

# Validity and practicality of Ecology Project Based Practicum Worksheets to Improve Science Process Skills

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**Abstract:** The research objective was to determine the validity of the due diligence worksheet based on an ecological project to improve science process skills. To find out the practicality of ecological project-based practicum worksheets to improve science process skills. The study method developed using Research and Development (R&D) consists of several stages of research implementation, namely the first stage is preparing for the Experiment/Preliminary Design. The second stage of product creation (process), includes: assessing students' abilities in selecting and using materials, tools and techniques. Next, the third stage of product assessment (appraisal), includes: assessing the products produced by students according to the established criteria. The target research subjects were 30 FKIP UNSAM Biology Education students. Data collection techniques carried out included using tests, observation sheets, questionnaires, interviews, assessment of Practicum Worksheets, portfolios, field notes and assessment rubrics. The results of this research show that the product feasibility validation test with an average score of 88.22% is declared very valid, while the practicalization test with an average score of 84.2% is declared very valid. So it can be concluded that the Practical Worksheet product is suitable for use for Biology practical learning activities.

**Keywords:** Ecological Project Model; Practicum Worksheets; Science Process Skills

## Introduction

Developing existing scientific knowledge among participants educate is part of the method scientific to increase science process skills (Afrizon et al., 2012). The implemented level of PPP in the learning process consists of two stages which are basic process skills (Bulent, 2015). Implemented KPS implementation process in learning that is communicated, predict, use connection related with time, communicate, classify, observe, measure and use numbers, create a conclusion, and predict, which is a useful formula for solving problems (Ozgelen, 2012).

To reach optimal science process skills for a student with a learning eye studying ecology based project. In overcome problem environment in do task project with use knowledge knowledge ecology. For can increase ability think creative and attitude scientific so using the project model (Susanti, 2013). Invention something

information important in construct knowledge for student characteristic independent learning so using a model (Siwa et al., 2013).

So called PjBL model with this Project based learning is a model of giving task project in the involving class lecturers and students as subject activities (Wena, 2014). In the real world Where a participant educates make something design and do investigation so can said use of the PjBL model (Sababha et al., 2016). PjBL model give something characteristic task project for student so that make they more think critically and challenging in solve problem for finish task the optimally and complexly (Movahadzadeh et al., 2012). The learning process is challenging and involved participant educate part of the PjBL model that delivers questions, assignments furthermore taking decision activity investigation in a manner independent in period time certain as well as in the end will produce real and useful products (Fitri et al., 2013).

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There are 6 stages the use of Project Based Learning, according to The George Lucas Educational Foundation (Lucas, 2005), namely: Determination Question Fundamental (Start With the Essential Question), Designing Planning Project (Design a Plan for the Project), Develop a Schedule (Create a Schedule), Monitor Participant Educate and Progress Project (Monitor the Students and the Progress of the Project), Testing the Results (Assess the Outcome), and Evaluating Experience (Evaluate the Experience).

Science is not free from activity practicum (Fajarudin, 2016; Rifai et al., 2016). Practice done with objective know ability psychomotor participant students (Fatimah & Abdul, 2017; Sadjati & Pertiwi, 2013). Activity practicum is also a must be equipped with device learning that is sheet Work practicum (Budiman et al., 2017; Nyamupangedengu & Lelliott, 2012; Putra & Sumarmo, 2017). Procurement sheet Work practice can help in understand activity learning practice with good inside laboratory (Hadrianti & Ramlawati, 2017). Worksheet practice can develop ability think and concretize concept (Larasati et al., 2017). Worksheet practice invite participant educate involved direct in something activity for solve related problems with life every day and give solution from problem (Abd.Rachman et al., 2017). Worksheet Practice made \_ in a manner interesting and systematic can help student For Study more active in a manner independent nor in groups (Barlenti et al., 2017).

