The Effectiveness of High School Biology Students Worksheets Based on Critical Thinking Skills on the Protist Concept

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ABSTRACT

Learning in the 2013 curriculum has one component, namely the existence of teaching materials in the form of student worksheets. This study aims to describe the effectiveness of student worksheets based on critical thinking skills on the Protista concept. This study uses a formative evaluation design method from Tessmer. The student worksheet developed refers to the student worksheets structure according to Daryanto & Dwicahyono, while his critical thinking skills refer to Facione 1990. Subjects in expert review consist of three experts, subjects in one to one evaluation consist of three students in class X high school and the subjects in the small group evaluation consisted of six high school grade X students. The results of research conducted indicate that: 1) student worksheets have a valid category based on the validity test; 2) student worksheets have a good category based on content practicality tests and has a very good category on practicality expectations based on students’ responses; and 3) student worksheets has a very good category based on the assessment of students’ critical thinking skills on the effectiveness test and has a very good category on interpersonal skills (working together) and intrapersonal skills (thorough).

A. Introduction

Critical thinking skills are one of the important skills to have in the 21st century. This is consistent with the results of the National Research Council workshop (2011) which stipulates that three skills need to be improved in this century, namely: 1) cognitive skills (critical thinking), 2) interpersonal skills (teamwork) and 3) intrapersonal skills (management self, self-regulation). These three skills are the focus of learning.

Critical thinking skills are important cognitive skills for students to have. This is because these skills can train students to be more responsive in solving and solving problems contained in learning. In the context of learning, critical thinking skills are based on constructivism learning theory. According to Facione (2015), experts agree to understand critical thinking as a drive for self-regulation through interpretation, analysis, evaluation, and inference.

As a concrete manifestation of how important this critical thinking skill is, the government finally adopted the 2013 curriculum. The learning process in the 2013 curriculum includes three domains, namely...
The effectiveness of data analysis techniques based on critical thinking skills in working on LKPD bills and interpersonal skills (working together) and intrapersonal skills (cooperating) and the most dominant interpersonal skills assessment (cooperating) and the most dominant intrapersonal skills (every 10 minutes).

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skills (meticulous) is calculated by the formula:

\[
\text{Score(%) = \frac{\text{numb. of scores obtained}}{\text{max. number of scores}}} \times 100\%
\]

The results obtained are adjusted to the categories adapted from Akbar & Sriwiyana (2010), namely 75.01 - 100.00% (very good), 50.01 - 75.00% (good), 25.01 - 50.00% (good enough) and 00.00 - 25.00% (not good).

C. Results and Discussion
The student worksheet resulting from the development of the Protista concept contains 5 topics namely 1) General Characteristics of Protists, 2) Animal-like Protists, 3) Plant-Like Protists, 4) Mushroom-like Protists and 5) The Role of Protists in Life. A summary of the results of the effectiveness test of LKPD expectations in the small group test is presented in Table 1 below.

Table 1 Summary of Student Worksheet Expectancy Test Results

<table>
<thead>
<tr>
<th>No.</th>
<th>Skills</th>
<th>Max Score</th>
<th>Student Worksheet</th>
<th>Average</th>
<th>Score (%)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Interpretation (1.1, 1.2, 1.3)</td>
<td>14</td>
<td>-</td>
<td>12.67</td>
<td>11.33</td>
<td>11.00</td>
</tr>
<tr>
<td>3.</td>
<td>Evaluation (3.1, 3.2)</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>Inference (4.1, 4.2, 4.3)</td>
<td>24</td>
<td>15.83</td>
<td>22.50</td>
<td>22.50</td>
<td>19.00</td>
</tr>
<tr>
<td>5.</td>
<td>Explanation (5.1, 5.2, 5.3)</td>
<td>20</td>
<td>19.33</td>
<td>14.67</td>
<td>17.50</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>Self-regulation (6.1, 6.2)</td>
<td>12</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
</tr>
</tbody>
</table>

Information:
1. Categories 75.01 - 100.00% (very good), 50.01 - 75.00% (good), 25.01 - 50.00% (good enough) and 00.00 - 25.00% (not good) adapted from Akbar & Sriwiyana (2010).
2. Student worksheet I = Characteristics of General Protists, Student worksheet II = Similar Animal Protists, Student worksheet III = Plant-Like Protists, Student worksheet IV = Similar Mushroom Protists, Student worksheet V = Role of Protists in Life.

Table 2 Summary of Results of Interpersonal Skills and Intrapersonal Skills

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Recapitulation of Interpersonal Skills (%)</th>
<th>Category</th>
<th>Recapitulation of Intrapersonal Skills (%)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adi Lukman</td>
<td>100</td>
<td>Very Good</td>
<td>100</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>Norhalimah</td>
<td>88</td>
<td>Very Good</td>
<td>88</td>
<td>Very Good</td>
</tr>
<tr>
<td>3.</td>
<td>Dwi Safera Putri</td>
<td>88</td>
<td>Very Good</td>
<td>88</td>
<td>Very Good</td>
</tr>
<tr>
<td>4.</td>
<td>Marya Al-Qur’ani</td>
<td>88</td>
<td>Very Good</td>
<td>100</td>
<td>Very Good</td>
</tr>
<tr>
<td>5.</td>
<td>M. Haidir</td>
<td>77</td>
<td>Very Good</td>
<td>77</td>
<td>Very Good</td>
</tr>
<tr>
<td>6.</td>
<td>Devina Rahmadiah</td>
<td>77</td>
<td>Very Good</td>
<td>77</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>86.33</td>
<td>Very Good</td>
<td>88.33</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Information:
Categories 75.01-100.00% (very good), 50.01-75.00% (good), 25.01-50.00% (good enough) and 00.00-25.00% (not good) adapted from Akbar & Sriwiyana (2010).
Table 2 explains the results of the assessment of interpersonal skills (collaborating) and intrapersonal skills (meticulous), both of which have very good categories. Based on these results, it can be seen that interpersonal skills (working together) and intrapersonal skills (meticulous) each student is different.

