



Preliminary Phase: High Order Thinking Skills-Oriented Student Worksheets in Biology Subjects for Tenth-Grade Students

Indah Maharani^{1*}, Rahmadhani Fitri², Muhyiatul Fadhillah³, Ganda Hijrah Selaras⁴ 

^{1,2,3}Jurusan Biologi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Padang, Padang, Indonesia

ARTICLE INFO

Article history:

Received August 08, 2021

Revised August 11, 2021

Accepted January 30, 2022

Available online April 25, 2022

Kata Kunci:

Lembar Kerja Peserta Didik, Hots, Pembelajaran Biologi

Keywords:

Student Worksheet, HOTS, Biology Learning



This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.

Copyright © 2022 by Author. Published by Universitas Pendidikan Ganesha.

ABSTRAK

Paradigma pembelajaran abad ke-21 menghadapi peserta didik pada berbagai tantangan. Sebagai upaya untuk menghadapi tantangan abad ke-21 peserta didik dituntut untuk mampu berpikir tingkat tinggi. Keterampilan berpikir tingkat tinggi dibagi menjadi tiga, yaitu berpikir kritis, pemecahan masalah, dan berpikir kreatif. Salah satu media pembelajaran yang dapat mengasah kemampuan berpikir tingkat tinggi siswa adalah lembar kerja peserta didik. Penelitian ini bertujuan untuk menghasilkan lembar kerja peserta didik yang berorientasi pada kemampuan berpikir tingkat tinggi untuk meningkatkan kemampuan berpikir tingkat tinggi siswa kelas X semester satu. Jenis penelitian ini adalah penelitian pengembangan dengan menggunakan model 4D. Subyek penelitian ini adalah 62 siswa kelas X semester I dan 1 guru biologi. Penelitian ini dibatasi pada tahap menganalisis kebutuhan sekolah terhadap pengembangan LKPD yang berorientasi pada kemampuan berpikir tingkat tinggi pada semester I biologi kelas X. Penelitian ini menggunakan teknik survei. Hasil penelitian menunjukkan bahwa LKPD yang berorientasi pada keterampilan berpikir tingkat tinggi perlu dikembangkan untuk melatih keterampilan berpikir kritis, pemecahan masalah dan berpikir kreatif.

ABSTRACT

The 21st-century learning paradigm confronts students with various challenges. Students are required to be able to think at a higher level to face the challenges of the 21st century. Higher order thinking skills are divided into critical, problem-solving, and creative thinking. One learning media that can hone students' higher-order thinking skills is student worksheets. This study aims to produce student worksheets oriented to higher-order thinking skills to improve higher-order thinking skills for first semester X grade students. This type of research is development research using a 4D model. The subjects of this study were 62 students of class X in the first semester and one biology teacher. This research is limited to analyzing the school's needs for developing LKPD, which is oriented towards higher order thinking skills in the first semester of biology class X. This study uses a survey technique. The results showed that LKPD oriented to higher order thinking skills needs to be developed to train critical thinking skills, problem-solving and creative thinking.

1. INTRODUCTION

The 2013 curriculum is a curriculum that was developed to achieve competence as an instrument to direct students to be better and to think critically (Anam, 2020; Raharjo, 2020). The 2013 Curriculum has been designed and prepared to face the challenges of 21st-century skills. The 2013 curriculum has met the qualifications of 21st-century skills in content, process, and assessment standards (Rahayu et al., 2022; Redhana, 2019). Students are required to be able to think at a higher level to face the challenges of the 21st century. Higher-order thinking skills are divided into three things: creative thinking, critical thinking, and problem-solving (Pratiwi & Puspito Hapsari, 2020; Saraswati & Agustika, 2020). Higher order thinking skills can occur when a person retrieves interconnected information in the stored memory and expands the information to achieve goals or find answers to confusing circumstances or situations (Widarti et al., 2020; Wu & Wu, 2020). Students are required to have high thinking skills so that students can solve problems faced in everyday life (Ellerton, 2022; Triana et al., 2020). Higher order thinking skills are thinking activities

that involve a high level of knowledge in Bloom's Taxonomy, namely analysis (C4), evaluation (C5), and creation (C6) (Pitt et al., 2015; Seibert, 2020).

