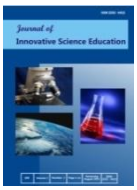
JISE 7 (2) 2018 : 215-222

Journal of Innovative Science Education

http://journal.unnes.ac.id/sju/index.php/jise



Development of Project-Based Learning Guide on Pollution and Environmental Conservation Material at SMA 1 Jekulo Kudus

Eni Dwi Astuti[1,2]✉, Margareta Rahayuningsih[2], Sri Ngabekti[2]

[1] SMA N 1 Jekulo Kudus, Indonesia
[2] Universitas Negeri Semarang, Indonesia

Article Info

Article History:
Received January 2018
Accepted March 2018
Published August 2018

Keywords:
Learning Guide , Pollution and Environmental Conservation, Project-Based Learning.

Abstract

One of the efforts to be an Adiwiyata school is done by improvement of knowledge, activities, attitudes, and skills of students regarding environment. The activities, attitudes, and skills, and the cognitive learning outcome of students were still low. Project learning is considered as one of the approaches to create learning environment that can support students to build knowledge, attitudes, and skills. The study aimed to describe the characteristics of learning guide and to test the validity, practicality, and effectiveness of learning guide on pollution and environmental conservation material. The study implemented research and development (R&D) design. The learning media was validated by the validator. The practicality was determined by student and teacher response. The effectiveness was observed from the activities, attitudes, and skills, and the cognitive learning outcome. The activities, attitudes, and skills were analyzed using percentage descriptive. The cognitive learning outcome was tested using independent t-test. The result of the study showed that the learning guide on pollution and environmental conservation material was valid, practical, and effective. The learning guide was declared valid with good category. The learning guide was declared stated practical by getting positive response from the students, and the teachers gave very good response. The learning guide was declaredeffective with activities, attitudes, and skills in very good category. The classical completeness of experiment class reached the Minimum Mastery Criteria 83,3% and control class 45,2%. There was significant difference between the post-test average score of experiment class and control class.

✉ Alamat korespondensi:
Jln. Raya Kudus-Pati Km. 10 No.34 Jekulo Kudus, Kudus, Jawa Tengah, Indonesia
E-mail: deeyas0487@gmail.com

p-ISSN 2252-6412
e-ISSN 2502-4523

INTRODUCTION

SMA Negeri 1 Jekulo as a community has declared itself as a National Adiwiyata school that cares about the environment and is conservative. Clean and comfortable environment increases learning spirit and creates enjoyable condition (Setyaningrum, 2015). The community perception towards waste management still leads to the responsibility of janitors, the optimization policy in waste management for environmental conservation has shown the understanding of community members of the conservative vision and conservative attitudes (Banowati, 2012).

The efforts of environmental conservation have to start form individuals by starting to do small things. The change made then can be 'spread' to be a habit in family or society, so as big change happens. According to Handayani (2013), a school is a leading education institution in Indonesia to develop character education. To handle the waste problems at schools, one of the things that can be done is establishment of waste management that can be implemented as school activity.

Waste is a global problem that needs to be paid attention by everyone because it can cause various kinds of diseases and ruin environmental aesthetics (Alex, 2013: 46). The environmental condition of SMA Negeri 1 Jekulo highly supported the learning of environmental problems and natural conservation especially waste management because there was a river that became the liquid waste disposal way of paper factory near the school, and rice field area behind the school, and there also existed a landfill at which many kinds of waste were found, mostly plastic waste, and much waste of leaves was found at the school forest that supported the making of compost at school starting from 2012. The initial survey found out that 46% of the students were inactive during learning. The poor activity especially affected the learning outcome. The result of daily quiz on pollution and environmental conservation material obtained average score of 64, with Minimum Master Criteria 70, only 52% of the students completed the learning. The cooperative attitude has not been observable, and there were many inactive students.

Based on the characteristics of the problems described, a project-based learning guide on pollution and environmental conservation was developed in accordance with Curriculum 2013. The learning process in the curriculum for all levels was done using scientific approach, namely student-centered learning (Fauziah et al., 2013; Wiyanto et al., 2017).

Project-based learning is a learning model using project/activity as the core of learning. According to CORD (2007) as well as Dickinson and Jackson (2008), project-based learning intends to take students to learn deeper in using inquiry, the teachers play the role as facilitators who guide the students to gain experience and do experiments that enable them to find principles and construct understanding independently.

