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THE IMPLEMENTATION OF CONSTRUCTIVISM-BASED STUDENT WORKSHEETS WITHIN THE THEME 'THE PREVENTION OF LAND AND FOREST FIRE' IN SCIENCE EDUCATION FOR SEVENTH GRADERS IN RIAU

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ABSTRACT

The issues of land and forest fire require a comprehensive effort, one of which is through the dissemination of educational values, such as science education. This verification study aims to examine the truth of the stage competence on the constructivism approach of the advanced test on student woksheet 1 and 2 and compare it with the test results 2 on the theme of forest and land fire and peat swamp ecosystem as well as global warming and its impact. The study was conducted in the laboratory of Biology department, Faculty of Teacher Training and Education, Universitas Riau and SMPN 1 Bungaraya in September-December 2016. This type of research is verivication research of advanced test results with test results on 2 sets of developed student worksheet. The data were collected from student worksheet. The results from this study indicate that students' competence in constructing ideas through constructivism approach is 'good' at student worksheet 1 (mean score=3.27) and 'very good' at student worksheet 2 (mean score=3.43). The data also show that there was a consistency between the advanced test to the experimental test II. This study concludes that student worksheet 1 and student worksheet 2 can improve the students' competence in building their knowledge on the topic of forest and land fires, and both worksheets (student worksheet 1 and 2) are eligible to be used as a reference for teaching science subject for Grade VII.

Keywords: student worksheets; constructivism; approach

INTRODUCTION

The Department of Forestry notes that the land and forest fire in Indonesia has reached 38,000-40,000 hectares in 2015. Peat swamp forests are vulnerable natural resources prone to environmental changes. Due to this vulnerability, this ecosystem should be handled carefully to prevent its function deteriorating from some causes, such as one of which, land and forest fire. To reduce the number of land and forest fire, related stakeholders need to conduct special policy enforcement interventions against the perpetrators of land burners (Darmawan et al., 2016).

Land and forest fire is related to the exploitation of peatlands for establishing oil palm plantations, followed by the addition of canals. These canals serve as water transportation routes to facilitate the transport of logged timber trees from forests or peatlands. Additionally, it also serves as means transport for palm seedlings and other necessaries that are difficult to transport through peat swamps. These canals cut the water flow to the creeks thus cause drainage of watershed areas. These could be the trigger for peatland fires in watershed and for the decline of fish diversity (Yustina, 2016).

Some efforts to prevent and avoid the land and forest fire have been made, yet the optimal results have not been achieved. One of the causes for the unsuccessfulness of the efforts is the lack of people knowledge and understanding on

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the dangers of land and forest fire and its impacts on the peat swamp ecosystem. Therefore, it needs more comprehensive efforts to instill the values of knowledge in order to prevent land and forest fire.

The cultivation of knowledge values, including the knowledge about land and forest fire is basically an inherent principal of educational process. Education is a means to shape perceptions, attitudes and human behavior. A positive attitude toward the environment can be effectively instilled through constructivism learning approach in secondary schools (Yustina et al., 2010). Therefore, optimizing the role of secondary education in developing the knowledge and understanding the environmental issues (e.g. land and forest fire) become very strategic to be student-centered. Sumarni et al. (2016) believed that student-centered learning has virtues and benefits to students to develop three learning domains namely cognitive, affective and psychomotor domains. It begins with practical organized work and plays an important role in the creativity associated with daily life activities to build students' knowledge and skills.

Constructivism is a combination of ideal behavior and cognitive. It describes how students understand the materials and also how teacher can deliver the material effectively. Constructivism as an educational theory requires teachers to consider what students know and allows students to develop their knowledge into practice (Amineh & Asl, 2015). Constructivism presents an alternative paradigm against objectivism in a way that investigation depends on how risk is built and handled in particular historical, sociocultural and political contexts (Chipangura & Waldtm, 2016).

