

## The effectiveness of student worksheets based on critical thinking skills in biology class XI high school odd semester

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Article Information	Abstract
<p><b>Keyword:</b> Effectiveness; Critical thinking; Student worksheet; Learning activities</p> <p><b>Kata Kunci:</b> Keefektifan; Berpikir kritis; Lembar kerja peserta didik; Aktivitas belajar</p>	<p>Cognitive skills that are important to note in students are critical thinking skills. Efforts can be made to build students' critical thinking skills through the learning process, supported by innovative teaching materials such as Student Worksheets (SW). This study aims to describe the effectiveness of SW based on critical thinking skills developed in the biology subject of class XI senior high school odd semester. The development stage includes self-evaluation, expert testing, individual testing, small group testing, and field testing. The research subjects were three experts for the validity test, three students for the individual test, seven for the small group test, and 25 for the field test. The effectiveness of SW was analyzed descriptively. The study results showed that the SW developed was stated to be effectively used with effective criteria. Based on these data, the average N-Gain value is 0.53, so the N-Gain category is medium. From the results of this study, it can be concluded that the developed SW based on critical thinking skills in Biology class XI subject matter was effectively used in learning activities.</p>
<p><b>History:</b> Received : 11/01/2023 Accepted : 16/06/2023</p>	<p><b>Abstrak</b></p> <p>Keterampilan kognitif yang penting diperhatikan pada diri peserta didik adalah keterampilan berpikir kritis. Usaha yang dapat dilakukan dalam membangun keterampilan berpikir kritis peserta didik adalah melalui proses pembelajaran, yang didukung oleh penggunaan bahan ajar inovatif seperti Lembar Kerja Peserta Didik (LKPD). Penelitian ini bertujuan mendeskripsikan keefektifan LKPD berbasis keterampilan berpikir kritis yang dikembangkan pada mata pelajaran biologi SMA kelas XI semester ganjil. Tahap pengembangan meliputi evaluasi diri, uji pakar, uji perorangan, uji kelompok kecil, uji lapangan. Subjek penelitian adalah 3 pakar untuk uji validitas, 3 peserta didik untuk uji perorangan, 7 peserta didik untuk uji kelompok kecil dan 25 peserta didik untuk uji lapangan. Keefektifan LKPD dianalisis secara deskriptif. Hasil penelitian menunjukkan LKPD yang dikembangkan dinyatakan efektif digunakan dengan kriteria efektif. Berdasarkan data tersebut maka nilai rerata N-Gain 0,53 sehingga diperoleh kategori N-Gain sedang. Dari hasil penelitian ini dapat disimpulkan bahwa LKPD berbasis keterampilan berpikir kritis pada materi pelajaran biologi kelas XI yang dikembangkan efektif digunakan dalam kegiatan pembelajaran.</p>

## A. Introduction

In the 21st century, education and people's lives have undergone many changes, partly due to science's rapid and comprehensive development. In this era, there has been a change in the paradigm of education and learning from teacher-centred to student-centred as the subject of learning. According to Sambodo (2019), "In line with the development of 21st-century education, which currently emphasizes critical thinking, students need to be equipped with higher order thinking skills or Higher Order Thinking Skills (HOTS) so that they can think critically, logically, reflectively, metacognitively, and think creatively (Kartika et al., 2019). 21st-century learning is ideally directed at four components, namely communication, collaboration, creative thinking and critical thinking, which students must achieve in the 2013 curriculum and estimates. Students should often be trained in critical thinking to have that ability.

Critical thinking skills are the potential that everyone has and can be measured, trained, and developed (Ilaah & Yonata, 2018). The best effort to develop critical thinking skills that can be done is by associating learning material with the real experiences of students in the everyday environment. So, in learning the 2013 Curriculum, it is necessary to design learning strategies to develop students' critical thinking skills. This strategy impacts students' comprehension of what is known (Wardani & Widiana, 2018).

Several previous studies stated that students' critical thinking skills can generally be trained and improved with several development alternatives, one of which is, according to Murni et al. on aspects of critical thinking skills such as basic clarification, inference, further explanation, reasoning, and integration are in the critical category, whereas in classes that do not apply the cooperative learning model are in the less critical category.