Currently, learning is still centered on the educator (teacher center). It causes students to be unable to master 21st-century skills optimally. Based on a preliminary study at SMAN 1 Payakumbuh, it is known that biology teachers have used Student Worksheets that were made by themselves. The Student Worksheet used by the teacher has not been able to direct students to analyze following what the 2013 curriculum wants. The Student Worksheet used by the teacher prioritizes understanding and practice skills only. In addition, based on the results of questionnaire analysis with tenth-grade students at SMAN 1 Payakumbuh, they agreed to develop a HOTS-oriented Student Worksheet because the Student Worksheet used had not trained critical thinking skills, problem-solving, and decision making. Based on the results of an observation questionnaire with students at SMAN 1 Payakumbuh through a google form given to 62 students in the tenth grade of Mathematics and Natural Sciences. In learning biology at SMAN 1 Payakumbuh, it is known that the media or teaching materials that students often use are printed books. This statement is based on the questionnaire results. As many as 83.9% of students choose printed books. A total of 93.5% stated that the Student Worksheet is important in learning.

One of the efforts that can be made so that students can understand the concepts of the material provided by the teacher is by using learning media. Well-designed learning media will greatly assist students in digesting and understanding the subject matter (Kharisma & Asman, 2018; Sarini & Selamet, 2019). The function of the media in learning activities is not just as a teaching aid for teachers but also as a carrier of learning information/messages (Krismawati, 2019; Maryono & Budiono, 2021). In addition to media, teaching materials, such as Student Worksheets, are needed. The Student Worksheet is a learning tool or device used to convey material to students (Fadhil et al., 2021; Noprinda & Soleh, 2019; Putra et al., 2021). The Student Worksheet is one of the teaching materials and learning resources whose existence is very important as a support that can help students to improve their understanding, skills, and attitudes independently (Ani & Lazulva, 2020; Herawati et al., 2017). The benefits of the Student Worksheet are that it can make students understand the learning material provided by the teacher, can increase students' learning motivation, make the learning process more efficient and effective, and students become more focused and responsible in doing the assigned tasks by the teacher (Riyani & Wulandari, 2022; Utami & Dafit, 2021). Student Worksheets were designed and developed per the current situation, and conditions educators and students face.

Previous research findings stated that E-Learner Worksheets could lead students to understand and generate confidence during learning activities. The scientific approach-based interactive Social Science Student Worksheet received very good qualifications. It was declared suitable for use in learning in the fourth grade of elementary school (Idayanti & Sujana, 2022). The weakness of developing Student Worksheets in previous research is to support the learning process. However, in this study, students' worksheets were oriented towards higher order thinking skills to improve tenth graders' higher order thinking skills. Biology teachers have used Student Worksheets that were made by themselves. The Student Worksheet used has not been able to direct students to analyze, following what the 2013 Curriculum wants, because the Student Worksheet used by the teacher prioritizes understanding and practice skills. Thus, this study aimed to produce student worksheets oriented to higher order thinking skills to improve tenth graders' higher order thinking skills in the first semester.

2. METHOD

This research is a Developmental Research that aims to produce a product in the form of a HOTS-oriented Student Worksheet using the 4-D development model (four-D models) from Thiagrajan, Dhoroty S. Semmel and Melvyn I. Semmel (1974) define, design, develop, and disseminate. This study was only carried out at the define stage because this research is a preliminary study that aims to analyze the school's needs for developing HOTS-oriented Student Worksheets for the tenth semester of biology material in the first semester. This study uses survey techniques. The research sample is 62 class students of X MIPA and one biology teacher at SMAN 1 Payakumbuh, conducted on December 19, 2020. The instrument used in this study was a questionnaire on the availability and use of biology learning resources for teachers and students to find out the problems teachers and students face regarding teaching materials used in learning biology for the tenth semester of the first semester. The data was collected by distributing questionnaires to the biology subject teachers and filling out the questionnaire using google forms to the tenth-grade students of the first semester.