Ministerial regulation No. 19 Year 2005 on Education based on Local Excellence stated that educators can develop teaching instruments and materials according to local uniqueness or needs by integrating them into particular subjects. Contextual environmental phenomena on the environmental management and diversity are very useful for teaching about environment and are to be applied in the students' daily life (Priyanto et al., 2013).

Rosnita (2016) also argues that the basic concept of science can be developed through scientific and critical thinking works. This can be done through some stimulating activities such as practicum in a well-equipped laboratory. Another strategy to develop students' curiosity is through useful and contextual learning materials. In the learning activities, students can be guided by using student worksheets.

Student worksheets within the theme 'preventing the land and forest fire' were integrated to three basic competences in science education for secondary schools. The three competences included in the worksheets are: basic competence 3.8 about ecosystem; 3.9 about environmental pollution; and 3.10 about global warming. The integration of materials on land and forest fire into student worksheets was considered on the basis that student worksheets have some advantages, such as facilitating the learners more effectively, helping the learners be more independent, and helping the learners to do written tasks.

Previous study has conducted a limited experiment on the development of student worksheets within the theme 'Preventing Land and Forest Fire' (Fitri, 2016). A verification study aims to verify this result by conducting a post hoc test to ensure the students' experience in using the worksheets. Prior to collecting data with the students, the study collected science teachers' responses in Bungaraya sub district on the content, design, and the pedagogy of the worksheets based on the constructivism approach. Finally, the present study revises the students worksheets to complement them (Yustina et al., 2016).

Verification research is conducted to test the truth of existing science either in the form of concepts, principles, procedures, propositions or practice of education itself. The research data obtained is used to prove the existence of doubt on information or educational problems (Arifin, 2014).

This verification study aims at testing the truth on the impression of competence process in each stages of scientific development through constructivism approach. The stages are: developing ideas, structuring ideas, application, and reflection. The data was collected from student worksheets for seventh grade students at SMPN 1 Bungaraya, Siak regency.

METHODS

This post hoc research investigated the use of students worksheets with the theme 'the prevention of land and forest fire' at SMPN 1 Bungaraya during August to December 2016. The study employed purposive sampling (Darmadi, 2014), and involved 60 students from Grade VII SMPN 1 Bungaraya. Two sets of student worksheets were used for the post hoc test. Student worksheet 1 with the theme 'types of ecosystems' and

student worksheet 2 with the theme 'global warming, effects, and prevention'. Data was collected from the students' responses on the worksheets. The students' competence on constructivism stages is classified into: generating ideas, structuring ideas, application, and reflection. The score was accumulated, drawn the percentage, compared to the experiment 2 result (Fitri, 2016), and then analyzed descriptively. The stages in this verification study are presented in Figure 1.

The description of the activities in the Figure 1 is as follows: (a) Together with the instructor of the training, the trainees conducted evaluation and revision of student worksheet format as a part of the training activities of student worksheet development on the prevention of land and forest fire to science teachers of Junior High School in Siak District. The revision they made was like an addition of activity schedule and assessment column at the end of section; (b) In the following week, this revised student worksheet was further applied by the teachers for further examination to Bungaraya Junior High School students; (c) In the third week, student worksheet results of this trial were analyzed to see the students' competence in terms of their skills of building knowledge through constructivism, which consisted of stages: idea-generating, idea-structuring, application and reflection; and (d) The result of student worksheet data analysis was shown in table form, and the mean value at each constructivism stage was shown as bar graph, then compared with result of trial II (Fitri, 2016) for verification test.

