determine the students' ability to understand spatial concepts on disaster mitigation materials. The following table shows the results

of the students' spatial concept understanding ability test in the experimental class and the control class.

Table 1. The Results of the Spatial Concept Understanding Ability Test

Number	Class	N	Pretest	Posttest	N-Gain score (%)
1.	Experiment	28	55.21	84.21	62.74
2.	Control	28	56.25	66.64	20.70

From the test results, the average pretest score for the ability to understand spatial concepts of disaster mitigation materials in the experimental class was 55.21 and 56.25 in the control class. Both classes are classified as having a low value of understanding spatial concepts. The average value obtained by the experimental class and the control class are difference but not too big. The experimental and control classes are considered to have equal or homogeneous abilities.

In the experimental class, the average posttest value of the ability to understand the spatial concept of disaster mitigation was 84.21, while in the control class, the average posttest value of the ability to understand the final spatial concept was 66.64.

The ability to understand the spatial concept of disaster mitigation material in this study is determined based on the difference between the pretest and posttest values, which is called the normalized gain. The gain normalization analysis technique illustrates the increase or decrease in the ability to understand spatial concepts of disaster mitigation materials in the experimental class and control class.

Based on the normalized gain calculation data, the average value for the experimental class is 62.74% and for the control class it is 20.70%. The experimental class and the control class both have an increased ability to understand spatial concepts. In the experimental class, there was an increase in the ability to understand spatial concepts after the implementation of the Problem Based Learning model with an average gain score of 62.74% belonging to the medium category. An increase in the ability to understand spatial concepts in the control class with a gain score of 20.70% belongs to the low category.

The results of hypothesis testing using independent sample t test analysis technique is able to improve students' ability to understand spatial concepts compared to before using

problem based learning. Based on the results of data analysis through the independent sample t test, it is known that the significance value (*sig*) is less than 0.05 (*sig* < 0.05), namely sig 0.00. This means H_1 accepted and H_0 rejected. Thus, it is said that the Problem Based Learning model has a significant influence on the ability to understand spatial concepts of disaster mitigation materials.

The results of this hypothesis test are strengthened by the results of research by Nurcahyo & Winanti (2021) which states that there is an increase in spatial thinking skills and knowledge of disaster mitigation materials using the Problem Based Learning model. Problem based learning is a way for students to upgrade thinking skills, that are the problem-solving process and intellectual intelligence skills (Susetyo, Sumarmi & Astina, 2017). With problem based learning, students can apply knowledge of theoretical concepts of disaster mitigation material from studying literature into real problem topics that have been obtained.

In this study, the experimental class experienced a significant increase in the ability to understand spatial concepts. This happens because the application of the Problem Based Learning model helps students understand the process of acquiring knowledge. This is in line with Gautama (2016) saying that there are significant differences in learning that uses the application of learning models in problem based contexts and without applying learning models in problem based contexts.

Increasing the ability of students in constructing problems, expressing problem solutions using spatial properties. This is in accordance with the Council (Nurcahyo & Winanti, 2021) that spatial thinking is a cognitive skill that can be used in everyday life to construct problems that are useful in finding answers and revealing solutions using spatial characteristics. Thus, this can be learned and taught formally to students using the right curriculum.

Implementation of Problem Based Learning Model on Disaster Mitigation Materials

The results of observations regarding the implementation of disaster mitigation learning materials using the Problem Based Learning model for three meetings are shown in table 2. as follows.

Table 2. The Results of the Implementation of the Problem Based Learning Model

Number	Meeting	Total	Criteria
1.	1	73	Good
2.	2	83	Very good
3.	3	89	Very good

From table 2. it shows that the Problem Based Learning model applied to the experimental class has a very good implementation. This can be seen from each learning meeting to have the achievement of learning quality with an increasing score. At the first meeting, they got a score of 73 in the good category. The very good category at the second meeting with a score of 83 and the third meeting with a score of 89. This proves that learning with the Problem Based Learning model is carried out very well according to the syntax available in this study.

