



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

MIRNA HARIATI ^{(1)*}, MUHAMMAD ZAINI ⁽²⁾, KASPUL ⁽¹⁾

⁽¹⁾ Biology Education Study Program, Faculty of Teacher Training and Education, Universitas Lambung Mangkurat, Jl. Brigjend H. Hasan Basri, Banjarmasin, Indonesia

⁽²⁾ Master Program of Biology Education, Postgraduate Program, Universitas Lambung Mangkurat, Jl. Brigjend H. Hasan Basri, Banjarmasin, Indonesia

*Corresponding Author Email: mirnahariati27@gmail.com

Article Info

Keyword:

Development Research
Student Worksheets
Protists
Critical Thinking Skills

History:

Received : 29/01/2020
Accepted : 01/04/2020
Published : 30/04/2020

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).

© 2020 BIO-INOVED : Jurnal Biologi Inovasi Pendidikan

How to cite: Hariati, M., Zaini, M., & Kaspul, K. (2020). The Effectiveness of High School Biology Students Worksheets Based on Critical Thinking Skills on the Protist Concept. *BIO-INOVED : Jurnal Biologi-Inovasi Pendidikan*, 2(1), 1-6.

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



affective (attitude), cognitive (knowledge), and psychomotor (skills). Besides, learning in the 2013 curriculum has also adopted the decision of the NRC workshop results (NRC, 2011), namely by using learning models that demand and facilitate students' critical thinking skills such as inquiry models, problem-based learning models, and problem-solving models.

The implementation of the 2013 curriculum has used the above models, but the role of student worksheets used in the learning process is considered to be lacking in facilitating students' critical thinking skills. The problem that often occurs is that the student worksheets which have been used have not been able to maximize the learning process in achieving learning objectives. Though student worksheets are made to help students find a concept, apply, and integrate various concepts that have been found.

This is different from student worksheets which have been circulating in schools where student worksheets only contain a summary or review of the subject matter and contain practice questions (questions). Iqbal (2017) reports that many student worksheets currently in circulation have less emphasis on the learning process because most only contain summary material. The material presented is also not accompanied by structured steps about how a concept formation.

This is in line with Suryawati, et al., (2017) who reported that based on the results of curriculum analysis and analysis of MGMP LKPD activities, there were some irrelevant activities where student worksheets was still a list of questions that were textual in nature, lacked training in thinking skills and scientific attitudes. Majid & Rochman (2015) added that the questions raised in students' worksheets were often in the form of questions that did not trigger students to think at a high level (analyzing, evaluating, and creating). Existing worksheets often ask students to only fill in the "dots" with short words or sentences.

In essence, student worksheets that have been circulating so far need to be improved to become student worksheets that can explore critical thinking skills. One way is to adopt the Facione model. Besides, the structure must also be following the

applicable structure (Daryanto & Dwicahono, 2014).

The student worksheet developed has great potential in supporting the process of learning biology in the 21st century that enhances three skills. Therefore, student worksheets by using the Facione model is expected to later become a quality student worksheets. Quality indicators are valid, practical, and effective. These three indicators are important in producing quality student worksheets.

The student worksheet which contains critical thinking skills is necessary so that students have cognitive skills in dealing with daily life. One way that can be done is to produce student worksheets that emphasize critical thinking skills through development research aimed at improving the product. Based on this description, the development of research on the effectiveness of high school students' worksheets in learning biology on the concept of Protist.

B. Materials and Methods

The student worksheet development research was conducted using a formative evaluation design from Tessmer (1993). The stages used to consist of self-evaluation, expert review, one to one evaluation, and small group evaluation. The study was conducted for one semester.

The research subjects for the validity test were two supervisors as academics and one biology teacher in Banjarmasin 9 as a practitioner. The research subjects for the individual test were three students of class X MIA 2, SMA Negeri 9 Banjarmasin, while the research subjects for the small group test were six students of class X MIA 2, SMA Negeri 9 Banjarmasin.

The effectiveness of expectation data is collected using the skills assessment instrument sheet at the small group test stage based on students' critical thinking skills from the LKPD bill, while interpersonal skills (cooperating) and intrapersonal skills (meticulous) based on those given to the aspects of interpersonal skills assessment (cooperating) and the most dominant intrapersonal skills (every 10 minutes).

