

The Effectiveness of the Developed Lesson Plan Instrument on the Topic of Environmental Pollution

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Abstract: *All this time, lessonplan(RencanaPelaksanaanPembelajaran/RPP) instrumentused by the teachers is already in line with the rules of 2013 Curriculum learning plan. However, there are some aspects which are needed to be fixed up in order to train the critical thinking ability of the students. The fixing up of learning plan is done through Tessmer Model development research with the steps of self-evaluation, expert reviews, one-one, small group, and field test as the research's focus. This research aims to determine the effectivenessof the developed lesson plan instrument on the topic of environmental pollution. The subjects are the VII grade students of SMP Negeri 1 KertakHanyar. The data types including 1) the critical thinking ability of the students, 2) the cognitive learning results and 3) the implementation of the lesson plan. The critical thinking ability of the students is received from the studentactivesheet (LembarKegiatanPesertaDidik/LKPD) which is done by the students, the cognitive learning result through the test is analyzed based on minimumcompletenesscriteria (KriteriaKetuntasan Minimal/KKM) and the lesson plan implementation results based on the observed scale on the learning process. The result of this research is showing the developed lesson plan is categorized as effective. The data effectiveness is determined based on 1) the students' critical thinking is categorized as good, 2) the cognitive learning result is surpassingminimum completeness criteria, and 3) the lessonplanimplementation is mostly done.*

Keywords: *Lesson Plan, Environmental Pollution, Critical Thinking*

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I. Introduction

The survey which was done the Programme for International Student Assessment (PISA) in 2015 that contained the critical thinking questions revealed that the Indonesian students were ranked on the lowest 9 of 70 countries on the natural science subject with the average score of 403 from the maximum score of 556 (Gurria, 2016). This showed that Indonesian students still have problems in answering questions requiring critical thinking ability.

According to the PISA survey, Indonesian students have to be facilitated to develop their critical thinking ability. The critical thinking ability is an important ability to be had by the students in order to solve the problems in their dynamic environment. So, training their critical thinking ability is an important thing to do and needed to be trained since the elementary until middle school.

Critical thinking ability is one of the national education goals and has functions in every aspect of life (Liliasari, 2003). If critical thinking ability is trained and developed, the students tend to be able to seek the truth, think divergently, analyze problems critically, think systematically and independently.

Faturrohman (2008) explains that critical thinking ability is not taught specifically as a subject but get a special place through every subject. Every learning activity has to be able to develop and train students' understanding and ability dimensions in order to be able to understand the reality and real-life problems in family, school, environment, and society. The learning of environmental pollution topic which becomes hot issue nowadays and very close to the students becomes the reason to train their critical thinking ability.

The implementation of 2013 Curriculum aims to train and develop their critical thinking ability. Natural science teachers should leave their conventional teaching, which makes the teachers as the central actor in the class learning (teacher-centered), and change it to the active learning method. One way to support the students' activeness in order to emphasize the critical thinking ability in natural science subject is by fixing up the learning set.

The law of the Ministry of Education and Culture No. 65/2013 about the standard process explains that the lesson plan instrument is designed in form of syllabi, lesson plan, student active sheet and assessment instruments which based on the standard content. All this time, the learning set used by the teachers in the class is in line with the rule of the learning set of the 2013 Curriculum. However, there are several aspects which

need to be fixed up in order to train their critical thinking ability such as learning goals, steps, materials, as well as student active sheet and the students' cognitive assessment.

This research is a development research which emphasizes on the formative evaluation and the use of development model that aims to produce the prototype (Tessmer, 1998). The development research has many similar terms. Despite that, there are principal similarities, those are introduction phase, prototype phase, and summative evaluation (Plomp and Nieveen, 2007). There are various terms of the development research (Reeves et al., 2010). These terms are designed-based research (Kelly, 2003), development research (Akker, 1999), experimental research (Brown, 1992; Collins, 1992), normative research (Newman, 1990), and education-designed research (Akker, 2006).

Designed research is an approach that combines several characteristics and adds several aspects in the knowledge progress in order to keep growing (Plomp and Nieveen, 2007). According to Edelson as quoted by Bakker (2004) either the designed research, development research, or experimental research, all place the designed process as the strategy to develop the theories.

Formative research produces a prototype that when the developed products through several steps or microcycle. The evaluation series of each micro cycle aims to improve the products, while the final product after field tests is called as the prototype (Plomp and Nieveen, 2007).

Based on those explanations, thus the research question is: How is the effectiveness of the developed lesson plan instrument on the topic of environmental pollution?