According to Putri et al. (2020), critical thinking skills are part of cognitive skills, and experts agree on the meaning of critical thinking and critical thinking ideas. Students understand critical thinking as a self-regulation drive through interpretation, analysis, evaluation, and inference, such as explaining based on evidence, concepts, methodological, criteria, or contextual considerations.

Developing critical thinking skills can be assisted through various aspects of learning, including using teaching materials. Teaching materials that can help students understand the concepts conveyed can make students study independently or work in groups and change behaviour with SW. The SW is a guide used to carry

out investigative activities to help students find answers or concepts, and this is in line with Achadah (2019), who argues that SW can help students in the teaching and learning process so that learning objectives can be achieved. In addition, this statement is relevant to the research of Husna et al. (2020) and Sari & Susanti (2019), which state that worksheets are teaching materials that can assist students in solving a problem and make it easier for students to understand the material presented by the teacher.

According to Wardani & Widiana (2018), SW can be in the form of guide steps for students to practice developing their critical thinking skills, and this is in line with Husna et al. (2021), explaining that SW contains a set of basic activities and facilities to assist and facilitate teaching and learning activities so that effective interactions are formed between students and educators, which can increase student learning activities and achievements.

Some high school schools have not maximized the use of SW in learning, so this is a scourge in education today (Zaini, 2018), and this is related to the results of interviews with biology teachers at SMAN 1 Juai. So far, biology teaching has not always used worksheets. If using SW teachers usually use SW, which only contains summaries and questions, material for doing exercises and is not yet based on higher-order thinking skills. The SWs are also usually not made by the teacher or a group of teachers, but SWs obtained from book distributors or other teachers. The SW, which is often used, also does not make students more active, so learning activities are still teacher-centred.

On the other hand, learning conditions in schools still tend to place students as learning objects and are required to be able to accept all material presented and memorized. The habit of remembering makes students weak in critical thinking skills. In learning in this way, it isn't easy to distinguish students' characters in terms of abilities, knowledge, learning motivation, and learning styles (Adi et al., 2020), and this is relevant according to Ulinniam et al. (2022), which suggests that one of the schools in Muara Teweh, namely MAN Barito Utara, also applies rote learning and is still focused on the teacher. In addition, this was stated by Zaini et al. (2020), who also said that if education focuses on the teacher, it will be difficult for students to achieve learning objectives.

Several previous studies related to increasing students' critical thinking show the level

of validity and effectiveness in terms of utilizing SW teaching materials. It's just that the SW used is not based on critical thinking skills, so the development SW is needed to train and hone students' critical thinking skills and can be observed from the process and results of activities. Syamsu (2020) found that Discovery Learning-oriented SWs are valid, practical, and effective for improving students' critical thinking skills. In addition, Firdaus & Wilujeng (2018) that guided inquiry SWs can improve critical thinking skills and student learning outcomes. Hidayat et al. (2020) suggest that good and systematically arranged SWs can help students develop critical thinking skills.

Based on the description above, the SW that previous researchers have developed only focuses on the material listed in the available textbooks, so it still does not relate to the surrounding environment, which can be used as the material contained in the SW. Therefore, researchers are interested in developing SW based on critical thinking skills with contextual material to be more embedded in students' memories because it relates to everyday life. In developing this SW, the researcher intends to develop a biology SW for class XI senior high school based on critical thinking skills.

## B. Material and Method

The research type is development research, which refers to the development design of Tessmer (1998). Preliminary studies were carried out to analyze essential materials that can be used in learning Biology.

In assessing the effectiveness of an SW, two parameters are tested, namely the results of students working on SW and evaluation questions. Effectiveness was tested in a small group test of seven students and a field test of 23 students.

Requirements for students as testers of the effectiveness of SW are as follows:

- 1) Students are included in the XI class of science.
- 2) Students involved in one-to-one are no longer involved in small groups and field tests.
- 3) The seven students in the small group were also involved in the field test.

The meaning of another sentence is that seven of the 23 students in the field test were never involved in the small group, and the other five were never involved.

