



## Effectiveness of Worksheets of Biology Students of High School Based On Critical Thinking Skills in Virus Concept

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### ABSTRACT

The 2013 curriculum learning process includes three domains, namely affective (attitude), cognitive (knowledge), and psychomotor (skills). This study aims to develop a valid, practical, and effective Student Worksheet. The research method used is the Tessmer design, which consists of (1) Expert review; (2) one-to-one; (3) small group. Validation subjects were three experts, individual subjects were three students in class X in high school and small group test subjects were six students in class X in high school. The results showed that: (1) the validity of LKPD based on expert testing had a valid category with an overall average of 3.59; (2) the practicality of the contents of LKPD has a good category with an overall average of 3.70 and the practicality of the LKPD's expectations based on the responses of students has a very good category with an overall average of 88.70%; and (3) the effectiveness of LKPD based on the assessment of students' critical thinking skills in working on LKPD has both categories (including interpretation) and very good categories (includes analysis, evaluation, inference, explanation, and self-regulation). Interpersonal skills (collaborating) of students have a very good category with a score of 86.33% and intrapersonal skills (conscientious) students have a very good category with a score of 88.33%.

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### A. Introduction

Critical thinking skills need to be improved at this time, one of the efforts that can be done to improve it is by implementing the 2013 curriculum which has been carried out gradually since 2014 until now. Permendikbud No. 69 of 2013 explains that the 2013 curriculum aims to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, affective, and able to contribute to the life of the community, nation, state, and world

civilization. The learning process in the 2013 curriculum includes three domains, namely affective (attitude), cognitive (knowledge), and psychomotor (skills).

According to the National Research Council (NRC) 2011, the learning process in the 2013 curriculum has adopted a decision by accommodating learning models that demand and facilitate students' critical thinking skills just like the inquiry model, the problem-based learning model, and the problem-solving model.



The problem that often occurs at this time is the use of Student Worksheets that have not been able to maximize the learning process in achieving learning objectives. Student Worksheets are created to help students find a concept through both practicum and theory and help students apply and integrate the various concepts that have been discovered. Permatasari (2018) explained that LKPD which had been circulating so far only contained summaries or reviews of subject matter, containing question exercises (questions). Student Worksheets that are used in schools currently do not train students to conduct an inquiry process, students answer questions that are not understanding the material (Mayasari, et al. 2015). Also, according to Andriyatin, et al. (2016) LKPD explains the added value if it is designed using existing approaches in the learning cycle that are made starting from apperception activities to evaluation so that it can be used for a whole learning process material and the information contained in LKPD is made in such a way to make students more active in learning activities.

Research on the development of LKPD has often been carried out. Thus, the LKPD in the reference book cannot facilitate students to gain meaningful learning (Anggraini, et al. 2016). So in essence LKPD needs to be improved which can explore critical thinking skills. One way is to adopt the Facione model. Not only that the structure must also be following the applicable structure (Daryanto, 2014)

Student Worksheets are developed using a Facione model that is expected to be of high quality. Quality indicators are valid, practical, and effective. It is said that the State of the knowledge Facione model is based on constructivism learning theory. This theory explains the formation of knowledge occurs as a result of human construction (knowledge) of the reality it faces. So based on the above statement, the theory of constructivism is that existing knowledge is the forerunner to get new knowledge (Dwiyoogo, 2018)

Student Worksheets that contain critical thinking skills are needed so that students have cognitive skills in dealing with daily life. One way that can be done is to develop Student Worksheets that emphasize Critical Thinking Skills through research aimed at improving the product. LKPD

obtained through development research is LKPD that has gone through stages of improvement through micro cycles to produce a prototype (Tessmer, 1993). The final product of development has valid, practical, and effective criteria (high-quality intervention) (Plomp & Nieveen, 2007).