II. Method

This development research is a research that uses Tessmer Model (Tessmer, 1993). The stages of this research consist of self-evaluation, expert reviews, one-one, small group, and field test. The small group and field test stages are becoming the focus of this research. The subjects are the VII grade students of SMP Negeri 1 Kertak Hanyar, Banjar District, South Kalimantan, Indonesia.

The data effectiveness types including 1) critical thinking ability, 2) cognitive learning result, 3) lesson plan implementation. The critical thinking ability of the students is received from the students' capability in completing the student active sheet activities using thinking ability assessment instruments which are assessed based on rubrics. The result of cognitive learning based on the number of right answers, which later referenced on the minimum completeness criteria (*Kriteria Ketuntasan Minimal/KKM* = 2,8). The lesson plan implementation through observation during the learning process is scored with the scale of 1-4.

III. The Result and Analysis

The Result

The summary of critical thinking ability of the students on the small group test is shown in Table 1.

Table 1. The Result of Critical Thinking Ability on the Small Group Test

Indicators	The Average Score of the Meeting				Average
	1	2	3	4	
Designing research questions (max score=10)	5,83	5,67	6,33	6,83	6,17
Creating hypothesis (max score=10)	5,67	6,17	6,50	6,67	6,25
Designing experiments (max score=20)	12,00	13,67	15,17	16,00	14,21
Doing experiments to get information (max score=20)	14,50	15,00	15,17	16,50	15,29
Data collecting and analyzing (max score=20)	13,33	14,00	14,33	16,33	14,50
Drawing conclusion (max score=20)	12,67	14,17	15,50	16,33	14,67
Total					71,08

Notes: 81-100% = very good; 66-80% = good; 56-65% = enough; 41-55% = less good; 0-40% = not good (Arikunto, 2009)

Table 1 shows the critical thinking ability of the students had reached the good category. The summary of critical thinking ability of the students on the field test is shown in Table 2.

Table 2. The Result of Critical Thinking Ability on the Field Test

Indicators	The Average Score of the Meeting				Average
	1	2	3	4	
Designing research questions (max score=10)	5,23	5,77	6,03	6,61	5,91
Creating hypothesis (max score =10)	6,04	6,51	7,07	7,15	6,69
Designing experiments (max score =20)	12,03	12,76	13,81	15,68	13,57
Doing experiments to get information (max score =20)	13,44	14,49	14,69	16,97	14,90
Data collecting and analyzing (max score =20)	13,79	14,57	14,19	16,91	14,87
Drawing conclusion (max score =20)	12,94	14,06	15,25	16,42	14,67
Total					70,60

Notes: 81-100% = very good; 66-80% = good; 56-65% = enough; 41-55% = less good; 0-40% = not good (Arikunto, 2009)

Table 2 shows the critical thinking ability of the students had reached the good category. The cognitive learning result of the students on the small groups test is shown on Table 3.

Table 3. The Result of Cognitive Learning on Small Group Test

No	Students' Name	Pre-test Score	Status	Post-test Score	Status
1	F	1.30	Failed	2.80	Passed
2	H	1.20	Failed	2.70	Failed
3	M. N.	1.30	Failed	2.90	Passed
4	R. A.	1.40	Failed	2.80	Passed
5	S. A.	1.40	Failed	2.70	Failed
6	Y. F.	1.10	Failed	2.90	Passed
Average Score		1,28		2,80	
Criteria		Failed		Passed	

Notes: Minimum Completeness Criteria/*Kriteria Ketuntasan Minimal (KKM)* $\geq 2,8$

Table 3 shows the average of cognitive learning result on the small group test had passed the minimum completeness criteria. Even though there are some students who did not pass it. For those who failed, they took the remedial. The result of cognitive learning on the field test is shown in Table 4.

Table 4. The Result of Cognitive Learning on the Field Test

No	Students' Name	Pre-test Score	Status	Post-test Score	Status
1	A.	1.20	Failed	2.80	Passed
2	A. M.	1.10	Failed	2.90	Passed
3	A. R.	1.10	Failed	2.90	Passed
4	A. D. K.	1.20	Failed	2.80	Passed
5	A. A.	1.20	Failed	3.10	Passed
6	B.	1.10	Failed	2.60	Failed
7	K. A.	1.20	Failed	3.10	Passed
8	K. I.	1.10	Failed	2.70	Failed
9	L.	1.50	Failed	3.10	Passed
10	M. S.	1.30	Failed	2.90	Passed
11	M. A. M.	1.60	Failed	3.10	Passed
12	M. A.	1.20	Failed	3.00	Passed
13	M. F. F.	1.40	Failed	2.90	Passed
14	M. K.	1.20	Failed	2.60	Failed
15	M. I. H.	1.30	Failed	3.00	Passed
16	M. M.	1.20	Failed	2.90	Passed
17	M. R. S	1.20	Failed	3.20	Passed
18	N. B. J.	1.20	Failed	3.10	Passed
19	R. T. W.	1.10	Failed	2.60	Failed
20	R. M. P.	1.30	Failed	3.10	Passed
21	R. W.	1.30	Failed	3.20	Passed
22	R. P. P.	1.10	Failed	2.70	Failed
23	S. A. R.	1.10	Failed	2.30	Failed
24	S. F.	1.20	Failed	3.10	Passed
25	S. R.	2.50	Failed	2.90	Passed
26	Z	1.30	Failed	3.30	Passed
27	M. B. B. I	1.30	Failed	3.00	Passed
Average Score		1,28		2,92	
Criteria		Failed		Passed	