Expected effectiveness is obtained from small group results, and actual effectiveness is obtained from field test results. Students' critical thinking skills, which include five indicators: Interpretation, Analysis, Evaluation, Inference and Explanation, are then calculated using Formula 1

for the normalized n-gain value (N-Gain or g) by Facione (1990). Critical thinking can be identified with high or low criteria based on N-gain, namely the classification in Table 1.

$$g = \frac{S_{\text{posttest}} - S_{\text{pretest}}}{S_{\text{maximum}} - S_{\text{pretest}}} \dots \dots \dots \text{Formula 1}$$

Information:

- g = gain value
- S post-test = KBK score meeting 3
- S pre-test = KBK score meeting 1

**Table 1 N-Gain Classification**

Category g value	Category g value
$g \geq 0,7$	High
$0,7 > g > 0,3$	Medium
$g \leq 0,3$	Low

(Source: Adaptation from Hake, 1998)

## C. Results and Discussion

The effectiveness of SW is obtained from the results of small group tests and field tests. The effectiveness test was carried out based on 14 SW, which were developed to get how far the students' critical thinking skills increased. Summary of data on students' critical thinking skills analyzed from filling out SW and answering evaluation questions in small group tests and field tests, the results obtained from students' expectations of critical thinking skills are shown in Table 2 and students' actual critical thinking skills are shown in Table 3.

Based on the results of Table 2, the effectiveness of the expectations of the SW developed in the field follows expectations with the effective category because it gets a value of 66.27%. This result shows that the SW developed in expectation effectiveness is included in the effective category, which means that the SW developed can help students work on biology learning, which is shown from the results of the work on the SW and the results of working on evaluation questions which get an average score of 66.27% which can be assumed that SW has a role in exploring students' critical thinking skills in the effective category.

Based on the results of Table 3, the actual effectiveness of the developed SW was in the effective category, namely at the second meeting of 69.60%. It increased at the third meeting with an average value of 85.62%. This result shows that the actual developed SW can explore students' critical thinking skills in the effective category. Improving students' critical thinking skills includes six indicators of critical thinking skills in small group tests and field tests calculated using the normalized Gain value formula (N-Gain or g) to obtain the results in Table 4.

**Table 2 The SW Expectation Effectiveness Test Results**

No	Indicator	SW Meeting 1			
		SW	Evaluation	Amount	Average
1	Interpretation	78,57	66,67	145,24	72,62
2	Analysis	75,00	50,00	125,00	62,50
3	Evaluation	85,71	66,67	152,38	76,19
4	Inference	85,71	66,67	152,38	76,19
5	Explanation	75,00	33,33	108,33	54,17
6	Self-regulation	78,57	33,33	111,90	55,95
<b>Amount</b>		<b>478,56</b>	<b>316,67</b>	<b>795,23</b>	<b>397,62</b>
<b>Average (%)</b>		<b>66,27</b>			

(Source: Data Processing Results)

**Table 3 The SW Actual Effectiveness Test Results**

No	Indicator	SW Meeting 2				SW Meeting 3			
		SW	Evaluation	Amount	Average	SW	Evaluation	Amount	Average
1	Interpretation	60,13	64,13	124,26	62,13	83,33	96,91	180,24	90,12
2	Analysis	50,25	83,09	133,34	66,67	78,57	89,77	168,34	84,17
3	Evaluation	50,25	69,75	120,00	60,00	91,66	75,00	166,66	83,33
4	Inference	65,25	83,57	148,82	74,41	85,00	83,33	168,33	84,17
5	Explanation	74,00	86,00	160,00	80,00	83,33	96,91	180,24	90,12
6	Self-regulation	65,25	83,57	148,82	74,41	78,57	85,01	163,58	81,79
<b>Amount</b>		<b>500,46</b>	<b>470,11</b>	<b>835,24</b>	<b>417,62</b>	<b>500,46</b>	<b>526,93</b>	<b>1027,39</b>	<b>513,70</b>
<b>Average</b>		<b>69,60</b>				<b>85,62</b>			

(Source: Data Processing Results)

**Table 4 N-Gain Test Results for Students' Critical Thinking Skills**

No	Indicator	Score			N-Gain	Average	Category
		Meeting 2	Meeting 3	Maximum			
1	Interpretation	62,13	90,12	100,0	0,74	0,53	Medium
2	Analysis	66,67	84,17	100,0	0,53		
3	Evaluation	60,00	83,33	100,0	0,58		
4	Inference	74,41	84,17	100,0	0,38		
5	Explanation	80,00	90,12	100,0	0,51		
6	Self-regulation	74,41	81,79	100,0	0,29		