3. RESULT AND DISCUSSION

Result

This research is a Developmental Research that aims to produce a product in the form of a HOTS-oriented Student Worksheet using a 4-D development model (four-D models). The define stage. This section contains a preliminary analysis. The final preliminary analysis aims to determine the main problems faced by teachers. The final preliminary analysis was carried out by filling out a questionnaire on the availability of learning resources to biology subject teachers at SMAN 1 Payakumbuh. Based on the questionnaire analysis of the availability of learning resources, it is known that the learning process has used the lecture, practice, and discussion methods. The learning media used by teachers in schools are videos, printed books, power points, modules, and audio. From the interview results, the teacher also said that he had made learning media. Learning media is used by teachers to assist teachers in delivering material to students in the form of power points and videos. The teacher also said that this learning media is important to use in the learning process because it can clarify the concept of the material and make learning more interesting. Tenth-grade students in the first semester at SMAN 1 Payakumbuh become the subject of research on developing HOTS-oriented Student Worksheets. Student analysis was carried out on 62 students by distributing questionnaires to find out information related to the Student Worksheets to be developed. Based on the results of this student analysis, they said they had used the Student Worksheet as one of the teaching materials at school. The Student Worksheet has not trained critical thinking skills, problem-solving and decision making. It is known based on the results of distributing questionnaires to students presented in Table 1.

Table 1. Student Worksheet Used by Students

<i>High Order Thinking Skills (HOTS)</i>	Percentage	
	Yes	No
Critical thinking skills	19,3%	80,7%
Problem-solving skills	17,7%	82,3%
Decision-making skills	14,5%	85,5%

Table 1 shows that the Student Worksheet used by students has not been able to train students' HOTS. Of the 62 respondents, as many as 80.7% of students answered that LKPD had not been able to train students' critical thinking skills, and 82.3% of students answered the Student Worksheet that they had not been able to practice problem-solving skills, and 85.5% of students answered the worksheet. Work Students have not been able to practice decision-making skills. Thus, students agreed to develop a HOTS-oriented Student Worksheet equipped with problem-solving activities to practice critical thinking skills, problem-solving, and decision making. It can be seen in Table 2.

Table 2. Development of HOTS-Oriented Student Worksheets

<i>High Order Thinking Skills HOTS</i>	Percentage	
	Yes	No
Critical thinking	98,4%	1,6%
Solve the problem	98,4%	1,6%
Make decisions	95,2%	3,2%

Based on Table 2, it can be seen that more than 50% of students agree to develop a Student Worksheet that is equipped with problem-solving activities to train the HOTS. 98.4% of students agreed to develop a Student Worksheet with problem-solving activities to practice critical thinking skills. 98.4% of students agreed to develop a Student Worksheet with problem-solving activities to practice problem-solving skills. As many as 95.2% of students agreed to develop a Student Worksheet equipped with problem-solving activities to practice decision-making skills. In addition to being equipped with problem-solving activities to train HOTS above, students agree that the Student Worksheet is equipped with questions that can practice critical thinking skills, problem-solving, and decision making. It can be seen in Figure 1.