Notes: Minimum Completeness Criteria/*Kriteria Ketuntasan Minimal (KKM)* $\geq 2,8$

Table 4 shows the average of cognitive learning result on the field test had passed the minimum completeness criteria. Even though there are some students who did not pass it. For those who failed, they took the remedial. The summary of lesson plan implementation by the teachers on the small group test is shown in Table 5.

Table 5. The Implementation of lesson plan on Small Group Test

No	Activity Type	Meeting			
		1	2	3	4

1	Introduction	4	3	3	4
2	Core	4	4	4	4
3	Closing	2	3	3	2
Modus		4	3	3	4

Keterangan: 1 = not accomplished; 2 = small portion accomplished; 3 = mostly accomplished; 4 = fully accomplished

Table 5 shows the implementation of lesson plan by teachers on the small group test was mostly accomplished. The summary of lesson plan implementation by the teachers on the test field is shown in Table 6.

Tabel 6. The Implementation of lesson plan on the Field Test

No	Activity Type	Meeting			
		1	2	3	4
1	Introduction	3	4	4	4
2	Core	4	4	4	3
3	Closing	3	3	2	2
Modus		3	4	4	4

Keterangan: 1 = not accomplished; 2 = small portion accomplished; 3 = mostly accomplished; 4 = fully accomplished

Table 6 shows the implementation of lesson plan by teachers on the field test was largely accomplished.

Based on the result, the lesson plan instrument is effective due to several considerations: 1) the critical thinking ability of the students is on good category, 2) minimum completeness criteria has been reached, and 3) the implementation of lesson plan by the teachers is mostly done.

IV. Analysis

The lesson plan instrument is fulfilling the effectiveness because all indicators have been met, those are: 1) the critical thinking ability when doing student active sheet in a group, 2) the result of the products of cognitive learning, and 3) the implementation of lesson plan. Jaya et al. (2012) stated that the effectiveness of developed lesson plan instrument is known by the students' character score, scientific performance, and concept mastering.

The critical thinking ability of the students is assessed using the scoring sheet which is given to the teachers to assess the students to do the inquiry steps in completing the student active sheet. The thinking indicator which is seen in this research is in line with the indicators of critical thinking by Ennis (2011) who also agree on the stages of guided inquiry learning which is providing question or problems, creating a hypothesis, designing experiments, doing experiments to get information, data collecting and analyzing and drawing a conclusion.

Overall, the critical thinking ability of the students is categorized as well based on the small group and field test. So, the learning set can be said has fulfilled the effectiveness data. Even though at the first meeting the critical thinking ability of the students is still low. This is caused by the students never had guided inquiry learning in their learning which aims to train their critical thinking ability. However, along with the learning experiences using guided inquiry, their critical thinking is started to be trained in the learning process.

Duran and Dökme (2016) reported that the learning of science and technology which is supported by inquiry-based learning has a significant influence on the students' critical thinking ability. The students actively participate in the learning process, involve in answering questions inside and among group discussion so it results in the positive responses to their critical thinking development.

Retnosari et al. (2016) also reported that guided inquiry with the help of interactive media influences the critical thinking ability of the students. It because the guided inquiry syntax can push the students to think critically. On the guided inquiry, the activity of questioning is done by the teachers. The teachers ask several questions to design investigation, create experimental data and analyze it, and communicate the result of the guided inquiry learning.

Yunita (2015) added the result of critical thinking ability analysis in doing the student active sheet during the learning process is very good for all parameters that tested to the critical thinking ability. The parameters are designing research questions, creating a hypothesis, collecting data, and drawing the conclusion.

Lohner et al. (2005) measures the thinking ability through the process of knowledge construction, create and evaluate their own hypothesis, and draw their own conclusion. The inquiry approach is commonly said as 'guided invention'. Guided inquiry learning model syntax is very supporting the high level of thinking.