(Source: Data Processing Results)

The SW effectiveness test data was divided into two stages: the expected effectiveness in the small group test and the actual in the field test, as seen from students' learning outcomes. The N-Gain value is obtained based on the results, indicating the medium category. The medium category means that the developed SW can train students' critical thinking skills, which shows that this SW is effective for use in Biology learning for students' critical thinking skills. Several studies of SW have been conducted by Fajeriadi (2018) and Fitriansyah et al. (2018), stating that very effective teaching materials are used to improve critical thinking skills. This is reinforced by Sari & Susanti (2019) that developing SW can improve students' critical thinking skills.

The results obtained in the developed SW can improve students' critical thinking skills. This SW can improve students' critical thinking skills because it is written in an easy-to-understand way so students can more easily grasp learning

material. Improving students' critical thinking skills is also influenced by the ability to understand the contents of SW.

Students' critical thinking skills were analyzed based on the assessment of filling out the SW and answering evaluation questions. Evaluation questions in the form of essays aim to determine students' learning success. This follows Achadah (2019), who explains that evaluation is an assessment process to describe a student's achievements according to the specified category. Meanwhile, assessment of students' critical thinking skills can be seen from the six indicators of critical thinking skills, namely interpretation, analysis, evaluation, inference, explanation, and self-regulation.

#### **Interpretation Indicator**

Based on the N-Gain data on students' critical thinking skills listed in Table 4, it can be seen that there are differences in the acquisition of scores on

students' critical thinking skills indicators. The interpretation indicator for the N-Gain value obtained in the field test is 0.74. The acquisition of the N-Gain value is an advantage of the developed SW, which has complex material, making it easier for students to learn. Interpretation abilities carried out by students can be seen when participants work on SW. When students read the discourse on the worksheet, they students can examine a problem from the discourse so that they have the ability to interpret it correctly. This achievement is because the developed SW has good systematics with the availability of actual discourse, making it easier for students to study a problem in the material provided (Yennita et al., 2018).

Improving students' abilities in interpreting to obtain scores included in the high N-Gain category on SW can trigger students' critical thinking skills in learning. Interpretation is an ability students possess, such as a good understanding of the situation or processing the information obtained. According to research by Sari & Susanti (2019), interpretation is the ability to understand, explain, and give meaning to data and information. In addition, Dharmono (2022) explains that indicators of interpretation skills can be seen in students who have started to train to predict and make data presentations.

### **Analysis Indicators**

In the Analysis indicator, the average N-Gain value is 0.53 in the medium category, and this is known when students can formulate solutions to problems they find in a narrative in the developed SW. Student's ability to perform analysis obtains a score in the medium N-Gain category because, in the learning process, students analyze their observation data using the developed SW. The analyzing results can be a reference to prove the truth of their hypothesis to the problems in the interpretation process. If the data collection procedure is correct, the data collected also follows the demands of the process, and the analysis is accurate, then accurate information is obtained. Therefore, students are responsible for their learning activities. Students can use analytical abilities to determine solutions to problems found during the learning process. The analysis indicator that gets an average N-Gain score is in this medium category because the developed SW has several advantages, such as containing actual discourse so that students can easily associate everyday problems with available discourse, making it easier for students to observe to solve a problem. However, the developed SW still has deficiencies, so the analysis indicators have not obtained maximum

results. The material is not too broad in its presentation, so there are limited materials for solving students' problems.

A student's skill in analysis is essential in guiding students to give their opinion on the problems in the interpretation. Students with good analytical skills will have problem-solving skills. According to Wardani & Widiana (2018), critical thinking skills are students' cognitive processes in systematically and explicitly analyzing the problems encountered, distinguishing these problems carefully and thoroughly, and identifying and reviewing information to plan strategies for solving these problems. This opinion aligns with Dwiyoogo (2018), who explains that critical thinking is deep reflective thinking in decision-making and problem-solving to analyze situations, evaluate arguments, and draw appropriate conclusions. People who think critically can conclude what they know, know how to use information to solve problems, and look for sources of relevant information to support solving the problems they face.