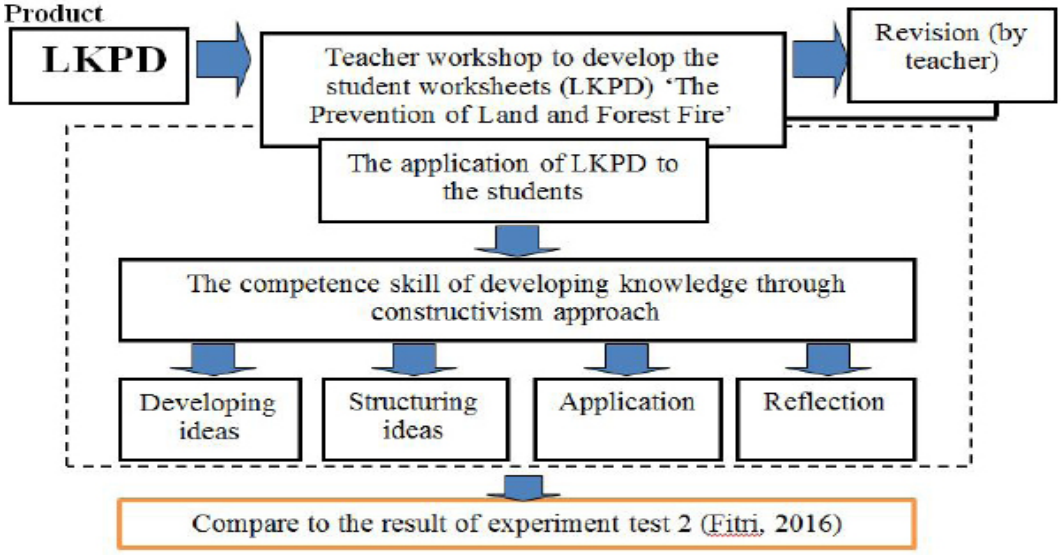

Figure 1. The Flowchart of Study: The Use of Students Worksheets Based on Constructivism Approach in Grade VII of SMPN 1 Bungaraya

Figure 1 shows that on the activity of student worksheet with theme of preventing forest fire, the science teachers in Siak carried out an evaluation of student worksheet format. In the following week, the revised format was implemented in SMP Bungaraya. In the third week, the students' competence is analyzed by using constructivism. The result of data analysis was presented in table and chart that it is compared to the Trial II for verification.

RESULTS AND DISCUSSION

Upon the collection of students' responses from the post hoc test, the responses were analyzed based on the constructivism approach which was the basis principle of developing the student worksheet. The post test of student worksheet completed by studeents was then submitted, so the teachers can assess the stages of constructivism in the student worksheet: developing ideas, structuring ideas, application, and reflection.

The worksheets under investigation are student worksheet 1 with the theme 'types of ecosystems' (Table 1) and student worksheet 2 with the theme 'global warming, effects, and prevention' (Table 2). Based on indicators of constructivism approach, each student worksheet obtained mean score of 3.27 and 3.43 within the category of 'good'. The highest score from both student worksheet is found at the stage of 'developing ideas' with mean score of 3.67 (very good). In this stage of developing ideas, students are able to explain what they already know about the 'types of ecosystems' in student worksheet 1 and 'factors causing global warming and the impacts of global warming' in student worksheet 2.

There were 60 Students who took the advanced test. Their average score is 3.27 (good category). The results of the assessment of constructivism stages in student worksheet show that the average score for the generating ideas is 3.67 (very good category) with the following details: 45 students with score 4 (very good category), 10 students with score 3 (good category) 2 with score 2 (enough category). While the average score for structuring ideas skills is 3.55 (very good category), with following details: 36 students with score 4, 21 students with score 3 and 3 students with score 2. Then, the average score for application skills is 3.00 (good category), with details: 24 students with score 4, 20 students with score 3, each of 8 students with scores 2 and 1. Finally, the average value for reflection is 2.87 (good category), with the details: 22 students with score 4, 18 students with score 3, and each 10 students with score 2 and 1.