METHODS

The study used research and development (R&D) design. The selection of R&D design referred to the opinion of Borg & Gall (1989) and Sugiyono (2013), who state that R&D design is a research method used to produce a certain product and to test the effectiveness of the product.

Small-scale experiment was done in class XI MIA-1 to 9 students with low, intermediate, and high ability based on class ranking/achievement. The sampling was done using purposive sampling technique with one-shot case study design. The learning guide revised in small-scale experiment was then experimented in large-scale experiment in class X MIA-3 and X MIA-4. The large-scale experiment design used pretest-posttest control group design.

The sample was taken for small-scale experiment using purposive sampling technique on 9 students of class XI MIA-1. The sample was taken for large-scale experiment using cluster random sampling cluster technique,

experimented in X MIA-3 (42 students), and X MIA-4 (42 students). The classes were selected by cluster random sampling after passing homogeneity test.

RESULTS AND DISCUSSION

Practicality of learning guide

The result of student positive response can be observed from Figure 1 as follows.

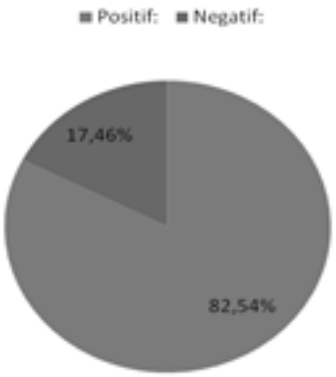


Figure 1. Student response of small-scale experiment class after learning using learning guide on pollution and environmental conservation

From the result of assessment, it could be concluded that the learning guide was declared practical. It was practical because the small-scale experiment class had percentage of student positive response of 82.54%. While the teachers gave very good response to the learning guide on pollution and environmental conservation. It can be seen from the following Table 1.

Table 1. Teacher response to the learning guide

No.	Assessment Aspect	Score
1	Title	4
2	Pictures	5
3	Material	4
4	Language	5
5	Writing	4
Total		22
Average		4.40
Category		Very Good

Effectiveness of the learning guide

Activities

The percentage of student activity acquisition can be seen from Figure 2 as follows.

Figure 2. Result of experiment class activity analysis

In Figure 2 above, it can be seen that the experiment class activities reached the indicator of success with percentage of 88% in very good category. Therefore, the learning guide on pollution and environmental conservation was effective.

Skills

The percentage of skill acquisition is shown in Figure 3 as follows.

Figure 3. Result of experiment class skill analysis

In Figure 3 above, it can be seen that the experiment class skill reached the indicator of success with percentage of 83% in very good category. Therefore, the learning guide on pollution and environmental conservation was effective because it reached the specified indicator of success.

Attitudes

The percentage of attitude acquisition can be seen from Figure 4 as follows.

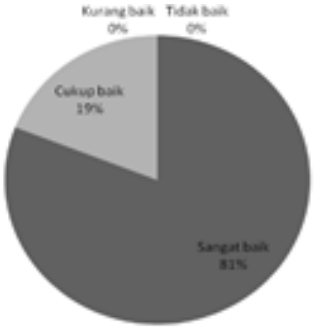


Figure 4. Result of experiment class attitude analysis

In Figure 4.3 above, it can be seen that the experiment class attitude reached the indicator of success with percentage of 81% in very good category. Therefore, the learning guide on pollution and environmental conservation was effective.

Cognitive Learning Outcome

Normality Test

The result of normality test can be seen on Table 2 as follows.

Table 2. Result of Normality Test of Experiment and Control Class

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pretest_Ex	.133	42	.061	.944	42	.040
Posttest_Ex	.088	42	.200(*)	.982	42	.728
Pretest_Control	.118	42	.154	.959	42	.136
Posttest_Control	,132	42	.063	.950	42	.064

Hypothesis:

Ho: data sourced from normal distributed population

Ha: data sourced from abnormal distributed population

Based on the output above, it can be seen that in Kolmogorov Smirnov column, it obtained the significance value for posttest score of experiment and control class respectively 0.08 and 0.132. Therefore, because the significance for all variables was 0.05, it could be concluded that the data of posttest score of experiment and control class was normal distributed.