Worksheet \_ practice need direct students for more independently (Mustami, 2017). One of the learning models that can direct independence student is project-based learning (Puspasari, 2017; Putra, 2016). Project based learning is an involving learning model student in a manner active in designing objective learning for produce product or project real (Bayu et al., 2015; Chiang & Lee, 2016; Kizkapalan & Bektaş, 2017). Use the project-based learning model, beside independent student can create product with his work themselves (Amirudin et al., 2015; Sitaresmi et al., 2017).

Practicality or level practicality is size addition from indicator appropriateness something sheet Work practicum. Previously development sheet Work practicum, however No use material test melde (Abd.Rachman et al., 2017; Barlenti et al., 2017; Fitriani et al., 2017; Hadrianti & Ramlawati, 2017; Hamidiyah, 2017; Mayasari et al., 2015; Putra, 2016; Wati & Santosa, 2017). related with study previously discussed about sheet Work practice as device learning vagina student then study about validation and practicalization sheet work practice-based project ecology Langsa City mangrove forest.

## Method

Improvement of KPS assessment instruments through development of project models in courses ecology as potency local area in the mangrove forest area in Propinsi Aceh. So formulated with use type method development or Research and Development (R&D), with method qualitative and quantitative (mixed method). Procedure research and development used in research adopted from Thiagarajan (4D), stages include Thiagarajan in (Imanda et al., 2017): Define, Design, Development and Disseminate. But on research This got to the stage third that is development. Because on research No measure level effectiveness product developed.

### *Define (Defining)*

At the define stage is done analysis and study literature. Stage analysis consists from analysis Biology Education Undergraduate curriculum, analysis material, analysis characteristics students, ecological CPMK analysis, and analysis objective learning eye college. Studies literature covers studies about development sheet Work practicum, materials ecology, project-based learning, science process skills.

### *Design (Design)*

At stage This done planning to sheet Work practicum to be arranged based on results analysis and study literature that has done. The design stage consists drafting content, format selection, and layout that resulted in the initial draft sheet Work practice ecology-based project for increase science process skills.

### *Development (Development)*

At stage This done development against early drafts sheet Work practicum that includes development material, Worksheet Student, approach learning, and development features on the sheet Work practice until be the final draft.

## Result and Discussion

This research succeeded in developing teaching materials, namely e-books based on the PjBL Model which integrates scientific literacy to train critical thinking skills in Coordination System material that is theoretically and empirically valid and practical. The e-book has sub-materials namely: Nervous System, Hormones and Sensory Organs. E-book development research obtained results which will be discussed as follows

Worksheet practice with project model approach This is sheet Work practice full student tasks project. There are several stages in implementation activity study development as following.

*Define (Definition)*

At the define stage, do analysis need sheet Work practicum which includes; analysis Biology Education Undergraduate Curriculum, analysis material, analysis characteristics student, ecological CPMK analysis, analysis objective learning eye college. Courses ecology be one eye earning college projects and products. Based on results analysis material ecology obtained results analysis material to be project ecology of activities sheet Work practice student with the products produced in Table 1.

**Table 1.** Worksheet \_ Practice Project Ecology

Steps Project Ecology	Indicator Project Development Ecology
Assess needs (What Which needed?And For What?)	identify activity practice Analyze literacy environment Which owned by students identify action conservation Inventory practice WhichThere is Look for input from student biology, lecturer
Assess capacity and need education (How practiceproject ecology support objective?)	Consider objective Andmake priority identify need education Determine source Power (lecturer And student) And capacity Develop target And objective practice project ecology Evaluate suitability activity practice with material lectures other
Define space scope and structurepractice project ecology (How structure project ecology? And hope What Which will fulfilled?)	Determine format, technique, Andneed project ecology Produce or developmaterial practice project ecology Which in accordance Analyze material practiceecology Develop strategy
Source Power For carry out program (Is lecturer Already prepared? is material and facility Ready and available?)	Evaluate competence student, lecturer And need practiceproject ecology Compile facility, supply And equipment Which needed
Evaluation (strategy What Which will developed And implemented For evaluate project ecology?)	Develop strategy, technique And criteria evaluation

*Design*

Stage planning aim for get draft I of the product learning to be developed. At stage This as reference for designing design product to be developed. Activities undertaken covers selection of target media media selection for develop suitable media with problem

research, the selection of the objective format so that the product will be developed own suitable concept with subject research, and realizing it in the design early. Activity which resulted in a similar draft I with research (Akhlis & Dewi, 2013) draft I was used for design a work program that will done.