Table 1. The Result of Student Worksheet I, Theme 'Type of ecosystems'

Constructivism Stages	Score				N (Students)	Mean	Category
	4	3	2	1			
Developing ideas	45	10	5	-	60	3.67	VG
Structuring ideas	36	21	3	-	60	3.55	VG
Application	24	20	8	8	60	3.00	G
Reflection	22	18	10	10	60	2.87	G
Mean						3.27	G

Note: VG=very good, G=Good, QG=Quite Good, NG=Not So Good

Table 2 describes assessment results of student worksheet II. Of the 60 students who followed the advanced test, their average score is 3.43, with the following details: In terms of developing ideas, 45 students get a score of 4; 10 students get a score of 3; and 5 students are with a score of 2. Their overall average score are 3.67 (very good category). For structuring ideas, 36 students get a score of 4; 21 students are with a score of 3; and 3 students are with a score of 2, with a mean score of 3.55 (very good category). The mean score for application is 3,34 (good category) with the following details; 28 students are with score 4; 24 students are with score 3; and 8 students are with score 2. The average score for reflection is 3,17 (good category), with the following details: 28 students are with score 4; 18 students are with score 3; 10 students are with score 2; and 4 students are with score 1.

Table 2. The Result of LKPD II, Theme 'The Causes and Effects of Global

Constructivism Stages	Score				N (Students)	Mean	Category
	4	3	2	1			
Developing ideas	45	10	5	-	60	3.67	VG
Structuring ideas	36	21	3	-	60	3.55	VG
Application	28	24	8	-	60	3.34	G
Reflection	28	18	10	4	60	3.17	G
Mean						3.43	G

Note : VG=very good, G=Good, QG=Quite Good, NG=Not So Good

The stage of 'structuring ideas' gained mean score of 3.55 (very good) in which students are able to differentiate the types of ecosystems, to explain the characteristics of peatland ecosystems, and mentioning the biotic and abiotic components in the water ecosystems (student worksheet 1). In student worksheet 2, students are able to explain the process of climate change and its impacts to the environment.

In the application stage, student worksheet 1 shows mean score 3.0 and student worksheet 2 shows 3.34 within the criteria 'good'. Questions in the worksheets related to this stage require the students to apply the ideas that they have developed to solve a problem, for instance: why land and forest fire could happen and why the fire is hard to cease (student worksheet 1), and what the correlation between global warming

and atmosphere layers (student worksheet 2). In the last stage (reflection), student worksheet 1 shows mean score of 2.87 and student worksheet 2 shows 3.17 within the category of 'good'. From the result of the advanced test from both student worksheet , it can be seen that the highest score from the constructivism stages is on the developing ideas and structuring ideas. Meanwhile, the lowest score is on the reflection stage.

Verification test

To test the truth of competence process in each stage of constructivism learning namely: developing ideas, structuring ideas, application, and reflection, the researcher compared the results from post hoc test to the experiment II from the previous study (Fitri, 2016) The comparison result on the stages of development from both student worksheets is presented in Figure 2.

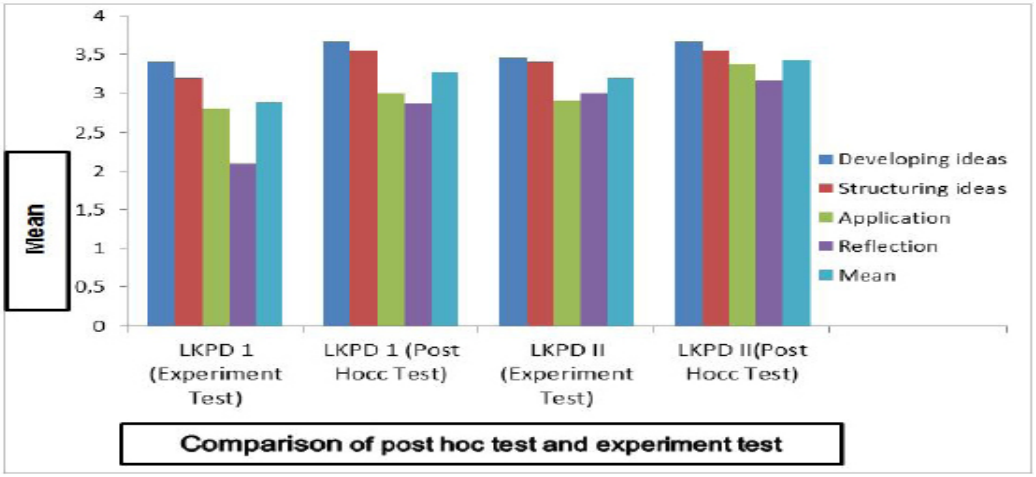

Figure 2. The Comparison of Advanced Test with The Experimental Test II on the Stages of Constructivism on Student Worksheet 1 and Student Worksheet 2