### **Evaluation Indicator**

The evaluation indicators get an average N-Gain value of 0.58 in the medium category. The ability of students in evaluation indicators has meaning in that students working on SW can assess statements or opinions received from themselves and others. Critical thinking skills of students in conducting evaluations obtain medium scores with an average N-Gain of 0.58. This is because, in the learning process, students are involved in assessing opinions or statements from a problem-solving.

Students who can evaluate or know a person's level of understanding and mastery in a subject or competency can quickly develop their critical thinking skills. Student achievement in improving critical thinking skills is inseparable from good SW, which can measure students' critical thinking skills. This is in line with the statement of Fajrin et al. (2018), which stated that the indicators stated that the learning tools developed were effective. The evaluation tools developed were able to measure students' critical thinking skills.

Students' skills in evaluation have increased because students are guided in assessing the statements or opinions received. Students with good evaluation skills will have an assessment of the information received. This is in line with Ramadhan et al. (2020) explaining that evaluation is a person's ability to assess the credibility of a statement of one's opinion or conclusions based on the relationship between information and concepts, with questions that exist on a problem. According

to Zaini (2018), evaluation skills are used to assess the strengths and weaknesses of arguments.

### **Inference Indicator**

The inference indicator gets an average N-Gain value of 0.38 in the medium category. The acquisition of the N-Gain value is suspected because students' ability in inference is still not able to conclude the correct solution found. The conclusions drawn should be the key or answer to the problems that are made so that they can prove the truth of the opinions put forward in the assumptions. There are differences in conclusions between students. Students who can make inferences or draw conclusions correctly show that these students carry out the analysis well because students must carry out data analysis with a good and correct process for a problem so that the conclusions obtained are appropriate.

According to Fajrin et al. (2021), students' critical thinking skills are inseparable from the learning process. This is relevant to the data on the implementation of SW, which was obtained at the field test stage. This is because, during the learning activities, students make observations and answer evaluation questions very well. Achadah (2019) suggests that students' ability in the environmental education process will improve their critical thinking skills so that the material is easy to understand and recall. Irwandi & Fajeriadi (2019) state that students are expected to match the conclusions with the hypotheses made after finding the concept. As well as Putra et al. (2020), student inference skills developed based on the results of the hypothesis testing that students have done.

### **Explanation Indicator**

The explanation indicator gets an average N-Gain value of 0.51 in the medium category. Students' abilities in explanation can be seen when students can identify and describe facts to find alleged solutions to problems and provide exact statements about these suspected solutions. Students' ability to explain received a medium score because, in the learning process, students were guided to give their opinions on the interpretations they made or on the problems they studied. After that, students must develop their own way of solving the problem to prove their opinions. Students with good explanation skills will be able to have solutions to solve problems correctly. This achievement shows that the WS developed is following students' needs because this WS contains actual material and is easy for students to understand. Apart from that, the developed WS has the advantage of displaying the images presented to be the same as the original.

Achievement in critical thinking skills can occur following the use of WS. This happens because, during learning activities, students make observations and answer evaluation questions very well. This aligns with the opinion of Pursitasari et al. (2020) that increasing critical thinking in learning is one of the variables that improve cognitive learning outcomes. Suciono (2021) reinforces this statement, stating that rising students' critical thinking abilities influence learning outcomes.

### **Self-regulation Indicator**

The self-development indicator gets an average N-Gain score of 0.29 in the low category. Students' self-regulation ability can be seen when they can regulate their existence in problem-solving. The ability of students to regulate gets a medium score because, in learning, students can apply a process where one can manage achievement with their actions to evaluate their success when achieving the target of a lesson that teaches individuals to be able to regulate themselves. This is in line with the statement of Fitriansyah et al. (2018), which states that self-regulation is the ability to regulate one's behavior and is one of the main drivers of human personality. A person must be able to regulate his behavior, directing this behavior to achieve the desired goal and an optimal plan.

The development of this SW has several advantages, namely, having content or material that is arranged neatly and clearly, and it is developed to contain colorful pictures to resemble the original form. This makes it easy for students to identify the problems encountered during learning. However, there are several weaknesses in the developed SW, such as in the development of the material, which is still not extensive enough so that the learning material developed can only be used in certain subjects. The advantages presented by the SW can positively affect the development of student's critical thinking skills so that the developed SW is effectively used in high school biology learning.

