



Development of Worksheets for High School Biology Students Based On Critical Thinking Skills on the Archaeobacteria and Eubacteria

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ABSTRACT

The learning process in the 2013 curriculum has accommodated learning models that demand and facilitate Critical Thinking skills, but the role of teaching materials namely the Student Worksheet (LKPD) used in the learning process is still lacking in facilitating Critical Thinking skills students. With the existence of quality LKPD, it is expected that learning will be able to achieve the 2013 curriculum objectives. This type of research is a research development with the stages of expert review, one to one evaluation, and small group evaluation. The subjects of the small group evaluation were six students of class XI MIA 2 in SMAN 9 Banjarmasin. The results of the study show the effectiveness of expectations based on the assessment of the critical thinking skills of the participants enjoyed in working on the LKPD which has very good categories (including interpretation, analysis, evaluation, and self-regulation) and good categories (including inference and explanation). Interpersonal (collaborating) and intrapersonal (meticulous) skills of students have excellent categories.

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A. Introduction

The challenge in the 21st century according to the United Nations is to create a knowledge-based society that has; (1) ICT and media literacy skill, (2) Critical thinking skills, (3) Problem-solving skills; (4) Effective communication skills, and (5) Collaborative skills. (Kusnandar, 2008).

Therefore, National Research Council (NRC) in 2011 set three skills that must be improved and become the focus of learning: (1) cognitive skills (problem-solving non-routine, critical thinking, and system thinking), (2) interpersonal skills (complex communication, social skills, teamwork, cultural sensitivity, diversity) and (3)

intrapersonal skills (Self-management, Time management, Self-development, Self-knowledge, Self-regulation, Adaptability and Executive functions).

The learning process in 2013 curriculum has adopted the decisions of the NRC workshop (NRC, 2011) by accommodating learning models that demand and facilitate students Critical Thinking Skills such as inquiry models, problem-based learning models, and problem-solving models, but the role of teaching materials is LKPD which is used in the learning process is considered lacking in facilitating the Critical Thinking Skills of students.



Permatasari (2018), reports that LKPD which is often circulating only contains summaries or reviews of learning material, including practice questions. LKPD should help students think systematically; this can be done if students are given complex assignments in one bill.

This is following previous research (Novitayani, 2019) that the study only used one sub-skill from several sub-skills in each critical thinking skill. Ideally, each sub-critical thinking skill uses all sub-skills. If these conditions can be met, then the demands of learning to meet the 21st-century critical thinking skills in educational problems can be achieved. So the nature of LKPD needs to be improved to explore students' critical thinking skills, one way that is guided by the Facione model. According to Facione (2011), critical thinking has six skills involved in the process of critical thinking. These skills are interpretation, analysis, evaluation, inference, explanation, and self-regulation.

The reason researchers chose the concept of Archaeobacteria and Eubacteria because the ability to think critically is very important in the learning process, one of which is to be able to train students to make decisions carefully, thoroughly, and logically. If critical thinking skills can be emphasized in students, intelligent human resources will be formed in solving problems. One way to do this is to produce LKPD that emphasizes critical thinking skills through development research aimed at improving products.

According to observations made at SMAN 9 Banjarmasin, learning facilities such as laboratory rooms are available, microscopes are available, but teachers only focus on learning resources in the form of books, even though this material is material that needs to be held practicum so students can observe directly and can stimulate student interest in the learning process. Based on the explanation above, it is necessary to research the Development of Work Sheet for Biology Students Based on Critical Thinking Skills on the Concept of Archaeobacteria and Eubacteria.

B. Materials and Methods

This research uses research type EDR (Educational Design Research) using the Tesmer design through the stages of expert review, one to one evaluation, and small group evaluation. The study period ranges for

one semester in 2019/2020. The place for researching is SMAN 9 Banjarmasin with subjects for one to one evaluation. There were six students of class XI MIA 2 SMAN 9 Banjarmasin.

The instrument used was the student's critical thinking skills assessment sheet which was done by distributing LKPD and then let the test subjects understand and carry out the work steps of LKPD, then distribute LP (assessment sheet) for test subjects working on LKPD individually. As well as instruments for interpersonal (collaborative) and intrapersonal (meticulous) skills, the observers observe and provide the most dominant aspects of assessment every ten minutes. Data analysis techniques for critical thinking skills, interpersonal skills (collaborating) and intrapersonal skills (meticulous) use the following formula:

$$\frac{\text{Number of scores obtained}}{\text{Maximum number of scores}} \times 100\%$$

Then the final results using categories namely: 75.01-100% (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

Student Worksheet (LKPD) on the concept of Archaeobacteria and Eubacteria has been successfully carried out by producing five topics, that is (1) The shape and characteristics of bacteria; (2) Bacterial structure; (3) bacterial reproduction; (4) bacterial classification; (5) The role of bacteria in life. The following are the results of research from the development of LKPD according to the steps of the development model.

After making the initial product LKPD based on critical thinking skills at the self-evaluation stage. The development LKPD was then validated by three expert review, this is two biology lecturers from FKIP ULM Banjarmasin as academics and one biology teacher at SMA Negeri 9 Banjarmasin.

After going through the stages of improvement continued at the practical stage of the contents of LKPD which were assessed individually by three students who were determined based on academic ability in class. The practicality of the content aims to

determine the assessment of students of product design in the form of LKPD that was developed. Furthermore, it enters the practicality stage of the LKPD's expectations carried out in a small group evaluation. The research subjects chosen were six students.