Student Responses to Problem Based Learning on Disaster Mitigation Materials

Data on student responses to learning disaster mitigation materials using the Problem Based Learning model were obtained from a questionnaire given in the experimental class. Data analysis of student responses to learning shows that students have a positive response to learning using a problem based learning model.
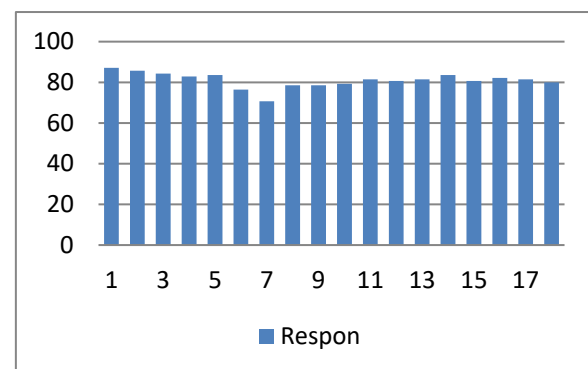

Figure 1. Precentages of Student Respon to Problem Based Learning

Based on Figure 1. the average results of each statement in the student response questionnaire are obtained. From the results, the student's response to learning is very strong, amounting to 87.14, which is found in the first indicator. This happens because the teacher has implemented the steps in Problem Based Learning well. While the results of the students' responses are the lowest average in statement 7 with a result of 70.71. This happens because the students are not accustomed to using worksheets in the Problem Based Learning process and students are not accustomed

to reading disaster events in teaching materials so that it is difficult to understand procedures in worksheets.

From Figure 1. it can be seen that each statement submitted received a strong response from students and it implies that students enjoy the learning process in class. Learning through the Problem Based Learning model is more fun than expository learning. In the experimental class, students play a role, so that students feel that their role is important in the learning activities. Students begin to build self-confidence during the learning process. The process of finding and managing information by students causes students to understand of disaster mitigation material to be more meaningful and enter into long-term memory. The Increasing of understanding the concept of disaster mitigation can increase knowledge about real problems in the daily lives of students. So, based on the responses of students during learning, it can be concluded that learning disaster mitigation through the Problem Based Learning model is appropriate to use.

This is reinforced by the research results of Purba, Fatchan, & Susilo (2016) that the Problem Based Learning model is able to appear an interest and enthusiasm for learning in students so it improves learning' outcomes. Increased knowledge is characterized by the ability to classify the types of disasters and to identify the natural phenomena around them. Increased knowledge about the concept of disaster mitigation can developed knowledge about the real problems.

The increased understanding of the spatial concept of disaster mitigation material for students from the application of the Problem Based Learning model is obtained from process skills in problem solving by following the syntax of the Problem Based Learning model.

CONCLUSION

Based on the results of the study, it can be seen that the initial condition of students' ability to understand spatial processes of disaster mitigation materials is still low. The Problem Based Learning model is effective in increasing the ability to understand spatial concepts of disaster mitigation materials. This is based on the average value of the ability to understand spatial concepts of disaster mitigation in the experimental class using Problem Based Learning which is higher than the control class. The ability to understand the spatial concept of

disaster mitigation materials of students after the implementation of the Problem Based Learning model has increased.

REFERENCES

Etherington, M. B. (2011). Investigative Primary Science : A Problem-based Learning Approach. *Australian Journal of Teacher Education*, *36*(9), 53–74.

Gautama, I. W. (2016). Pengaruh Penerapan Model Pembelajaran Berbasis Masalah Terhadap Kemampuan Berpikir Spasial Peserta Didik (Penelitian Quasi Eksperimen Pada Pembelajaran Geografi , Pokok Bahasan Barang Tambang Indonesia , Kelas XI IPS 3 SMAN 22 Bandung). *Jurnal Pendidikan*.

Hosnan, M. (2016). *Pendidikan Saintifik dan Kontekstual dalam Pembelajaran Abad 21*. Bogor: Ghalia Indonesia.