This research is about the development of high school biology LKPD based on critical thinking skills on the concept of Virus. The choice of the concept of Virus is because the main concept is taught to odd semesters following the time of research, and the lack of research on the development of LKPD on this concept so that researchers take the initiative to research the concept of Viruses. Besides, according to a statement from one of the Biology teachers at SMAN 9 Banjarmasin, learning tools especially LKPD still lack trigger critical thinking skills of students because they are only in the form of short answer questions and some essay questions whose demands are still at the mentioning stage and the learning process is only delivered by the concept. Therefore, this study aims to describe the effectiveness of high school biology LKPD expectations through the development of critical thinking skills with the concept of viruses.

## **B. Materials and Methods**

This research belongs to the type of educational design research using formative evaluation with the design of Tessmer (1993). Development of LKPD through self-evaluation stages than to obtain validation data is done through an expert review, for data practicality content is done through individual test stages (one-to-one evaluation) then to obtain practicality data expectations and effectiveness of the expectations carried out stages small group evaluation.

This research was conducted for two months (October-November) at SMA Negeri 9 Banjarmasin. This study only focuses on the effectiveness of the LKPD expectations at the small group evaluation stage. Small group test subjects consisted of six students in class X MIA 2 in the academic year 2019/2020 SMA Negeri 9 Banjarmasin. The small group evaluation stage aims to determine the effectiveness of LKPD expectations, in terms of the consistency between design and learning experiences and student learning outcomes. The selection of research subjects

is determined based on different academic abilities obtained from biology teacher information. The effectiveness of expectation data was obtained using the critical thinking skills assessment sheet instrument obtained from students' responses to the learning process, interpersonal skills (collaborating), and intrapersonal skills (meticulous). The technique of analysing the effectiveness of expectations based on critical thinking skills in carrying out tasks in LKPD is calculated using the formula:

$$P = \frac{f}{N} \times 100\%$$

Then the data explained uses the categories 75.01-100.00% (very good), 50.01-

75.00% (good), 25.01-50.00% (good enough), 00.00-25.00% (not good) (adapted from Akbar & Sriwiyana, 2010).

### C. Results and Discussion

Research on the development of the Student Concept Worksheet for Viruses only focuses on the effectiveness of expectations. The resulting LKPD consists of four LKPD with each topic, namely: (1) characteristics of the virus form; (2) characteristics of virus structure; (3) virus replication cycle; and (4) diseases caused by viruses. The results of the assessment of critical thinking skills by students through the answers of LKPD tasks when small groups are the effectiveness of the expectations presented in Table 1.

**Table 1 Expectations Effectiveness of LKPD**

No	Skills	Score Max	LKPD section-				Average	Score (%)	Category
			I	II	III	IV			
1	Interpretation	14	10,25	11,5	7,33	-	9,69	69,21	Good
2	Analysis	10	-	9,17	9,09	8,92	9,06	90,60	Very good
3	Evaluation	20	19,33	-	-	-	19,33	96,65	Very good
4	Inference	24	-	22	-	16,5	19,25	80,21	Very good
5	Eksplanation	20	17,67	-	-	-	17,67	88,35	Very good
6	Self-regulation	12	10,0	-	9,17	-	9,59	79,92	Very good

Information:

1. Categories 75.01-100.00% is very good, 50.01-75.00% is good, 25.01-50.00% is less good, 00.00-25.00% is not good (adapted from Akbar & Sriwiyana, 2010).
2. LKPD I = Characteristics of virus forms, LKPD II = Characteristics of virus structures, LKPD III = Virus replication cycle, LKPD IV = Disease caused by viruses.

Table 1 explains the effectiveness of LKPD expectations which are determined based on critical thinking skills in both categories (including interpretation) and very good categories (includes analysis, evaluation, inference, explanation, and self-regulation). Furthermore, this activity can be continued on intrapersonal and interpersonal skills.

Based on the results of the study, students' critical thinking skills in the interpretation of 69.21% (good), analysis of 90.60% (very good), evaluation of 96.65%, inference of 80.21% (very good), expansion of 88.35% (very good), and self-regulation of 79.92% (very good).

