JPII 6 (1) (2017) 165-169

Jurnal Pendidikan IPA Indonesia

http://journal.unnes.ac.id/index.php/jpii

DEVELOPING SCIENCE PROCESS SKILLS AND PROBLEM-SOLVING ABILITIES BASED ON OUTDOOR LEARNING IN JUNIOR HIGH SCHOOL

S. Wahyuni[1]*, Indrawati[1], Sudarti[1], W. Suana[2]

[1]Physics Education Program, Faculty of Teacher Training and Education, Universitas Jember, Indonesia
[2]Physics Education Program, Faculty of Teacher Training and Education, Universitas Lampung, Indonesia

DOI: 10.15294/jpii.v6i1.6849

Accepted: February 23th 2017. Approved: March 23th 2017. Published: 30th April 2017

ABSTRACT

This research aims to develop science process skills and problem-solving abilities based on outdoor learning in junior high school. This study uses a mixed method design embedded experimental models. Data was performed in the qualitative and quantitative analysis. Qualitative data analysis is used to determine the science process skills while quantitative data analysis is used to determine the increasing problem-solving ability by using normalized gain (N gain) formula. The results show that the science process skills developed at every phase comprise of making observations, formulating hypotheses, experiment, create data, classify and analyze the data, formulating its conclusions, communicate, and apply the concepts and make predictions obtained by the average value of 75.33 in the good category. While the problem-solving ability of students based on outdoor learning also increased by 0.58 in the medium category. The conclusions of this research show that the application of outdoor learning can be teacher use as an alternative to learning, so it is quite effective in developing science process skills and problem-solving abilities.

Keywords: science process skills; problem-solving abilities; outdoor learning

INTRODUCTION

Natural Sciences (IPA) is a way to find out about nature systematically is not only mastering a set of knowledge but also finding process and knowledge reconstruct through scientific procedures as performed by the scientist. According to Wahyuni (2015), IPA is a set of knowledge about objects and natural phenomenon obtained from the result of thought and investigation conducted by skills of scientists experimented using scientific methods. Learning will be meaningful if the investigation activities and experiments involving students actively and directly related to learning resources.

Characteristics of IPA learning is a learning including product, process, scientific attitudes, and daily applications. The fourth element is a whole IPA characteristic and can not be separated from each other. The process of IPA learning should have a direct experience of students thereby increasing students ability to construct, to understand, and apply the concepts learned (Listyawati, 2012). Thus, students will be practiced to find their various concepts holistically, meaningful, authentic and applicable to problem-solving. It corresponds in Ango (2002) which states that there are two kinds of options in the process of learning that is meaningful and rote learning.

Based on observations during the learning process in schools, to activate the students, teachers usually assign the task directly from the textbooks, worksheets or undertake LKS with the task to summarize material. Although the purpo-

***Alamat korespondensi:**
E-mail: yunifisika@gmail.com

se is to activate students and reduce the lecture method, the main point is the targeted material can be completed. Though most students only use the level of the basic concepts that have been obtained previously in learning (MCBride et al., 2010). According to Sumarni et al. (2016), the criteria for good IPA learning not only from books, but teaching should include practice instrument as well as associated with the environment. Therefore developed IPA learning connecting or brings together the various fields into a single discussion. According to Solichah et al., (2013), IPA learning carried out in an integrated can improve learning achievement, process skills and attitudes of students towards science.

Science process skills are skills that need to be implanted, practiced and owned by students. It is the foundation for scientific inquiry and intellectual development necessary to learn the science concepts (Duran et al., 2011). According to Ergül et al., (2011) developing science process skills enable students to problem-solving, thinking critical, make decisions, looking for answers, helping students to logical thinking, ask questions in a reasonable and problem solving they face in daily.

Problem-solving is one of the very important ability in science learning (Heller et al., 1992, Afriana et al., 2016). Science issues are an idea that is important to build the capacity of students' problem solving and make science lessons more fun and motivate students to perform better. Problem-solving skills used in solving problems of science in mathematical form and solves the problem of phenomena happens in the environment. But in fact, students experiencing difficulties because of the strategies taught in learning only to solve problems that require mathematical calculations (Ogilvie, 2009).

