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# Development of Worksheets for Biology High School Student-Based On Critical Thinking Skills on the Concept of Biodiversity

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**ABSTRACT**

Critical thinking skills are one of the cognitive skills that are necessary for learners in the 21st century. The government implements the 2013 curriculum to improve learners ' critical thinking skills with one of its components of teaching materials in a student's worksheet (LKPD). The problem is that the use of LKPD is still lacking in facilitating learners ' critical thinking skills. This research aims to develop the LKPD on the concept of biodiversity that is valid, practical, and effective. The research methods used are Tessmer design, which includes: expert review, one-to-one evaluation, and small group evaluation. The LKPD structure was developed referring to Daryanto & Dwicahyono and critical thinking skills referring to the Facione 1990. Subject validation includes three experts, one to one evaluation subjects are three learners of class X SMA, and a small group evaluation subject is six students of class X SMA. The results showed that the effectiveness of expectations seen from the assessment of critical thinking skills of learners in completing the LKPD belongs to a very good category.

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## A. Introduction

Critical thinking skills are very important skills including the ability to use, analyze, and process information. The results of the National Research Council (NRC) workshop in 2011 established 3 skills that need to be improved in the 21st century, namely 1) cognitive skills; 2) interpersonal skills; and intrapersonal skills. Critical thinking skills are part of cognitive skills based on constructivism learning theory. Based on the view of constructivism students get new knowledge from old knowledge they have.

According to Dwiyogo (2018) students are required to be active so that the teacher is only as a facilitator. The activeness of students is useful in supporting the achievement of learning objectives. The activeness of students can be seen from their involvement in completing learning tasks, engaging in problem-solving, asking other students or teachers about things that are not understood, seeking information for problem-solving, conducting group discussions, and assessing their abilities from the results obtained (Sudjana, 2006).

The learning process in the 2013 curriculum has implemented a learning model that emphasizes and facilitates students' critical thinking skills, such as inquiry models, problem-based learning models, and problem-

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solving models. The implementation of the 2013 curriculum has used these models, but the role of teaching materials in the form of LKPD used in the learning process is still lacking in facilitating students' critical thinking skills. The problem that occurs is the use of LKPD has not grown students' critical thinking skills because it is only a summary of the material and questions. So far, the LKPD in circulation only contains a summary of learning material, exercises, and less emphasis on the learning process (Permatasari, 2018; Iqbal, 2017).

Students need LKPD which contains critical thinking skills to have cognitive skills in dealing with life. According to Majid & Rochman (2015) the LKPD used was given at the end of the learning process, so the LKPD used was like a matter of practice. The questions contained in LKPD are less triggering in higher-order thinking because they only fill in the dots with short sentences to make students less active in learning.

Development research aimed at improving products is one way that can be done to produce LKPD that emphasizes students' critical thinking skills. Development research aims to produce a prototype in improving the product produced by emphasizing formative evaluation to assess the strengths and weaknesses of teaching at the development stage (Zaini, 2018).

Teaching material in the form of LKPD developed has great potential in supporting the process of learning biology. Therefore it is necessary to research the development of biology LKPD to determine the effectiveness of expectations based on students' critical thinking skills. The learning process can utilize LKPD at the stage of understanding one of the concepts in the concept of biodiversity.

Based on the syllabus of specialization in mathematics and the natural sciences in biology in the 2013 curriculum, the concept of biodiversity is a concept that must be taught at the high school level of grade X. One of the basic competencies in this concept is 3.1 Analyzing observations about various levels of biodiversity (genes, types, and ecosystems) in Indonesia. Biodiversity is closely related to human life. Indonesia is a country that has very high biodiversity. According to Nurichah (2012), the concept of biodiversity contains topics known by students. The existence of topics known to be an important determinant in growing students' critical thinking skills so that these skills can be achieved properly.

## B. Materials and Methods

The LKPD development research originated from the existing LKPD and then was improved using the Tessmer design (1993) through the stages of Self Evaluation, expert review, one-to-one evaluation, and small group evaluation.

This study focuses on the effectiveness of LKPD expectations at the small group evaluation stage. Small group evaluation subjects were 6 students of class X MIA 2 SMAN 9 Banjarmasin in odd semester 2019/2020. According to Rusdi (2018), the number of research subjects depends on the representation of the diversity of user characteristics that have been determined. Participants involved a minimum of three people. The selection of research subjects is based on the academic ability of students in a class. The effectiveness data were obtained from the critical thinking skills assessment sheet instrument.

The analysis technique used is descriptive. First of all, the percentage of students' correct answers in completing tasks in LKPD is calculated by the formula the total score obtained divided by the maximum score multiplied by 100%. Then the calculation results obtained are compared with the categories adapted from Akbar & Sriwiyana (2010) namely 75.01-100.00% (very good); 50.01-<75.00% (good), 25.01-<50, 00% (less good), and 00.00-<25.00% (not good).