From the post hoc and experiment test II on both student worksheets (Fitri, 2016), it can be seen that the highest mean score is on the stages of developing ideas and structuring ideas. In experiment test II, the lowest mean score is on application stage, while on the post hoc test the lowest score is on reflection stage. The experiment test II shows mean score in student worksheet 1 which tends to be lower than student worksheet 2. Meanwhile, the post hoc test shows higher score than the experiment II test. Despite this slight difference, it can be concluded that students' competence in constructivism learning is on the category of 'good'.

DISCUSSION

In the stage of developing ideas, students are able to express their pre-existing knowledge on the types of ecosystems and the issues of global warming and the impacts. Similarly, on the stage of structuring ides, students are required to recall their memories to express what they already know. The themes in student worksheet 1 and student worksheet 2 are on issues of land and forest fires related to peatland ecosystems (Rasyid, 2014) which students experience in their daily life. The difference in students' competence is determined not only by teaching instruction, but also students' engagement in the learning process. According to Cirik & Kaya (2015), teaching experience is not one of the most effective variables for designing and implementing constructivist learning environments. The implementation of a constructivist approach is not only related to teacher action, but also student participation in this process should also be taken into account.

In the stage of structuring ideas, students build their own assumptions to make useful knowledge in new situations. Students should make any efforts to understand the information they receive. They should be able to manipulate, discover, and create knowledge to fit their belief system. Questions in the worksheets at this stage provide an opportunity for students to develop ideas, and to select which ideas must be retained and which ones to be removed/replaced. This is in line with the conclusion by Bhattacharjee (2015) that new learning experience is built on prior knowledge in order to understand information, to make connections between old knowledge and new information. Students should compare, ask, challenge, investigate, accept or discard old information and beliefs for the new ones.

Later on, Sundawan (2016) argues that the learning process (knowledge acquisition) begins with the occurrence of cognitive conflict. This cognitive conflict can only be anticipated by self-

regulation, and the outcome of the learning process will be constructed by the students themselves through experience of interaction with their environment. The emphasis on teaching and learning focuses more on the students organizing their experiences, rather than on students' precision in replicating what the teachers say or do.

Saputra et al. (2016) states that the implementation of constructivism learning presented in some stages will be able to improve students' ability of quantitative literacy and scientific attitude. Student positive responses to the stages of constructivism learning help them build concepts and structuring ideas during direct interaction with groups or individuals.

Riau province has peatland ecosystems with the prolonging problems on land and forest fire for the past 17 years. This phenomenon is naturally experienced by the student participants in this study. By connecting students' experience to teaching and learning activities through student worksheets, it is expected to increase their learning motivation. This is because contextual learning can improve students' motivation thus facilitate their understanding on the materials (Yustina & Febrita, 2013). The constructivism approach has some main aims to help the students learn 'how to learn' by promoting critical thinking and independent learning (Kalpana, 2014).

In the application stage, mean score in post hoc test tends to be lower than the experiment 2 test. Questions on worksheets regarding this stage require the students to apply the ideas that they have developed to solve problems. However, some students seem difficult to relate some concepts, such as: which characteristics of peatlands can cause fire and how this fire impacts the climate change and other human activities.