The effectiveness of data analysis techniques based on critical thinking skills in working on LKPD bills and interpersonal skills (working together) and intrapersonal

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 describes the effectiveness of the expectations of students' worksheets that are determined based on critical thinking skills that have very good categories which include interpretation, analysis, inference, explanation, and self-regulation skills. Besides, the effectiveness of this expectation also evaluates interpersonal skills (working together) and intrapersonal skills (meticulous). The summary results of interpersonal skills (working together) and intrapersonal skills (meticulous) are presented in Table 2.

Table 1 Summary of Student Worksheet Expectancy Test Results

No.	Skills	Max Score	Student Worksheet					Average	Score (%)	Category
			I	II	III	IV	V			
1.	Interpretation (1.1, 1.2, 1.3)	14	-	12,67	11,33	11,00	-	11,67	83,36	Very Good
2.	Analysis (2.1, 2.2, 2.3)	10	9,83	9,67	9,67	9,67	-	9,71	97,10	Very Good
3.	Evaluation (3.1, 3.2)	20	-	-	-	-	-	-	-	-
4.	Inference (4.1, 4.2, 4.3)	24	15,83	22,50	22,50	19,00	23,00	20,57	85,71	Very Good
5.	Explanation (5.1, 5.2, 5.3)	20	19,33	14,67	17,50	-	21,08	18,15	90,75	Very Good
6.	Self-regulation (6.1, 6.2)	12	12,00	12,00	12,00	12,00	12,00	12,00	100,00	Very Good

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).
- 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

No.	Name	Recapitulation of Interpersonal Skills (%)	Category	Recapitulation of Intrapersonal Skills (%)	Category
1.	Adi Lukman	100	Very Good	100	Very Good
2.	Norhalimah	88	Very Good	88	Very Good
3.	Dwi Safera Putri	88	Very Good	88	Very Good
4.	Marya Al-Qur'ani	88	Very Good	100	Very Good
5.	M. Haidir	77	Very Good	77	Very Good
6.	Devina Rahmadiyah	77	Very Good	77	Very Good
Average		86,33	Very Good	88,33	Very Good

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 activeness, 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.

E. Acknowledgment

Through writing this article, the authors thank: (1) Prof. Dr. H. Muhammad Zaini, M.Pd., and Drs. H. Kaspul, M.Sc. as a supervisor who always continues to guide and provide direction and guidance in conducting research and writing articles, and (2) Sari Oktarina, M.Pd. as Head of the 9th High School in Banjarmasin and Sukardi, M.Pd. as a biology teacher as well as a partner who always helps during the conduct of research and students of class X MIA 2 in the academic year 2019/2020 as subjects in research.

F. References

- Akbar, S., & Sriwiyana, H. (2010). *Pengembangan Kurikulum dan Pembelajaran Ilmu Pengetahuan Sosial*. Yogyakarta: Cipta Media.
- Arbainsyah. (2016). *Pengembangan Perangkat Pembelajaran Topik Interaksi Makhluk Hidup dengan Lingkungannya dalam Melatih Keterampilan Berpikir Kritis Siswa SMP*. Unpublished PhD thesis, Universitas Lambung Mangkurat.
- Astuti, P., Purwoko, P., & Indaryanti, I. (2017). Pengembangan LKS untuk melatih kemampuan berpikir kritis dalam mata pelajaran matematika di kelas VII SMP. *Jurnal Gantang*, 2(2), 145-155.
- Daryanto, D., & Dwicahyono. (2014). *Pengembangan Perangkat Pembelajaran*. Yogyakarta: Gava Media.
- Facione, P. A. (1990). *Critical Thinking: A Statement of Experts Consensus for Purposes of Educational Assessment and Instruction "The Delphi Report" Executive Summary*. California: The California Academic Press.
- Facione, P. A. (Ed.). (2015). *Critical Thinking: What It Is and Why It Counts*. Hermosa Beach, CA: Measured Reasons LLC.
- Fadilah, S. I., Kardi, S., & Supardi, Z. I. (2017). Pengembangan perangkat pembelajaran biologi berbasis inkuiri materi sistem ekskresi manusia untuk melatih keterampilan berpikir kritis dan