## C. Results and Discussion

The results of the critical thinking skills assessment in the small group test are presented in table 1. Then, the recapitulation data of the interpersonal skills and intrapersonal skills of students can be seen in table 2.

Research on LKPD development of the concept of biodiversity only focuses on the effectiveness of expectations; include four topics, namely (1) The Concept of Biodiversity at the Gen, Type and Ecosystem Level; (2) Biodiversity in Indonesia; (3) Conservation and Biodiversity Benefits in Indonesia, and (4) Classification of Organism.

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**Table 1 Students' Critical Thinking Skills**

| No | Skills | Score Max | LKPD | | | | Average | Score (%) | Category |
|---|---|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | | | |
| 1 | Interpretation | 14 | 13,33 | 12,22 | - | 13 | 12,85 | 91,79 | Very good |
| 2 | Analysis | 10 | 9 | - | 9 | 9 | 9 | 90 | Very good |
| 3 | Evaluation | 20 | - | - | 16,5 | - | 16,5 | 82,5 | Very good |
| 4 | Inference | 24 | 22 | - | 20 | - | 21 | 87,5 | Very good |
| 5 | Eksplanation | 20 | 13,83 | 16,67 | - | - | 15,25 | 76,25 | Very good |
| 6 | Self-regulation | 12 | - | 12 | - | - | 12 | 100 | Very good |

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

| No | Name | Interpersonal Skills (%) | Category | Intrapersonal Skills (%) | Category |
|---|---|---|---|---|---|
| 1. | Ahmad Maulana | 77 | Very good | 77 | Very good |
| 2. | Anisah | 77 | Very good | 88 | Very good |
| 3. | Fitri | 88 | Very good | 88 | Very good |
| 4. | Karmila | 88 | Very good | 88 | Very good |
| 5. | M. Luthfi | 77 | Very good | 77 | Very good |
| 6. | Rizki Maulana | 88 | Very good | 88 | Very good |
| | Average | 82,5 | Very good | 84,3 | Very good |

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).

The results showed that LKPD was developed effectively based on critical thinking skills, intrapersonal skills, and intrapersonal skills of students which were classified as very good. This has similarities with the results of research Angkowati et al. (2018) namely the development of modules developed effectively based on 1) students 'cognitive learning outcomes beyond classical achievement, 2) students' critical thinking skills are very good, 3) students 'attitudes including honesty and average responsibilities are very good, 4) students' social skills which include working together and contributing ideas on average is very good, 5) student responses are generally good.

The effectiveness of LKPD expectations in this study is determined based on the students' critical thinking skills in completing tasks in LKPD that are different from some other studies (Rachman, et al., 2017; Hairiani, et al., 2016; Zaini & Jumirah, 2016; Zulyusri, et al., 2017) which explains effectiveness measured from learning outcomes, student activeness, students' analytical skills, process skills, performance skills, spiritual assessments, critical thinking assessments, social skills assessments, assessment of student activity and assessment of teacher activities.

Aspects of critical thinking skills based on Facione (1990) assessed include interpretation, analysis, evaluation, inference, explanation, and self-regulation that have been represented with at least one sub-skill. Based on the results of the study, LKPD was stated to have the effectiveness of expectations with very good categories based on critical thinking skills including interpretation, analysis, evaluation, inference, explanation, and self-regulation). The results showed students' critical thinking skills in the interpretation of 91.79% (very good), analysis of 90% (very good), evaluation of 82.5% (very good), inference of 87.5% (very good), explanation of 76.25% (very good), and self-regulation of 100% (very good). According to Yunita, et al., (2018), the level of critical thinking skills of students can be 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%.

According to Wiyono (2009), critical thinking skills need to be improved in students because through critical thinking skills students can understand deep concepts very easily, sensitive to problems that occur so that they can understand and solve problems and can apply concepts in situations that are different. One way that can be done to

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improve critical thinking skills is to utilize the 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.

Research on the development of LKPD based on critical thinking skills that have been conducted can use by students for teaching materials that can improve critical thinking skills in facing the challenges of the 21st century. The 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 because students can express their ideas and opinions in criticizing a problem. Following the theory of constructivism that underlies critical thinking skills, the constructivist perspective requires students to be active.

Assessment of interpersonal skills (cooperation) of students covers 5 aspects, namely the division of labor, unselfishness, ways of solving problems, tolerance, and motivation while the assessment of intrapersonal skills (meticulous) includes 3 aspects namely doing each stage correctly, doing all stages and doing on time. The results showed that students 'interpersonal skills were very good with a score of 82.5 and students' intrapersonal skills were also very good with a score of 84.3. Interpersonal skills are also called social skills.

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## D. Conclusion

The effectiveness of LKPD expectations in the excellent category based on students' critical thinking skills includes interpretation, analysis, evaluation, inference, explanation, and self-regulation skills; intrapersonal skills; and interpersonal skills.

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