Homogeneity Test

Homogeneity test was done to investigate whether the experiment and control class was homogenous or not. Homogeneity test was done using Levene statistic aided by SPSS 18. The result obtained can be seen on Table 3 as follows.

Table 3. Result of Homogeneity Test of Experiment and Control Class

Levene Statistic	df1	df2	Sig.
.692	1	82	.408

Hypothesis:

Ho: experiment and control class were homogenous

Ha: experiment and control class were not homogenous

Based on the output above, it can be interpreted that the experiment and control class were homogenous because the significance value was 0.692 or sig. > 0.05.

Completeness of Knowledge Ability

Completeness was used to investigate the achievement of classical completeness of experiment class. In the experiment class, there were 35 students who completed and 7 students who did not complete the Minimum Mastery Criteria (70). The percentage of completeness was obtained for 83.3% of 42 students in experiment class.

Average Difference Test

The test used two-sample independent test (independent t-test). The test aimed to observe whether the cognitive learning outcome of experiment and control class was different in reality. The result can be seen on Table 4. as follows.

Table 4. Result of Average Difference Test

	Class	N	Mean	t-calculate	t-table
Combined value	Experiment class	42	77.1429	5.080	1.990
	Control class	42	68.2738		

Ho: there was no difference between average posttest scores of experiment and control class

Ha: there was a difference between average posttest scores of experiment and control class

Based on Table 4.9, the value of t-calculate was 5.080 with t-table 1.990. Because t-calculate > t-table (5.080 > 1.990), Ho was rejected, so it means that there was a significant difference between average posttest scores of experiment and control class. Therefore, the use of learning guide on pollution and environmental conservation was effective for the student cognitive learning outcome. In accordance with Munawaroh (2013), that the application of project-based learning on human digestion system could improve student learning outcome. The existence of positive correlation was in accordance with the theory of constructivism learning that students could build their own learning in the context of their own experience and not as a knowledge transferred directly by teachers to students (Murphy, 1997) in Wena (2009).

Characteristics of Learning Guide

The learning guide developed has some aspects of excellence. The striking difference of the guide with other learning guides was how the teachers attempted to support adiwiyata school. Theconservative action in supporting adiwiyata school at SMA N 1 Jekulo was the utilization of the surrounding environment of the school by observation done by the students at the river in which liquid waste from Pura Paper Factory existed. During the observation, the students found the change of color and smell of the river. The students were happy and interested because they got to know and were able to differentiate polluted water from non-polluted one.

During observation at a market near the school to observe the waste disposal there, the students were enthusiastic to observe the condition of market environment. Waste was everywhere and there was bad odor from the waste that made it difficult for them to breathe. There were also a lot of flies at the garbage bins and later they observed that the flies perched on food, fruits, and vegetables of the sellers. It made the students understand the importance of placing food in the proper place and maintaining the environmental hygiene for beauty and health.

During the practice of organic waste compostingtaken from the park, garden, and forest of the school, all students were interested and enthusiastic to be able to learn outside of the class, especially at the garden and forest of the school that were cool, and to experience with their teammates to collect dry leaves and then mince them using leaf mincer owned by the school, to put the minced leaves into composter bin and add EM-4 liquid and palm sugar solution water to accelerate the decomposing. Furthermore, during the practice of plastic waste recycle, the students were happy and enthusiastic to ask the canteen employees for plastic waste to be processed into bags.

The occurring facts attempted to present data regarding real destruction occurring in surrounding environment so that it could touch the awareness of students of the nature destruction that happened. The part "student activities" in the learning guide aims that the students do not only stop on the level of environmental conservation opinion, but they

are also on the level of environmental conservation actions by processing organic or inorganic waste.

Conservation education has to be able to improve sensitivity, knowledge, understanding, care, identification, and investigation on environmental problems (Domroese& Sterling, 1999). According to Widiyatmoko (2012), each student has different learning style, so that the project-based learning gives opportunities to students to explore the material using various ways that are meaningful for them and to conduct experiments collaboratively. Therefore, the learning process in conservation education, especially pollution problems, has to improve sensitivity, knowledge, and understanding on pollution problems where humans as the main cause, to motivate the students to care and actively participate in environmental protection and improvement to prevent more serious pollution impacts, and to improve the ability to identify and investigate global warming problems.