One of the learning which utilizes nature as a source of learning is outdoor learning. It affects the interest in learning and student learning outcomes (Ali, 2008; Syawiji, 2009, Amini, 2015). However outdoor learning activities are rarely carried out in learning as it relates to the difficulty of class management, making it difficult for teachers and in its implementation and requires a tight of time management (Santiningtyas et al., 2012).

Though many advantages gained by utilizing the environment as a learning resource. Through the utilization of field around the school would allow students to learn directly about the natural phenomenon based on observations of its own so that the learning process more meaningful (Zwick & Miller, 1996). Outdoor learning needs to be repeated to create learning fun and humanist. Learning is considered able to stimulate the students to improve the quality of learning in all aspects (affective, cognitive and psychomotor) to involve more senses of sight, auditory senses, sense of touch, sense of smell to the students and provide a more memorable experience about the subject.

Based on the results of previous research, Santiningtyas et al., (2012) show that implementation of outdoor learning inquiry-based significantly influence student learning outcomes, as well as research from Solichah et al., (2013) with the development of experimental pieces in the inquiry-based integrated IPA outdoor learning as feasible and more effective in learning. Based on the background and identify the problem, this research aims to develop science process skills and problem-solving abilities based on outdoor learning in junior high school.

METHODS

This study uses a Mixed Methods design embedded experimental Model (Creswell, 2013). This method comprised of two basic processes, that is quantitative process accompanied by a qualitative process which embedded inside and the process based on a qualitative interpretation of the results.

The quantitative research design using Pre-Experimental design using a design The One Group Pretest-Posttest Design. Early research before is treated by administered problem-solving tests as preliminary data of students pretest. After being given the treatment, problem-solving tests given to get the data again from students posttest. While the design of qualitative research was conducted during the intervention using outdoor learning when intervention gave the observations to determine the science process skills of students during learning.

The instrument used in this study comprised of science process skills observation sheets and pretest and posttest questions used to measure students' problem-solving abilities. Data analysis techniques to determine the qualitative data of science process skills used by reducing the data, encoding and interpretation of the results process skills are applied every meeting on the outdoor learning. While the data of problem-solving abilities performed by using an N gain score or the normalized gain.

$$g = \frac{Xm - Xn}{100 - Xn} \quad (1)$$

With:
g = gain score
Xm = posttest score
Xn = pretest score

After calculation, the results are confirmed by gains normalized criteria; a) g <0.3; low, b) 0.7> ≥ 0.3 g; medium, c) ≥ 0.7 g; high (Hake, 1998).

RESULTS AND DISCUSSION

Learning activity in this study is in principle by the lesson plan that had been developed, which applying outdoor learning adapted from Eggen & Kauchak (2012) which is applied to a VII class at one of junior high school in Jember. The outdoor application learning was done in six main stages i.e. the identification of the problem, examine the question (to formulate the problem), create a hypothesis, collect data, analyze the data and make conclusions, as well as build and communicate the report. These six stages are adjusted to the character of IPA lessons that require a variety of methods to practice and improve the science process skills and problem-solving ability of students.

Aspects of science process skills contained in the outdoor learning include observation, formulating questions, formulate hypotheses, make observations outside the class, create data, classifying and analyzing data, drawing conclusions, communicate, and apply concepts and make predictions. Aspects of science process skills results are shown in Table 1.

Based on Table 1, in general, the average value of science process skills in good categories, that is equal to 75.33. These results are due to in learning; students are invited to make direct observations of the neighborhood where they live, which is one of the most effective ways to portray the concepts studied by aligning themselves as much as possible to reality (Liu et al., 2009).

Application of outdoor learning makes the students active and no longer memorize the concepts, but students can construct their knowledge. So that these lessons can also develop science process skills directly in the field, making the lesson more clear and concrete, easy for students to understand the lessons, stimulate students to more actively observe and try themselves so that students are more motivated and enthusiastic in observation (Wahyuni, 2016). According to Arend (2008) expressed curiosity something that can motivate students to construct knowledge students actively, so that the student-centered learning process (student centered).

Table 1. Average Value of Students Science Process Skills (KPS)

KPS aspect	KPS Average Value	Category
Observation	80.60	Very good
Formulating Questions	78.90	Good
Formulating Problems	54.00	Less
Observation Outside the Class	90.25	Very good
Creating Data	74.80	Very good
Classifying and Analyzing Data	72.30	Good
Formulating Conclusions	75.25	Good
Communicate	80.30	Very good
Apply the Concepts and Making Predictions	71.60	Good
Average	75.33	Good

The problem-solving ability of students is measured by using a posttest comprised of five questions in the form the description consisting of four (4) stages, problem analysis, planning, problem-solving, problem-solving alternative, and reflection. The results of data analysis the average score of pretest and posttest of each stage is presented in Table 2.