The effectiveness of LKPD expectations in this study is based on students' critical thinking skills, interpersonal skills (collaborating) and intrapersonal skills (rigorous) in carrying out the tasks contained in LKPD during the small group test stage, in

contrast to other studies (Rachman, et al . 2017; Hairiani, et al. 2016; Zaini & Jumirah, 2016; Zulyusri, et al. 2017) which explains effectiveness seen based on learning outcomes, student activeness, students' analytical skills, process skills, performance skills, spiritual assessments, critical thinking assessment, social skills assessment, student activity assessment and teacher activity assessment.

The aspects of critical thinking skills assessed include interpretation, analysis, evaluation, inference, explanation, and self-regulation that have been represented with at least one sub-skill. The results showed that LKPD was stated to have the effectiveness of expectations in both categories based on critical thinking skills (interpretation) and very good categories (analysis, evaluation, inference, explanation, and self-regulation). This is in line with previous studies



(Anggiasari, et al. 2018; Nuraini, 2017; Susilowati, et al. 2017) which explains that each critical thinking skill has different scores and criteria for each skill.

Critical thinking skills need to be developed in students because through critical thinking skills students will more easily understand each concept more deeply, understand the problems that occur so that they can understand and solve problems and be able to apply concepts in different situations. One way that can be done to improve critical thinking skills is to use LKPD in the learning system because with the use of LKPD students can play an active role and take control to solve the problems

encountered. This statement agrees with Astuti et al. (2017) which explains that so students are actively involved in critical thinking, one alternative that can facilitate is the use of LKPD where students can express their ideas and opinions in criticizing a problem.

According to Yunita, et al. (2018) in Novitayani (2019), the level of critical thinking skills of students was divided into 3, namely low with a percentage of 0% -59%, moderate with a percentage of 60% -75%, and high with a percentage of 76% -100%.

The results of the interpersonal (collaborative) and intrapersonal (rigorous) research are presented in Table 2.

**Table 2 Data Recapitulation of Interpersonal Skills and Intrapersonal Skills of Students**

No	Name	Interpersonal Skills (%)	Category	Intrapersonal Skills (%)	Category
1.	A	100	Very good	100	Very good
2.	B	88	Very good	88	Very good
3.	C	88	Very good	77	Very good
4.	D	88	Very good	77	Very good
5.	E	77	Very good	100	Very good
6.	F	77	Very good	88	Very good
<b>Average</b>		<b>86,33</b>	<b>Very good</b>	<b>88,33</b>	<b>Very good</b>

Information:

Categories 75.01-100.00% is very good, 50.01-75.00% is good, 25.01-50.00% is less good, 00.00-25.00% is not good (adapted from Akbar & Sriwiyana, 2010).

Assessment of interpersonal skills (collaborating) which includes five aspects namely division of labor, unselfishness, ways of solving problems, tolerance, and motivation while intrapersonal skills (meticulous) include three aspects namely doing each stage correctly, doing all stages correctly and doing on time. This shows that LKPD developed not only improve students' skills but also can improve interpersonal and intrapersonal skills. This study is in line with previous research (Lestari, et al. 2015) which reports that meticulous attitude is one of the scientific attitudes of students that can support students' critical thinking skills. The difference is that in this study critical thinking skills were improved through a combination of inquiry and reciprocal teaching methods in the concept of an excretion system.

One way that can be done to improve these three skills is to use LKPD in the learning system because with the use of LKPD students can play an active role and take control to solve the problems faced. This

statement agrees with Astuti, et al. (2017) which explains that so students are actively involved in critical thinking, one alternative that can facilitate is the use of LKPD where students can express their ideas and opinions in criticizing a problem. All LKPDs developed in this study already included six critical thinking skills of Facione category (1990).

#### **D. Conclusion**

The effectiveness of the developed LKPD expectations obtained good categories based on critical thinking skills including interpretation with a score of 69.21%, and very good categories include analysis with a score of 90.60%, evaluation with a score of 96.65%, inference with a score of 80.21%, explanation with a score of 88.35%, and self-regulation with a score of 79.92%. Interpersonal skills have an average of 86.33% with a very good category and intrapersonal skills have an average of 88.33% with a very good category.



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