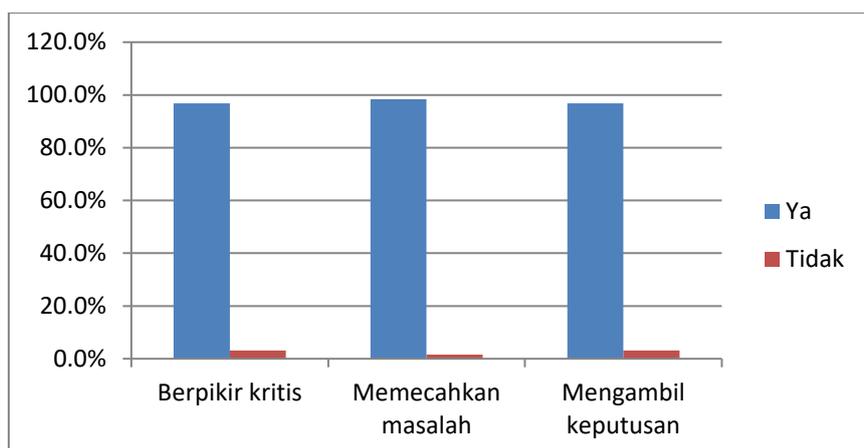


Figure 1. Development of Student Worksheets Equipped with HOTS Questions

Based on the graph above, it can be seen that 96.8% of students agree that if a Student Worksheet is developed, it is equipped with questions that can train critical thinking skills. 98.4% of students agree to develop a Student Worksheet that can practice problem-solving skills, and 96% of students agree to develop a Student Worksheet that can practice decision-making skills in solving problems.

Discussion

Based on this explanation, developing a HOTS-oriented Student Worksheet is necessary to improve students' higher-order thinking skills. If there is a HOTS Student Worksheet, students will no longer be difficult to solve the questions that are required to be solved by thinking critically in solving problems. Learning becomes more meaningful for students because, in the learning process, students are not just memorizing material but can understand the material being studied more deeply. Teachers use student worksheets and questions on daily, midterm, and final exams. It is known that the Student Worksheet used by the teacher has not been able to improve students' higher-order thinking skills, and the questions used by the teacher are still at the cognitive levels of C1, C2, C3, and C4. Learning media is needed in the form of Student Worksheets that can be used independently and in groups by students to train students' higher-order thinking skills (Hendriani & Gusteti, 2019; Nareswari et al., 2021). So that the Student Worksheet is provided with activities that can train students' higher-order thinking skills and HOTS-oriented questions. (Ariani, 2020; Indriyani et al., 2019).

Second, from the aspect of task analysis, task analysis aims to identify and analyze the abilities that students must master by determining the content in learning units that are following the 2013 Curriculum. Based on the preliminary study results, the Basic Competencies of Biology are determined in the tenth grade in the first semester. Task analysis is carried out by outlining Core Competencies, Basic Competencies, and Competency Achievement Indicators. Concept analysis aims to identify the main concepts in the tenth-grade biology material in the first semester. Concept analysis is carried out by arranging the main concepts that will be taught systematically and arranging the order of the material and concepts of the subject matter to be understood by students. The first semester's tenth-grade biology subjects are presented on the HOTS-oriented Student Worksheet. Concept explanations assisted by supporting pictures and exercises on Student Worksheets can train students in critical thinking processes. Analysis of learning objectives which is the basis for designing Student Worksheets aims to identify learning objectives from core competencies, basic competencies, and learning indicators following the 2013 curriculum (Kurniaman & Noviana, 2017).

Based on the preliminary analysis, a teacher must prepare students with high-level thinking skills as a driver in the world of education. The advantage of this HOTS-oriented Student Worksheet compared to other Student Worksheets is that this Student Worksheet prioritizes creative and critical thinking skills in solving problems related to functions that involve divergent and convergent phases. The divergent thinking phase trains students to find problems, formulate problems, and look for options or alternatives. While the type of thinking in the convergent phase, students can make decisions (choose among various alternatives), take action (commitment to carry out decisions for the results obtained), and evaluate results. The problem-solving process carried out by students has great potential to train students to think at higher levels. Learning media is useful for stimulating students' attention, interests, thoughts, and feelings in learning activities to achieve learning objectives (Aprilianingrum & Wardani, 2021; Baidillah, 2016). The Student Worksheets used were published from a triad of printing and made by the teacher himself. The 2013 curriculum is facing the challenges of the 21st century because the Student Worksheet used by the teacher