Isnaeni, A. W., Tjahjono, H. & J. (2014). Peran Mata Pelajaran Geografi Dalam Pendidikan Kebencanaan Bagi Siswa di SMA Negeri Se-Kabupaten Kebumen. *Edu Geography*, *3*(1), 1–9.

Istifarida, B., Santoso, S. & Yusup, Y. (2017). Pengembangan E-Book Berbasis Problem Based Learning-Gis untuk Meningkatkan Kecakapan Berfikir Keruangan Pada Siswa Kelas X SMA N 1 Sragen 2016/2017. *Jurnal GeoEco*, *3*(2), 133–144.

Jairina, N. S. I., Handoyo, B., & Astina, I. K. (2020). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Mitigasi Bencana. *Jurnal Pendidikan*, *5*(2), 225–228.

Jonassen, D. H.,& Hung, W. (2012). All Problems are Not Equal : Implications for Problem-Based Learning. *Interdisciplinary Journal of Problem-Based Learning*, *2*(2), 10–13.

Lestari, M., Suharini, E. & Banowati, E. (2018). Efektivitas Model Problem Based Learning Mata Pelajaran Geografi Materi Pokok Ketahanan Pangan, Energi, dan Industri di Kelas XI SMA Negeri 3 Pekalongan. *Edu Geography*, *6*(1), 33–43.

Maharani, Winda & Maryani, E. (2015). Peningkatan Spatial Literacy Peserta Didik Melalui Pemanfaatan Media Peta. *Jurnal Pendidikan Geografi*, *15*(1), 46–54.

Nafiah, Y. N. (2014). The Application of The Problem-Based Learning Model to Improve The Students Critical Thinking. *Jurnal Pendidikan Vokasi*, *4*(1), 125–143.

Nurcahyo, A. D., & Winanti, E. T. (2021). Pengaruh model Problem Based Learning Terintegrasi

Pendekatan Induktif terhadap Kemampuan Berpikir Spasial dan Pengetahuan Siswa Pada Materi Mitigasi Bencana. *Jurnal Pendidikan Geografi*, *26*(1), 41–47.

Oktavianto, D. A., Sumarmi, &, & Handoyo, B. (2017). Pengaruh Pembelajaran Berbasis Proyek Berbantuan Google Earth Terhadap Keterampilan Berpikir Spasial The Effect Of Project-Based Learning Assisted Google. *Jurnal Teknodik*, *21*(1), 59–69.

Purba, R. H., Fatchan, A. & Susilo, S. (2016). Pengaruh Kombinasi Model Problem Based Learning Dengan Team Games Tournament Terhadap Hasil dan Minat Belajar Geografi Siswa Man Rejotangan Kabupaten Tulungagung. *Jurnal Pendidikan Geografi*, *1*, 44–52.

Saputro, R., Setyowati, D. L., & Hardati, P. (2019). The Students Spatial Critical Thinking Skill by Using Map and Remote Sensing Imagery on Geography Lesson. *International Conference on Science and Education and Technology. Atlantis Press.*, *443*(Iset 2019), 250–254.

Segara, N. B., Pasya, G. K., & Maryani, E. (2012). Kontribusi Pemahaman Konsep Geografi Terhadap Sikap dan Perilaku Keruangan Peserta Didik SMA di Kota Cirebon. *Jurnal Pendidikan Geografi*, *12*(2), 28–36.

Setiawan, I. (2015). Peran Sistem Informasi Geografis (Sig) Dalam Meningkatkan Kemampuan Berpikir Spasial (Spatial Thinking). *Jurnal Pendidikan Geografi*, *15*(1), 63–89.

Suharini, E., Setyowati, D. L., & Kurniawan, E. (2015). Pembelajaran Kebencanaan Bagi Masyarakat di Daerah Rawan Bencana Banjir Das Beringin Kota Semarang. *Jurnal Forum Ilmu Sosial*, *42*(2), 184–195.

Susetyo, B. B., Sumarmi & Astina, I. K. (2017). Pengaruh Pembelajaran Problem Based Learning Berbasis Outdoor Adventure. *Jurnal Pendidikan*, *2*(12), 1669–1675.