Table 2. The results of the comparison of Problem Solving Ability pretest and posttest score

Stage	Pre-test	Post-est	N gain	Category
Problem analysis	60.24	88.56	0.71	High
Problem Solving Planning	36.75	76.65	0.63	Medium
Problem Solving Alternative	56.30	75.45	0.43	Medium
Reflection	40.56	73.45	0.55	Medium
N-gain Average Score			0.58	Medium

Based on Table 2, in general, the problem-

solving ability of students has increased to the score of N gain average of 0.58 in the medium category. It is because of students already familiar and well-practiced in outdoor learning. So that students become familiar to analyze and solve real problems that are going on around him, collecting data based on observations, make hypotheses, discussion, and students can make their conclusions related to the observation and study have been received.

The presence of triggers to be a problem in outdoor learning made students more interested in and challenged to learn. Where in the steps of outdoor learning, students are encouraged observation outside the class makes the students acquire direct experience of what students learn and interact directly with the object being observed so that students have a strong interest in learning from within himself. It is according with the opinion of Tolga (2008) which states that a child will be interested in learning when he learned it was a little known or enjoyed its benefits so that it can grow the curiosity.

Improved problem-solving ability is possible due to the application of outdoor learning, students familiar to solve problems that led to the learning becomes more meaningful. It is due to students are invited to learn outdoors to take advantage of the environment as a learning resource, thus making the concepts/facts related to the subject can be easily mastered students through observations on a concrete situation. It is according to Yuniastuti (2016) states that the use of learning strategies to use in real world problems as a context for students to learn, making the students can improve their critical thinking skills and solve problems, and get the concept of knowledge.

Outdoor learning is the positive impact on problem-solving skills and science process skills of students. Students become used in preparing the material to be learned by studying seriously, if there were not understood or encounter difficult problems related to everyday life, they carry out identification of problems and find solutions to solve these problems, ask the teacher or a person who could provide an explanation regarding the problems encountered, reading, or looking out from a variety of sources/media.

Positive impact on outdoor learning is also a permanent impact on the students. Students maintain their learning style and attitude of environmental care. This finding is evidenced by completion of a problem using problem-solving stages, as well as the attitudes of the students when there is trash scattered, they immediately took to be thrown in the trash and reminding each other for not littering. With the existence of the positive attitude, it will improve the ability to solve problems and practice students' science process skills which will further improve learning outcomes. It is according to Liu et al., (2009) research which states that students show a good positive attitude towards learning strategy and outdoor learning accompanied by group work.

CONCLUSION

Based on the results of research and discussion, we can conclude that (1) science process skills that exist for the application of outdoor learning scored the highest with very good criteria found in four aspects that observation, observation outside the class, create data, and communicate. Good criteria found in four aspects, formulating questions, organizing data, formulating its conclusions, and applying the concept/prediction. While the average score was lowest for the aspects of formulating hypotheses. (2) Problem-solving abilities. During the learning process of outdoor learning has increased by an average of 0.58 N-gain in the medium category.

Based on the discussion and findings. The application of outdoor learning can be teachers use as an alternative to learning because it proved able to teach you how to learn efficiently and can optimize the science process skills and problem-solving abilities. Sometimes learning conducted in the classroom and sometimes students are encouraged to learn in a different atmosphere outside the class so that the enthusiasm for learning can increase student learning and evolve.

REFERENCES

Afriana, J., Permanasari, A., & Fitriani, A. (2016). Project based learning integrated to stem to enhance elementary school's students scientific literacy. *Jurnal Pendidikan IPA Indonesia*, *5*(2), 261-267.

Ali, H. (2008). Efektivitas Pembelajaran Biologi melalui Metode Out Door Study dalam Upaya Meningkatkan Minat Belajar Siswa. *Jurnal Bionature*, *8*(1), 18-23.

Amini, R. (2015). Outdoor based environmental .education learning and its effect in caring attitude toward environment. *Jurnal Pendidikan IPA Indonesia*, *4*(1), 43-47.