The difference on the result between the post hoc and experiment test II is allegedly cause by the difference of participant numbers, where participants in the experiments II consist only 18 student participants selected randomly from one class. Meanwhile, the participants on post hoc test consist of 65 student participants. The bigger is the sample size approaching the population size, the error margin in generalization is smaller. Similarly, the smaller number of sample in comparison to the population size, the error margin in generalization is bigger (Darmadi, 2014).

The reflection stage in the post hoc gained the lowest score of the other stages. The reflection stage can be seen in the conclusions made by the students, according to Maimunah (2001) this stage aims to make students aware of changes of earlier idea and to familiarize themselves with the learning process that allows them to reflect on the extent to which their ideas have changed. This is related to the student's ability to process the information and to connect, integrate, incorporate, interpret, and analyze the results either by inductive or deductive principles.

According to Subahan & Ismail (2017) the skills of information processing relate to the students' ability to assess, organize, absorb, and use information effectively from various sources through the process of analyzing, interpreting, assessing and synthesizing. This is in line with the constructivism view which emphasizes the students' active role in developing their understanding and processing the information. Constructivist teaching is thus a learner centered approach in which students are actively involved in the construction of knowledge rather than passively engaged as passive listeners (Kalpana, 2014).

The overall result on the assessment of the constructivism approach stages could be classified as 'good'. This indicates that the developed student worksheet is in accordance with the desired constructivism approach and is able to help the students reconstruct their ideas related to the materials at the student worksheet.

The use of constructivism approach in education has an immediate effect on student learning. Students are active agents in the process of knowledge construction and dissemination. They participate in the learning process and are responsible for their own learning by making meaning in their own context (Hussain, 2012). The stages of constructivism approach help students build their knowledge both independently and collectively thus they can improve student learning outcomes (Sutisna, 2013). This idea was supported by Irawati (2011) who argues that contructivism learning invites positive responses from the students as they are fully involved in the process of constructing knowledge, practicing their communication skills in discussion and cooperation, and improving their responsibility by the individual or group works.

According to Amin (2012), the success and effectiveness of constructivism learning are much determined by the teacher efficacy in managing the classroom and learning activities within ideal achievement time, improving students' involvement and positive response, as well as improving the student outcomes. Constructivism-based cooperative learning application by using animated video, for instance, can inspire students and help them relate the teaching materials to the real-life situations around them (Imamah, 2012).

Constructivism emphasizes student-centered learning, learning styles and collaborative learning supported by teachers' scaffolding and authentic tasks (Dagar & Yadav, 2016). Constructivist learning can be developed using the principles of social constructivism to improve academic achievement, higher-order thinking and social and emotional skills of students. To implement the constructivist principle in teaching and learning process, teachers need to have strong knowledge of content as well as the knowledge of pedagogy. Constructivist theory is very useful for teachers in their efforts to help students understand the substantive and syntactic components of the subject being taught (Amarin & Ghishan, 2013).

Bada & Olusegun (2015) suggests that in constructivism approach, students need to actively build knowledge in their own minds by selecting and modifying information, verifying new information to the old information, and revising the information when it is no longer valid. This constructivism view considers the students as an active agent in the process of acquiring knowledge. Two important notions revolve around the process of constructing knowledge. The first notion suggests that learners build a new understanding by using what they already know. The second notion suggests that learning is active rather than passive.

CONCLUSION

This study concludes that students' competence in constructing ideas through constructivism approach is 'good' at student worksheet 1 (mean score=3.27) and 'very good' at student worksheet 2 (mean score=3.43). The data also showed that there was a consistency with the second trial test.

The research implies that both worksheets (student worksheet 1 and 2) can improve students' competence in building their knowledge on the prevention of land and forest fire. It also implies that student worksheet 1 and 2 are eligible as reference materials for the teaching science education, especially for Basic Competence 3.8 on ecosystem, Basic Competence 3.9 on environmental pollution and Basic Competence 3.10 on global warming. These worksheets are suitable for Grade VII science teachers working at peat ecosystem in improving the students' understanding and knowledge on the prevention of land and forest fire as well as on the preservation of peat swamp ecosystem.

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