prioritizes the ability to understand and practice only. The teacher said that the advantage of using Student Worksheets in the learning process is that the teaching and learning process becomes more interesting and meaningful, and the learning process is student-centered. There are no more obstacles in terms of time. Using Student Worksheets in the learning process can open up opportunities for students to be active and creative in the learning process. This finding is reinforced by previous findings, which state that the E-Learner Worksheet is feasible and valid for increasing self-confidence during learning activities (Dewi & Agustika, 2022; Putra et al., 2021). Media Interactive Student Worksheets get very good qualifications and are declared suitable for use in learning in the fourth grade of elementary school (Idayanti & Sujana, 2022; Nareswari et al., 2021; Noprinda & Soleh, 2019). Student Worksheets can help students in the learning process. The implications of this research are expected to help improve students' critical thinking skills.

4. CONCLUSION

Based on the preliminary research results, it can be concluded that to hone students' higher-order thinking skills. Teachers need learning tools like media to help grow and develop students' higher-order thinking skills. Through the HOTS-oriented Student Worksheet, it is hoped that it can help students develop higher-order thinking skills. In addition, students also need Student Worksheets that can make them study actively and independently.

5. REFERENCES

- Anam, C. (2020). Deskripsi Kemampuan Berfikir Kritis Siswa Terhadap Implementasi Kurikulum 2013 Pada Pembelajaran Tematik. *Proceeding International Conference on Islamic Education*, 5(1), 35–39. <http://conferences.uin-malang.ac.id/index.php/iced/article/view/1224>.
- Ani, N. I., & Lazulva. (2020). Desain dan Uji Coba LKPD Interaktif dengan Pendekatan Scaffolding pada Materi Hidrolisis Garam. *Journal of Nature Science and Integration*, 3(1), 87–105. <https://doi.org/10.24014/jnsi.v3i1.9161>.
- Aprilianingrum, D., & Wardani, K. W. (2021). Meta Analisis: Komparasi Pengaruh Model Pembelajaran Problem Based Learning dan Discovery Learning dalam Meningkatkan Kemampuan Berpikir Kritis Siswa SD. *Jurna Basicedu*, 5(2), 1006–1017. <https://doi.org/10.31004/basicedu.v5i2.871>.
- Ariani, T. (2020). Analysis of Students' Critical Thinking Skills in Physics Problems. *Physics Educational Journal*, 3(1), 1–13. <https://doi.org/10.37891/kpej.v3i1.119>.
- Baidillah, I. (2016). Penerapan Problem Based Learning Dalam Kerangka Lesson Study Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Hasil Belajar Akuntansi Siswa. *Journal of Accounting and Business Education*, 2(4). <https://doi.org/10.26675/jabe.v2i4.6074>.
- Dewi, N. P. D. M., & Agustika, G. N. S. (2022). E-LKPD Interaktif berbasis Etnomatematika Jejahitan Bali pada Materi Bangun Datar Kelas IV SD. *Mimbar PGSD Undikhsa*, 10(1), 94–104. <https://doi.org/10.23887/jjpsd.v10i1.45350>.
- Ellerton, P. (2022). On critical thinking and content knowledge: A critique of the assumptions of cognitive load theory. *Thinking Skills and Creativity*, 43, 100975. <https://doi.org/10.1016/j.tsc.2021.100975>.
- Fadhil, A., Handoko, A., & Suherman, S. (2021). Lkdp-Guided Inquiry: Pengembangannya Pada Materi Organ Gerak Hewan. *Adi Widya: Jurnal Pendidikan Dasar*, 6(2), 138. <https://doi.org/10.25078/aw.v6i2.2339>.
- Hendriani, M., & Gusteti, M. U. (2019). Validitas LKPD Elektronik Berbasis Masalah Terintegrasi Nilai Karakter Percaya Diri untuk Keterampilan Pemecahan Masalah Matematika SD Di Era Digital. *Jurnal Basicedu*, 5(4), 2430–2439. <https://doi.org/10.31004/basicedu.v5i4.1243>.
- Herawati, E. P., Gulo, F., & Hartono. (2017). Pengembangan Lembar Kerja Peserta Didik (LKPD) Interaktif Untuk Pembelajaran Konsep Mol Di Kelas X Sma. *Jurnal Penelitian Pendidikan Kimia*, 3(2), 168–178. <https://doi.org/10.36706/jppk.v3i2.8163>.
- Idayanti, I. A. M. D., & Sujana, I. W. (2022). LKPD Interaktif IPS Berbasis Scientific Approach pada Materi Pengaruh Lingkungan terhadap Mata Pencaharian. *Mimbar Ilmu*, 27(1), 33–43. <https://doi.org/10.23887/mi.v27i1.45111>.
- Indriyani, D., Mawardi, M., & Wardani, K. W. (2019). Peningkatan Keterampilan Berpikir Kritis Melalui Model Inkuiri Berbantuan Media Konkret Pada Siswa Kelas 5 SD Negeri Mangunsari 05 Tahun Pelajaran 2018/2019. *Jurnal Basicedu*, 3(1). <https://doi.org/10.31004/basicedu.v3i1.74>.
- Kharisma, J. Y., & Asman, A. (2018). Pengembangan Bahan Ajar Matematika Berbasis Masalah Berorientasi pada Kemampuan Pemecahan Masalah Matematis dan Prestasi Belajar Matematika. *Indonesian Journal of Mathematics Education*, 1(1), 34. <https://doi.org/10.31002/ijome.v1i1.926>.
- Krismawati, N. U. (2019). Pengembangan Bahan Ajar Penulisan Sejarah Berbasis Model Project-Based