Ango, M. L. (2002). Mastery of Science Process Skills and Their Effective Use in the Teaching of Science: An Educology of Science Education in the Nigerian Context. *Online Submission*, *16*(1), 11-30.

Arend, R.I. 2008. *Learning To Teach*. New York: Mc

Graw Hill Companies, Inc.

Duran, M., Işik, H., Mihladiz, G., & Özdemir, O. (2011). The relationship between the pre-service science teachers'scientific process skills and learning styles. *Western Anatolia Journal of Education Science*: 467-476.

Creswell, John W. 2013. *Research Design*. Yogyakarta: Pustaka Pelajar.

Eggen, Paul. & Kauchak, Don. 2012. *Strategi dan Model Pembelajaran Mengajarkan Konten dan Ketrampilan Berpikir*. Jakarta: PT. Indeks.

Ergül, R., Şımşeklı, Y., Çaliş, S., Özdılek, Z., Göçmençelebı, Ş., & Şanli, M. (2011). The effects of inquiry-based science teaching on elementary school students'science process skills and science attitudes. *Bulgarian Journal of Science & Education Policy*, *5*(1), *48-68*.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American journal of Physics*, *66*(1), 64-74.

Heller, P., Keith, R., & Anderson, S. (1992). Teaching problem solving through cooperative grouping. Part 1: Group versus individual problem solving. *American journal of physics*, *60*(7), 627-636.

Listyawati, M. (2012). Pengembangan perangkat pembelajaran IPA Terpadu di SMP. *Journal of Innovative Science Education*, *1*(1), 61-69.

Liu, T. Y., Tan, T. H., & Chu, Y. L. (2009). Outdoor natural science learning with an RFID-supported immersive ubiquitous learning environment. *Educational Technology & Society*, *12*(4), 161-175.

McBride, D. L., Zollman, D., & Rebello, N. S. (2010). Method for analyzing students' utilization of prior physics learning in new contexts. *Physical Review Special Topics-Physics Education Research*, *6*(2), 020101, 1-10.

Ogilvie, C. A. (2009). Changes in students' problem-solving strategies in a course that includes context-rich, multifaceted problems. *Physical Review Special Topics-Physics Education Research*, *5*(2), 020102, 1-14.

Santiningtyas, K., Prasetyo, A. P. B., & Priyono, B. (2012). Pengaruh Outdoor Learning Berbasis Inkuiri terhadap Hasil belajar Materi Ekosistem. *Unnes Journal of Biology Education*, *1*(2), 91-98.

Solichah, A. P., Parmin, P., & Nurhayati, S. (2013). Pengembangan lembar eksperimen ipa terpadu berbasis inkuiri dalam outdoor learning pada tema ekosistem. *Unnes Science Education Journal*, *2*(2), 337-343.

Sumarni, W., Wardani, S., Sudarmin, S., & Gupitasari, D. N. (2016). Project based learning (pbl) to improve psychomotoric skills: a classroom action research. *Jurnal Pendidikan IPA Indonesia*, *5*(2), 157-163.

Syawiji. 2009. Metode Outdoor Learning dan Peningkatan Minat Belajar Aritmatika Social. *Jurnal Pendidikan,* 9(1): 30-46.

Tolga, G. Ö. K. (2008). Effects of problem-solving strategies teaching on the problem-solving attitudes of cooperative learning groups in physics education. *Journal of Theory and Practice in Education*, *4*(2), 253-266.

Wahyuni, S. (2015). Developing web-based performance assessment in integrated science course. *Jurnal Pendidikan IPA Indonesia*, *4*(1), 7-10.

Wahyuni, S. (2016). Developing science learning instruments based on local wisdom to improve students'critical thinking skills. *Jurnal Pendidikan Fisika Indonesia*, *11*(2): 156-161.

Yuniastuti, E. (2016). Peningkatan Keterampilan Proses, Motivasi, dan Hasil Belajar Biologi dengan Strategi Pembelajaran Inkuiri Terbimbing pada Siswa Kelas VII SMP Kartika V-1 Balikpapan. *Jurnal Penelitian Pendidikan*, *13*(1), 78-86.

Zwick, T. T., & Miller, K. W. (1996). A comparison of integrated outdoor education activities and traditional science learning with American Indian students. *Journal of American Indian Education*, 1-9.