Pattanaporn and Ashavabhumi (2012) find a teaching method to develop the critical thinking ability after used and proved it in line to develop the students' critical thinking ability on the five aspects of the subjects which are taught in school. The five aspects are the ability to define and know the problems, choosing information regarding the problems, distinguishing the problems and identifying the differences, determining to

decide and choose hypothesis is the ability of choosing hypothesis from the statements and reasonable given situations and the ability to conclude rationally is the ability to choose something to solve the problems reasonably, to realize the causes and effects when making decisions.

The cognitive learning result of the students is received from the students' answers to the critical thinking questions with the C3-C5 cognitive domain which is implementing, applying, and evaluating. The questions are multiple choices with four choices each question. Cognitive learning result is achieved after the students do the guided inquiry model learning. This aims to know how far the students' ability in understanding the environmental pollution issue and its impacts on the ecosystem after the teacher delivered in the learning process.

The students' cognitive learning already passed the minimum completeness criteria so it can be said that the learning set is categorized as effective. The cognitive learning result on small group and field test shows that at pre-test no one passed the minimum completeness criteria, but 4 of 6 students passed the minimum completeness criteria on the post-test. On the field test, 22 of 27 students passed the minimum completeness criteria. This is in line with the previous research (Wang et al, 2013; Khusnah, 2014; Jumirah, 2015; Asnita et al, 2016).

Overall, the cognitive learning result of the students already passed the minimum standard. However, each student's completeness on learning result varies. The students' learning result is influenced by internal and external factors. The internal factors are: 1) the physical condition of the students, 2) the psychological condition of the students, 3) and fatigue. The external factors are: 1) family relationship, economic condition, and cultural background; 2) environment, situation, and condition of school; 3) and the relation with the social environment (Zubaidah, 2012).

The difference between the pre-test and post-test result is caused by the direct learning experiences of the students after learning with the guided inquiry model. Yaumi (2003) explains that the experiences in doing assignments can create students' knowledge construction which is received by the students' involvement in the learning process.

In this case, the guided inquiry learning can be implemented in the learning process to improve the cognitive learning result. The memorizing and understanding ability of the students increase to the learning materials because of the knowledge concepts or received information is based on the learning experiences when finding out answers independently of the questions when learning using guided inquiry. So, the memory and understanding can be reused in new situations like the cognitive learning result.

Brown (2010) stated by implementing the guided inquiry-based learning, it can improve the students' learning result. This is based on the students' learning result who participated in the student-centered learning environment through guided inquiry-based group exercise surpass the result of students who did not participate in it.

Yewang et al. (2016) added the guided inquiry learning method can improve the students' learning result, which also means improving students' participation because it focuses on the inquiry ability mastering to solve the problems thus the students are trained to think critically, solving the problems, and become independent students. The good result is caused by the critical thinking ability of the students which is received from through good guided inquiry learning. Thus, the critical thinking ability is very needed and the students must have it (Beaumont, 2010).

The lesson plan implementation is received from the learning on the stage of small group and field test. The assessment of lesson plan implementation used the available instruments which used the guided inquiry model starting from the introduction, core, and closing activities in the three meetings. The analysis of lesson plan implementation shows that the actual practice has been reached which can be seen through small group and field test that mostly done by the teachers (Hidayati, 2015; Supiati, 2015; Yunita, 2015; Asnita et al, 2016;). Even though in the closing activities there is still lesson plan implementation that only done in small portion done. This is caused by most of the time is focused on the core activities, which makes the closing activities was only done in small time in order to complete all activities in lesson plan.

In four meetings of lesson plan implementation, teachers were getting used to implementing the guided inquiry model in the teaching process. According to Schaal et al. (2012) that the learning process using inquiry model can be an alternative to give the teachers experiences in the field. The teachers' responsibility is to develop and stimulate the thinking ability of all students (Fung, 2004). McBride et al. (2012) also added that in the guided inquiry learning, the teachers could help the students to make questions to guide the investigations.

The teachers who are mastering in teaching using guided inquiry model will be easier to guide the students through the learning process because the students are directed to reach the learning goal. Teachers have an important role in the teaching process using guided inquiry model which has been reported previously (Yana, 2015).

Teachers in the class are the teachers who set the goals, directions, and rules or conditions which are in line with the interests and ability of the students (Suyono, 2001). The role of teachers in natural science is the

leader of inquiry that including facilitating, motivating, directing, and guiding the students in the inquiry activities (Depdiknas, 2006).

V. Conclusion

The lesson plan instrument is effective based on 1) the students' critical thinking is categorized as good, 2) the cognitive learning result is surpassing minimum completeness criteria, and 3) the lesson plan implementation by the teachers is mostly done.

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