- Learning. *Indonesian Journal of Social Science Education (IJSSE)*, 1(2), 156–170. <https://doi.org/10.29300/ijssse.v1i2.1905>.
- Kurniaman, O., & Noviana, E. (2017). Penerapan Kurikulum 2013 Dalam Meningkatkan Keterampilan, Sikap, Dan Pengetahuan. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 6(2), 389. <https://doi.org/10.33578/jpfkip.v6i2.4520>.
- Maryono, M., & Budiono, H. (2021). Pengembangan Bahan Ajar Membaca dan Menulis Berbasis Mobile Learning Sebagai Alternatif Belajar Mandiri Siswa Kelas Awal Sekolah Dasar. *Jurnal Basicedu*, 5(5), 4281–4291. <https://doi.org/10.31004/basicedu.v5i5.1502>.
- Nareswari, N. L. P. S. R., Suarjana, I. M., & Sumantri, M. (2021). Belajar Matematika dengan LKPD Berbasis Kontekstual. *Jurnal Mimbar Ilmu*, 26(2), 204–213. <https://doi.org/10.23887/mi.v26i2.35691>.
- Noprinda, C. T., & Soleh, S. M. (2019). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Higher Order Thinking Skill (HOTS). *Indonesian Journal of Science and Mathematics Education*, 2(2), 168–176. <https://doi.org/10.24042/ij sme.v2i2.4342>.
- Pitt, V., Powis, D., Levett-Jones, T., & Hunter, S. (2015). The influence of critical thinking skills on performance and progression in a pre-registration nursing program. *Nurse Education Today*, 35(1), 125–131. <https://doi.org/10.1016/j.nedt.2014.08.006>.
- Pratiwi, B., & Puspito Hapsari, K. (2020). Analisis Kemampuan Berpikir Tingkat Tinggi Melalui Pemanfaatan YouTube Sebagai Media Pembelajaran Bahasa Indonesia. *Jurnal Ilmiah Sekolah Dasar*, 4(2), 282. <https://doi.org/10.23887/jisd.v4i2.24238>.
- Putra, G. Y. M. A., Suarjana, I. M., & Agustiana, G. A. T. (2021). E-LKPD Materi Pecahan dalam Pembelajaran di Sekolah Dasar. *MIMBAR PGSD Undiksha*, 9(2), 220–228. <https://doi.org/10.23887/jjgsd.v9i2.35813>.
- Raharjo, T. (2020). Efektivitas pendampingan implementasi kurikulum 2013 untuk meningkatkan kemampuan guru melaksanakan pembelajaran. *Indonesian Journal of Educational Development*, 1(1), 93 – 103. <https://doi.org/10.5281/zenodo.3760717>.
- Rahayu, R., Iskandar, S., & Abidin, Y. (2022). Inovasi Pembelajaran Abad 21 Dan Penerapannya Di Indonesia. *Jurnal Basicedu*, 6(2), 2099–2104. <https://doi.org/10.31004/basicedu.v6i2.2082>.