Validity of Learning Guide

The learning guide on pollution and environmental conservation required validation by validator. According to Sugiyono (2013), a valid learning guide means that it can be used in the learning.

The result of assessment of validator shows that the learning guide on pollution and environmental conservation developed was valid and had good criteria. The result could not be separated from the researcher's efforts to develop the guide based on the syllabus of Biology for Senior High School of Curriculum 2013. According to Nieveen (1999), a learning guide can be said as good if it fulfills the string theoretical rational, for example, preparation of guide that refers to the existing core competence and basic competence.

The developed design of syllabus product is stated valid and in good category. According to the Regulation of Minister of Education and Culture No. 59 Year 2014 regarding Curriculum of Senior High School, the syllabus as referred to in Article 1 verse (2) letter c is a learning plan for a subject that covers Core competence, Basic Competence, learning material, learning activities, assessment, time allotment, and learning source. The developed syllabus covers syllabus components expected by regulations related to preparation of syllabus for Curriculum 2013. So, no wonder that the score obtained from the validator reached the average of 4.2 (good).

Practicality of Leaning Guide

There is a significant difference of biology learning outcome between the students leaning using project-based learning model and direct learning model (Jagantara, 2014). The product design stated as valid in the study was then experimented in small-scale experiment and product improvement. Small-scale and large-scale experiment aim to investigate the practicality and to improve the quality of learning guide on pollution and environmental conservation.

The practicality was determined by positive response of students and teachers on the learning guide. According to Nieveen (1999), the practicality aspect is fulfilled when (a) the experts and practitioners (teachers) state that what is developed can be implemented; and (b) the reality shows that what is developed can be implemented and get positive response from students.

The obtained result shows that the learning guide on pollution and environmental conservation was valid. The data in Figure 4.1 show that the learning guide on pollution and environmental conservation got positive response from students. The teachers in Table 4.6 gave very good response from the aspect of picture, material, language, and writing. Usman (2009: 27) state that a good condition of teaching and learning is determined by student interest and attention in the learning.

The teachers' efforts in implementing the PJBL-model learning guide on pollution and environmental conservation by inviting the students to process the waste and practice the conservation efforts were a positive stimulus. Positive stimulus will make students give good

response so that the learning process becomes effective. Fikri (2014) states that student response towards learning using PJBL model is good, and it is considered as something new and interesting.

Effectiveness of Learning Guide

The effectiveness of the learning guide in the study was determined by the aspect of activities, attitudes, skills, and cognitive learning outcome. The indicator of success are as the following. Firstly, the score of activities, attitudes, and skills of students of experiment class reached very good criteria above 75%. Secondly, the cognitive learning outcome of students reached the Minimum Mastery Criteria ≥ 70 for 75% and there was a difference between the average posttest scores of experiment and control class.

Based on the result of the study, it can be concluded that the learning guide on pollution and environmental conservation was effective for the activities, attitudes, skills, and cognitive learning outcome of students. In accordance with Indarti (2017), the effective Project-Based Learning (PjBL) model can create active learning, give real experience so that the learning becomes enjoyable, and improve the activities and learning outcome on High-Level Plant Diversity at SMA Negeri 1 Bergas.

The activities of students of experiment class reached the indicator of success with percentage of 88% in very good category. The attitudes of experiment class reached the indicator of success with percentage of 81% in very good category. The skills of experiment class reached the indicator of success with percentage of 83% in very good category. It is in accordance with the result of study by Dewi (2012) that concludes that project-based learning can improve student activities and learning outcome that makes students become active.

The percentage of cognitive learning completeness obtained 83.3% of 42 students of experiment class. The value of t-calculate > t-table (5.080 > 1.990) so that Ho was rejected that means that there was a significant difference between the average posttest scores of experiment and control class.

The result of the study conforms to previous studies, such as the study by Buck (1999), Moursund (1997). A study regarding project-based learning was done by Yance (2013) with result that project-based learning can improve the result of physics learning for the eleventh graders. Another study supporting the study is by Khamdi (2007) where project-based learning gives better effect on student learning outcome compared to direct learning.