The practicality of the developed LKPD expectations is measured through the student's response to the LKPD assessment. The purpose of carrying out the practicality of hope is to find out how students respond based on critical thinking skills that have been

learned, the developed LKPD is declared to have the practicality of hope if all aspects of the assessment meet the criteria of "at least good".

The effectiveness of LKPD is carried out in small group evaluations. Similar to practicality, the effectiveness of the research subjects used was six students.

The following are the results of the research from the development. LKPD along with further discussion following the steps of the development model, namely:

Table 1 Average Effectiveness of LKPD (Small Group Evaluation)

No	Skills	Score max	Section of LKPD					Average	Score	Category
			I	II	III	IV	V			
1	Interpretation,	14	-	10,83	13,25	-	-	12,04	86	Very good
2	Analysis	10	-	-	-	7,75	7,67	7,71	77,1	Very good
3	Evaluation	20	-	-	-	17,17	-	17,17	85,85	Very good
4	Inference	24	-	-	16,89	-	-	16,89	70,37	Good
5	Explanation	20	15,46	14,83	-	15,17	13,30	14,69	73,45	Good
6	Self-regulation	12	9,33	8,00	12,00	-	-	9,77	81,42	Very good

Information:

- 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 and Sriwiyana, 2010).
- LKPD I = Form and characteristics of bacteria, LKPD II = Structure of bacteria, LKPD III = Reproduction of bacteria, LKPD IV = Classification of bacteria, LKPD V = The role of bacteria in life.

Table 1 explains the effectiveness of LKPD which is determined based on student's critical thinking skills and obtained very good categories (including interpretation, analysis, evaluation, and self-regulation) and good categories (including inference and explanation).

During the small group evaluation and assessment of interpersonal and intrapersonal skills was also carried out. The summary results of interpersonal and interpersonal skills are presented in table 2.

Table 2 Summary of Interpersonal Skills and Intrapersonal Skills

No	Name	Recapitulation of Interpersonal Skills (%)	Category	Recapitulation of Intrapersonal Skills (%)	Category
1	Aulia Safira	100	Very Good	88	Very Good
2	Intan	77	Very Good	100	Very Good
3	Lidya Nafa	77	Very Good	77	Very Good
4	Nor Halisa	88	Very Good	77	Very Good
5	M. Anis	77	Very Good	88	Very Good
6	Rhida Haliyah	88	Very Good	77	Very Good
Average		84,50	Very Good	84,50	Very Good

Information:

- 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 and Sriwiyana, 2010).
- LKPD I = Form and characteristics of bacteria, LKPD II = Structure of bacteria, LKPD III = Reproduction of bacteria, LKPD IV = Classification of bacteria, LKPD V = The role of bacteria in life.

Table 2 explains that the results of the assessment of interpersonal skills namely (collaboration) and intrapersonal (careful)

students when working on LKPD in small group evaluation found very good categories.



Small-Group Evaluation is conducted to determine the effectiveness of LKPD. The effectiveness of this study was measured based on students critical thinking skills, interpersonal skills (collaborating) and intrapersonal skills (conscientious) of students in doing the tasks in LKPD, different from other studies (Hairiani, et al., 2016; Zaini & Jumirah, 2016;) who explained that effectiveness was measured based on learning outcomes, student activeness, students' analytical skills, process skills, performance skills, spiritual assessments, critical thinking assessments, social skills assessments, student activity evaluations, and teacher activity assessments.

In carrying out effectiveness, the first step taken is to introduce LKPD which is equipped with tasks of critical thinking skills to students. then, ask students to do the tasks that exist in LKPD following the instructions contained in LKPD.

The level of effectiveness is measured using the instruments of critical thinking skills and the ability of students to complete the tasks that are in the LKPD. Aspects of critical thinking skills that are assessed are interpretation, analysis, evaluation, inference, explanation, and self-regulation that have been represented with at least one sub-skill. The results showed in table 1 that LKPD was stated to have the effectiveness of expectations with very good categories including interpretation with a score of 86%, an analysis with a score of 77.1%, evaluation with a score of 85.85% and self-regulation with a score of 81.42%) and a category both includes inference with the category 70.37% and explanations with the category 73.45%). This is in line with previous research (Nuraini, 2017; Susilowati, et al., 2017) explaining that each critical thinking skill has a different score and criteria for each skill.

In addition to assessing students' critical thinking skills, and assessment of interpersonal (collaborative) and intrapersonal (meticulous) skills is also carried out. Based on the results of the study in table 2, shows that interpersonal skills (collaborating) and intrapersonal skills (conscientious) students have a score of 84.50 with a very good category.

As we know in the 21st century or commonly called the industrial revolution 4.0, critical thinking skills, interpersonal skills,

and intrapersonal skills need to be improved and developed. This is following the results of the NRC workshop (2011) there are three focus skills of the 21st century namely 1) cognitive skills (non-routine problem solving, critical thinking, systems thinking); 2) interpersonal skills (complex communication, social skills, teamwork, cultural sensitivity, diversity); and 3) intrapersonal skills (self-management, time management, self-development, self-regulation, adaptability, and executive functions).

These three skills are interconnected and are needed by students. One way 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 be able to solve the problems being faced. The statement is in line with Asturi et al, (2017) who explained that so students can be actively involved in critical thinking, one alternative that can facilitate is by using LKPD where students can easily express their ideas and opinions in criticizing a problem.

D. Conclusion

This LKPD has the effectiveness of expectations with very good categories based on students' critical thinking skills (including interpretation, analysis, evaluation, and self-regulation) and good categories (including inference and explanation), as well as interpersonal (collaborating) and intrapersonal (thorough) skills very good category.

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F. References

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