## **D. Conclusion**

Research on the development of the developed SW can be concluded that the developed SW obtains effective criteria based on the results of the small group test and the field test, and then the N-Gain results show an average value of 0.53 with medium N-Gain criteria. Therefore, the developed SW is said to be effective in helping students understand biology learning at school.

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## F. References

- Achadah, A. (2019). Evaluasi dalam pendidikan sebagai alat ukur hasil belajar. *An-Nuha: Jurnal Kajian Islam, Pendidikan, Budaya dan Sosial*, 6(1) 92-104. DOI: <https://doi.org/10.36835/annuha.v6i1.296>
- Adi, N. H., Fernandes, A. L., & Hermansyah, H. (2020). Pengembangan media pembelajaran berbasis android pada mata kuliah fisika dasar. *Cetta: Jurnal Ilmu Pendidikan*, 3(1) 58-65. DOI: <https://doi.org/10.37329/cetta.v3i1.414>
- Dharmono, D. (2022). Kelayakan buku ilmiah populer tumbuhan rawa sebagai niche ikan dalam melatih berpikir kreatif mahasiswa pendidikan biologi. In *Prosiding Seminar Nasional Lingkungan Lahan Basah*, (Vol. 7, No. 1, pp. 4-5). Seminar Nasional Lingkungan Lahan Basah, Universitas Lambung Mangkurat.
- Dwiyogo, W. D. (2018). *Pembelajaran berbasis blended learning*. Depok: Rajawali Pers.
- Facione, P. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction* (The Delphi Report). Retrieved from <https://philarchive.org/archive/faccta>
- Fajerandi, H. (2018). *Pengembangan buku ilmiah populer diversitas gastropoda untuk siswa SMA di kawasan pesisir*. (Master's Thesis, Program Studi Magister Pendidikan Biologi Fakultas Keguruan dan Ilmu Pendidikan Universitas Lambung Mangkurat, Banjarmasin). Retrieved from <https://repo-mhs.ulm.ac.id/handle/123456789/12745>.
- Fajrin, A., Dharmono, D., & Zaini, M. (2021). The practicality of popular ethnobotany scientific books on mangrove plants genus avicennia, tabanio village. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 3(1) 53-54. DOI: <http://dx.doi.org/10.20527/bino.v3i1.9922>
- Fitriansyah, M. Arifin, Y.F., & Biyatmoko, D. (2018). *Validitas buku ilmiah populer tentang echinodermata di pulau sembilan kotabaru untuk siswa sma di kawasan pesisir*. (Master's Thesis, Program Studi Magister Pendidikan Biologi Fakultas Keguruan dan Ilmu Pendidikan Universitas Lambung Mangkurat, Banjarmasin). Retrieved from <https://repo-mhs.ulm.ac.id/handle/123456789/13863>
- Husna, N., Soendjoto, M. A., & Zaini, M. (2020). Keefektifan bahan ajar tumbuhan mangrof untuk melatih keterampilan berpikir kritis siswa. *QUANTUM: Jurnal Inovasi Pendidikan Sains*, 11(2) 171-177. DOI: <http://dx.doi.org/10.20527/quantum.v11i2.9278>
- Ilaah, F. Y. (2018). Kemampuan berpikir kritis siswa SMA Kemala Bhayangkari 1 Surabaya pada materi laju reaksi melalui penerapan model pembelajaran inquiri. *UNESA Journal of Chemical Education*, 4(1) 78-83. DOI: <https://doi.org/10.26740/ujced.v4n1.p%25p>
- Irwindi, I., & Fajeriadi, H. (2019). Pemanfaatan lingkungan sebagai sumber belajar untuk meningkatkan minat dan hasil belajar peserta didik sma di kawasan pesisir, kalimantan selatan. *Bio-Inoved: Jurnal BiologiInovasi Pendidikan*, 1(2) 66-73. DOI: <http://dx.doi.org/10.20527/binov.v1i2.7859>
- Kartika, E., Yunarti, T., & Widyastuti, W. (2019). Analisis self-efficacy berpikir kritis peserta didik dengan pembelajaran socrates kontekstual. *Jurnal Pendidikan Matematika Unila*, 3(4). 120-121. DOI: <http://dx.doi.org/10.23960/jpf>
- Murni, A., Anggraini, R. D., & Sakur, S. (2018). The development of student worksheets based on metacognitive approach to improve students' mathematical representation ability. In *Journal of Physics: Conference Series 1088*, 2(1), 38-39. DOI: 10.1088/1742-6596/1088/1/012120
- Pursitasari, I. D., Suhardi, E., Putra, A. P., & Rachman, I. (2020). Enhancement of student's Critical thinking skill through science context-based inquiry learning. *Jurnal Pendidikan IPA Indonesia*, 9(1), 97-105. DOI: <https://doi.org/10.15294/jpii.v9i1.21884>
- Putra, N. H. M. S., Dharmono, D., & Mahrudin, M. (2020) Contents practicality of the popular ethnobotany scientific book of Gliricidia maculata in the Tamiang hill forest area, Tanah Laut Regency. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 3(1), 1-5. DOI: <http://dx.doi.org/10.20527/bino.v3i1.9348>
- Putri, A. I., Dharmono, D., & Zaini, M. (2020). Validitas buku ilmiah populer keanekaragaman spesies family fabaceae dalam melatih keterampilan proses sains mahasiswa. *Quantum: Jurnal Inovasi Pendidikan Sains*, 11(2), 186-195. DOI: <http://dx.doi.org/10.20527/quantum.v11i2.8822>