Effectiveness of expectations student worksheets in this study was measured based on critical thinking skills, interpersonal skills (working together) and intrapersonal skills (conscientious) of students in doing LKPD tasks at the small group test stage, in contrast to previous research (Hairiani, et al., 2016; Zaini & Jumirah, 2016; Zulyusri, et al., 2017) which explained the effectiveness measured from learning outcomes, student activenes, students' analytical skills, process skills, performance skills, spiritual judgment, assessment of critical thinking, assessment of social skills, student activity assessment and teacher activity assessment.

The student worksheet based on critical thinking skills based on Facione (1990) which was also conducted by previous researchers but with different concepts namely (Novitayani, 2019; Faridah, 2019; Sa'diyah, 2019; Rahmina, 2019). The aspects of critical thinking skills assessed include interpretation, analysis, inference, explanation, and self-regulation that have been represented with at least two sub-skills.

The results showed the worksheets of students stated to have the effectiveness of expectations with excellent categories based on critical thinking skills (interpretation, analysis, inference, explanation, and self-regulation). This is in line with studies that have been previously reported (Nuraini, 2017; Susilowati, et al., 2017) which explain that each critical thinking skill has a different score and criteria for each skill.

Based on the results of the study, students' critical thinking skills in the interpretation of 83.36% (very good), analysis of 97.10% (very good), inference of 85.71 (very good), explanation of 90.75% (very good), and self-regulation of 100.00% (very good). According to Yunita, et al., (2018) in Novitayani (2019), the level of critical thinking skills of students is divided into three, namely low with a percentage of 0% - 59%, moderate with a percentage of 60% - 75%, and high with a percentage of 76% - 100%.

In addition to assessing students' critical thinking skills, an assessment of interpersonal skills (working together) which includes five aspects, namely division of labor, unselfishness, ways of solving problems, tolerance and motivation, while intrapersonal skills (meticulous) includes three aspects, namely doing each stage with a right, doing all the stages correctly and working on time.

Based on the research results, it is known that interpersonal skills (working together) have a very good category which proves that the worksheets of students produced in addition to improving critical thinking skills can also improve interpersonal skills (working together) on students. This is in line with research that has been done before (Fadilah, et al., 2015) which reports that through learning using incurs-based learning tools in addition to being able to practice critical thinking skills can also train students' collaborative abilities. The difference lies in the model and material used which in this study uses the inquiry model and the material of the human excretion system.

Based on the explanation above, it can be seen that the critical thinking skills and cooperation of these students are needed to prepare themselves for the students' future in solving problems, including in making decisions in the world of work that will be faced by students later in their daily problems. These skills need to be trained by teachers to students in their learning activities in class. Learning biology with the right method is expected to be a means of developing this thinking ability so that the learning process takes place optimally. A well-planned learning process plays a very important role in achieving educational goals (Fadilah, et al., 2015).

In addition to the assessment of interpersonal skills (working together), an assessment of students' intrapersonal skills (conscientious) also carried out in which the results showed intrapersonal skills (conscientious) had very good categories. 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.

Other research (Natalina, et al., 2013) reports that to improve curiosity, cooperation, conscientiousness, tolerance, discipline, self-confidence, and responsibility can be done using the guided inquiry model. Students will be involved in activities directly in finding and finding their core of the material and students are trained to be independent in solving problems that have been given by the teacher in the group. Students with a higher attitude of accuracy will try to understand the concept actively to satisfy their curiosity.

In this 21st century, critical thinking skills, interpersonal skills, and intrapersonal skills are skills that need to be owned and improved. This is consistent with the results of the NRC workshop (2011) which established that three skills needed to be improved, namely: 1) cognitive skills (critical thinking), 2) interpersonal skills (teamwork) and 3) intrapersonal skills (self-management, self-regulation).

These three skills are interconnected and are needed by students. One way that can be done to improve these three skills is to use students ‘worksheets in the learning system because with the use of students' worksheets, students can play an active role and take control to solve the problems faced. The statement agrees with Astuti et al., (2017) which explains that for students to be actively involved in critical thinking, one alternative that can facilitate is the use of students' worksheets where students can pour their ideas and opinions in criticizing a problem.

All student worksheets developed in this study already included five Facione critical thinking skills, but some did not fulfill all the subcritical thinking skills. Nevertheless, critical thinking skills have been represented by at least two sub-skills on each task in the student worksheet. Besides, researchers realize the lack of one critical thinking skill according to Facione (1990), namely evaluation. This is due to the limited ability possessed by researchers to develop questions in the form of bills containing evaluation skills.

D. Conclusion
Student Worksheet has the effectiveness of expectations in very good categories (interpretation, analysis, inference, explanation, and self-regulation) and has interpersonal skills (working together) and intrapersonal skills (meticulous) with very good categories.

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F. References


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