- kerjasama siswa SMA. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 5(1), 779-787.
- Faridah. (2019). *Pengembangan Lembar Kerja Peserta Didik Biologi SMA Berbasis Keterampilan Berpikir Kritis pada Konsep Sistem Kekebalan Tubuh*. Unpublished PhD thesis, Universitas Lambung Mangkurat.
- Hairiani, H., Zaini, M., & Kaspul, K. (2016). Keterampilan Proses dan Keterampilan Kinerja Siswa Kelas XI Madrasah Aliyah dalam Pembelajaran Konsep Sistem Sirkulasi Melalui Penelitian Pengembangan Lembar Kerja Siswa. *Prosiding Seminar Nasional Lahan Basah* (Vol. 2, pp. 719-724).
- Iqbal, M. (2017). *Pengembangan Lembar Kerja Peserta Didik (LKPD) dengan Pendekatan Kontekstual ditinjau dari Pemahaman Konsep dan Disposisi Matematis*. Diakses melalui digilib.unila.ac.id pada 10 Agustus 2019.
- Lestari, I. L., Utami, B., & Budhiretnani, D. A. (2015). Improving Critical Thinking Ability and Scientific Attitude Students through the Combine Methods of Inquiry and Reciprocal Teaching on the Material Excretion Systemat 11th Natural Science 5 Class Senior High School 7 Kediri Academic Year 2014-2015. *In Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning* (Vol. 12, No. 1, pp. 276-280).
- Majid, A., & Rochman, A. (2015). *Pendekatan Ilmiah dalam Implementasi Kurikulum 2013*. Bandung: PT. Remaja Rosdakarya.
- Murti, K. E. (2013). *Pendidikan Abad 21 dan Implementasinya pada Pembelajaran di Sekolah Menengah Kejuruan (SMK) untuk Paket Keahlian Desain Interior*. Dalam Artikel Kurikulum 2013 SMK.
- Natalina, M., et al. (2013). Penerapan Strategi Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Sikap Ilmiah dan Hasil Belajar Biologi Siswa Kelas VIII7 SMP Negeri 14 Pekanbaru Tahun Ajaran 2012/2013. *BIOGENESIS (Jurnal Pendidikan Sains dan Biologi)*, 9(2): 28-38.
- National Research Council. (2011). *Assessing 21st Century Skills: Summary of a Workshop*. J. A. Koenig, Rapporteur. Committee on the Assessment of 21st Century Skills. Board on Testing and Assessment, Division of Behavioral and Social Science and Education. Washington, DC: The National Academic Press.
- Novitayani, A. (2019). *Pengembangan Lembar Kerja Peserta Didik Biologi SMA Berbasis Keterampilan Berpikir Kritis Pada Konsep Sistem Ekskresi*. Unpublished PhD thesis, Universitas Lambung Mangkurat.
- Nuraini, N. (2017). Profil Keterampilan Berpikir Kritis Mahasiswa Calon Guru Biologi sebagai Upaya Mempersiapkan Generasi Abad 21. *DIDAKTIKA BIOLOGI: Jurnal Penelitian Pendidikan Biologi*, 1(2): 89-96.
- Rahmina, N. (2019). *Pengembangan Lembar Kerja Peserta Didik Biologi SMA Berbasis Keterampilan Berpikir Kritis Pada Konsep Sistem Reproduksi*. Unpublished PhD thesis, Universitas Lambung Mangkurat.
- Sa'diyah, H. (2019). *Pengembangan Lembar Kerja Peserta Didik Biologi SMA Berbasis Keterampilan Berpikir Kritis Pada Konsep Sistem Pernafasan*. Unpublished PhD thesis, Universitas Lambung Mangkurat.
- Susilowati, E., et al. (2017). Pengembangan Lembar Kerja Siswa Biologi SMA Berbasis Pendekatan Ilmiah untuk Meningkatkan Keterampilan Berpikir Siswa. *Jurnal Pendidikan Biologi*, 6(2).
- Tessmer, M. (1993). *Planning and Conducting Formative Evaluations*. London: Routledge.
- Zaini, M. (2019). *Penelitian Desain Pendidikan Aplikasi Teori ke dalam Praktik*. Yogyakarta: Penebar Media Pustaka.
- Zaini, M. & Jumirah, R. (2016). Pengembangan Perangkat Pembelajaran Topik Ekologi Terhadap Keterampilan Berpikir Kritis Siswa Madrasah Aliyah. *Jurnal Pendidikan Biologi Indonesia*, 2(1).
- Zulyusri, Z., Sumarmin, R., & Miswati, M. (2017). Pengembangan Soal Biologi Berbasis Literasi Sains untuk Siswa SMA Kelas X Semester 1. *Bioeducation*, 1(1), 88-94.
- National Research Council. (2011). *Assessing 21st Century Skills: Summary of a Workshop*. J. A. Koenig, Rapporteur. Committee on the Assessment of 21st Century Skills. Board on Testing and Assessment, Division of Behavioral and Social Science and Education. Washington, DC: The National Academic Press.