- Ramadhan, F., Soendjoto, M. A., & Dharmono, D. (2020). Practicality pocketbook "keanekaragaman lepidoptera di hutan mangrof". *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 2(2), 71-75. DOI: <http://dx.doi.org/10.20527/bino.v2i2.8551>
- Sambodo, S. (2019) *Pengembangan media pembelajaran mobile learning (m-learning) berbasis android untuk mahasiswa kelas XI SMA/MA*. (Master's Thesis, Program Studi Magister Pendidikan Biologi Fakultas Keguruan dan Ilmu Pendidikan UIN Sunan Kalijaga). Retrieved from <https://repository.ar-raniry.ac.id/id/eprint/2569>
- Sari, L. Y., & Susanti, D. (2019). Uji efektivitas media pembelajaran interaktif berorientasi konstruktivisme pada materi neurulasi untuk perkuliahan perkembangan hewan. *Jurnal Bio Concetta*, 2(1), 158-164. DOI: <https://dx.doi.org/10.22202/bc.2016.v2i1.1806>
- Suciono, W. (2021). *Berpikir kritis (tinjauan melalui kemandirian belajar, kemampuan akademik dan efikasi diri)*. Bandung: Penerbit Adab.
- Ulinniam, U., Sopwan, I. D., & Muhaemin, a. (2022). Keanekaragaman tanaman hias di Desa Kedokanbunder sebagai sumber belajar biologi siswa SMA kelas X. *Jurnal Riset Rumpun Ilmu Pendidikan*, 1(2), 151-161. DOI: <https://doi.org/10.55606/jurripen.v1i2.351>
- Wardani, I. K., & Widiyana, G. T. (2018). Pengembangan lembar kerja peserta didik (lks) saintifik berbasis keterampilan berpikir kritis untuk peserta didik kelas V SD/MI di Kabupaten Jombang. *Jurnal Bidang Pendidikan Dasar*, 2(1), 40-47. DOI: <https://doi.org/10.21067/jbpd.v2i1.2192>
- Yennita, K. I., Gibran, G., & Irianti, M. (2018). Development of worksheet based on high-order thinking skills to improve high-order thinking skills of the students. *Journal of Educational Sciences*, 2(1). 37-38. DOI: <http://dx.doi.org/10.31258/jes.2.1.p.37-45>
- Zaini, M. (2018). *Penelitian desain pendidikan aplikasi teori ke dalam praktik*. Yogyakarta: Penebar Media Pustaka.
- Zaini, M., Amintarti, S., Ajizah, A., Nadhira, D. M., Hariati, M., & Hidayati, H. (2020). Student worksheets microbial concepts based on urban wetlands to improve critical thinking skills at high school levels. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 2(1), 53-63. DOI: <http://dx.doi.org/10.20527/bino.v2i1.8154>