CONCLUSION

The development of learning guide on pollution and environmental conservation using project-based learning (PjBL) model was effective on the activities, attitudes, skills, and cognitive learning outcome of students and the knowledge of students and to stimulate the student activities into conservation actions in supporting Adiwiyata School by utilizing the surrounding environment of the school. The learning guide on pollution and environmental conservation was stated valid and practical.

REFERENCES

Alex, S. (2013). *Sukses Mengelola Sampah Organik Menjadi Pupuk Organik*. Yogyakarta: Pustaka Baru Press.

Banowati, E. (2012). Pengembangan *Green Community* Unnes Melalui Pengelolaan Sampah. *Indonesian Journal of Conservation,* 1(1), 6-11.

Borg, W.R. & Gall, M.D. (1989). *Educational Research an Introduction.* New York: Longman.

Buck, I.E. (1999). *Project based learning*. Available at http://www.bgsu.edu/ organization/etl/proj.html [diakses 15 april 2017].

Cord, A. (2007). *Project based learning*, (online) available at http://www.cord.org/project-based-learning [accessed on 17 December 2016].

Dickinson, G. & Jackson, J.K. (2008). Planning for success. How to design and implement project based science activities. *The science teacher*, 8(1), 29-32.

Domroese, M.C. & Sterling E.J. (1999). *Developing a Conservation Education Program*. http://www.izea.net (downloaded on 2 May 2017).

Handayani, A. (2013). *Peningkatan Sikap Peduli Lingkungan Melalui Implementasi Pendekatan Sains Teknologi Masyarakat (Stm) Dalam Pembelajaran IPA Kelas IV.1 di SD N Keputran "A"*. Universitas Negeri Yogyakarta.

Indarti & Eling, P. (2017). Keefektifan *Project Based Learning* dengan Observasi pada Materi Keanekaragaman Tumbuhan Tingkat Tinggi. Faculty of Mathematics and Natural Science of State University of Semarang. *Journal of Biology Education*, 6(2), 187-194.

Jagantara. (2014). Pengaruh model pembelajaran berbasis proyek (project based learning) terhadap hasil belajar biologi ditinjau dari hasil belajar siswa SMA Singaraja. *E-jurnal pascasarjana universitas pendidikan ganesha*, 4(1).

Khamdi, W. (2007). Pembelajaran berhasil proyek : model potensi untuk meningkatan mutu pembelajaran. Available at http: //lubisgrafura.wordpress.com accessed on 5 July 2017.

Morsund, D. (1997). *Project: Road a Head (Project-Based Learning)*. http://www.iste.org (downloaded on 13 September 2015).

Munawaroh, A., Wulan, C., & Supriyanto. (2013). Penerapan Model Pembelajaran Berbasis Proyek Untuk Meningkatkan Hasil Belajar Sistem Pencernaan SMP. *Unnes Journal of Biology Education,* 2(1), 20-23).

Nieveen, N. (1999). *Design Approaches and Tools in Education and Training (Prototyping to Reach Product Quality,* in *Van den Akker, R.M Branch, K. Gustafsson, N. Nieveen, &Tj. Plomp).* Dordrecht Netherland: Kluwer Academic Publisher.

Setyaningrum, T. Enni, S.R., & Ning, S. (2015). Pembelajaran Berbasis Proyek Pembuatan Miniatur Ekosistem Untuk Mengoptimalkan Hasil Belajar Ekologi Pada Siswa SMA. *Unnes Journal of Biology Education*, 4(3), 290-297.

Wena, M. (2009). *Strategi Pembelajaran Inovatif Kontemporer: Suatu Tinjauan Konseptual Operasional*. Jakarta: BumiAksara.

Widiyatmoko, A. (2012). Pembelajaran berbasis proyek untuk mengembangkan alat peraga IPA dengan memanfaatkan bahan bekas pakai. *Jurnal pendidikan IPA Indonesia*, 1(1), 51-56.

Wiyanto, Nugroho, S.E., & Hartono. (2017). The Scientific Approach Learning: How prospective science teachers understand about questioning. *Journal of Physics: Conference Series*, 824(1), 012015.

Yance, R. (2013). Pengaruhpenerapan model *project based learning* terhadap hasil belajar fisika siswa kelas XI IPA SMA N Batipuh kabupaten Tanah datar. *Pillar of Physics Education,* 1(1), 48-54.