- Redhana, I. W. (2019). Mengembangkan keterampilan abad ke-21 dalam pembelajaran kimia. *Jurnal Inovasi Pendidikan Kimia*, 13(1), 2239–2253.
- Riyani, N. L. V. E., & Wulandari, G. A. A. (2022). Pengembangan LKPD Interaktif Berbasis STEAM pada Kompetensi Pengetahuan IPS Siswa Kelas V di SD No. 3 Sibangede. *Jurnal Ilmiah Universitas Batanghari Jambi*, 22(1), 285–291. <https://doi.org/10.33087/jiubj.v22i1.2046>.
- Saraswati, P. M. S., & Agustika, G. N. S. (2020). Kemampuan Berpikir Tingkat Tinggi Dalam Menyelesaikan Soal HOTS Mata Pelajaran Matematika. *Jurnal Ilmiah Sekolah Dasar Undiksha*, 4(2). <https://doi.org/10.23887/jisd.v4i2.25336>.
- Sarini, P., & Selamat, K. (2019). Pengembangan Bahan Ajar Etnosains Bali bagi Calon Guru IPA. <https://doi.org/10.23887/wms.v13i1.17146>.
- Seibert, S. A. (2020). Problem-based learning: A strategy to foster generation Z's critical thinking and perseverance. *Teaching and Learning in Nursing*, 000, 2–5. <https://doi.org/10.1016/j.teln.2020.09.002>.
- Triana, D., Anggraito, Y. U., & Ridlo, S. (2020). Effectiveness of environmental change learning tools based on STEM-Pjbl towards 4C skills of students. *Journal of Innovative Science Education*, 9(2), 181–187. <https://doi.org/10.15294/JISE.V8I3.34048>.
- Utami, D. P., & Dafit, F. (2021). Lembar Kerja Peserta Didik (LKPD) Berbasis High Order Thingking Skills (HOTS) pada Pembelajaran Tematik. *Jurnal Mimbar Ilmu*, 26(3), 381–389. <https://doi.org/10.23887/mi.v26i3.41138>.
- Widarti, H. R., Rokhim, D. A., & Syafruddin, A. B. (2020). The Development Of Electrolysis Cell Teaching Material Based On Stem-Pjbl Approach Assisted By Learning Video: A Need Analysis. *Jurnal Pendidikan IPA Indonesia*, 9(3), 309–318. <https://doi.org/10.15294/jpii.v9i3.25199>.
- Wu, T. T., & Wu, Y. T. (2020). Applying project-based learning and SCAMPER teaching strategies in engineering education to explore the influence of creativity on cognition, personal motivation, and personality traits. *Thinking Skills and Creativity*, 35. <https://doi.org/10.1016/j.tsc.2020.100631>.