*Development (Development)*

*Validation Test Appropriateness Product*

Validity test Validity test done for know evaluation from design product or teaching materials carried out by experts. Aspect assessment on validity test consists of the five components, viz component content, component language, component presentation, suitability with model learning project and LKP Student science process skills.

Result validity sheet Work practicum done counted use percentage with average rating of 88.22 in very valid category. Height level validity created sheet Work practice Already fulfil conditions in field component content, component language, component presentation, suitability with model learning project and LKP Student science process skills. Use language and terms you are familiar with student be one excess from textbook. Completeness sheet work and sheets project as well complementary in this textbook. Appropriateness something available teaching materials worn will more If mark validity is at in category high (Imran et al., 2021; Rahmi & Sumarmin, 2021; Sabri et al., 2022; Sonjaya et al., 2022). In accordance with condition appropriate teaching materials, deep V grades very valid and feasible category used for learning. Teaching tools made with worthy will own high functionality in the teaching process (Kosasih, 2021).

**Table 2.** Validation Test Appropriateness Product

Aspect rated	Score		Average
	V1	V2	
I. Content Components			
suitability materi with objective learning	4	3	3.5
LKP contents exist map draft material ecology	4	3	3.5
suitability with syntax Project	4	4	4.0
Suitability with indicator science process skills	3	4	3.5
Validity Score ( %)			90.5
II. Presentation			
Systematics Presentation	4	3	3.5
suitability topic LKP with material	4	4	4.0
Writing objective learning	4	3	3.5
Writing tool and material on LKP	4	4	4.0
Quality LKP image	4	3	3.5
Quality of LKP layouts			
Validity Score ( %)			77.0
III. Language			
LKP uses	4	4	4

Aspect rated	Score		Average
	V1	V2	
Language Indonesia Which good and according to EYD			
Language in accordance with the students' thinking ability	4	4	4.0
Identity and Source Information	3	4	3.5
Validity Score (%)			95.6
IV. Compatibility With Model Project Learning			
LKP reflects question orientation problem	4	2	3.0
LKP reflect organizing student in analysis draft material lectures	4	3	3.5
LKP reflect activity mentoring investigation	4	3	3.5
LKP request student develop and produce work	4	4	4.0
LKP load review results and processes	4	3	3.5
Validity Score (%)			87.4
V. LKP Train Skills Process Student			
LKP contains activities reflecting process skills science and make student more active	4	4	4.0
In the LKP requires students to can make formula problem	4	4	4.0
In the LKP requires students to can make hypothesis	4	3	3.5
In the LKP require students to can formulate variables test	4	3	3.5
In the LKP requires students to can make design test	4	3	3.5
In the LKP demand student for do test	4	3	3.5
In LKP demands student for do analysis data results test	4	3	3.5
In the LKP requires students to conclude results test.	4	3	3.5
Validity Score (%)			90.6
Overall validity score			88.22

**Practicality Test**

Practicality is size other eligibility of sheet Work practice developed. As instrument practicality and effectiveness data collection as study advanced needed a number of instrument measurement. validity instrument study need is known to use explain authenticity from instrument measurement (Mukhlisin, 2022; Susanti et al., 2021; Wigati & Ali, 2021). Explanation validity instrument measurement in study described in Figure 1.

Based on results table on in accordance with instrument research used fulfil standard in mark validity and reliability showing authenticity from instrument measurement in measure thing to be become variable bound in research (Putri et al., 2021). That instrument measurement worthy for used in research. Book guide practice is A book to be guide student in do practical and helpful a teacher for reach something objective learning (Sari, 2018). Availability book guide

IPA practicum can guide student in implementation practicum and help the teacher in reach objective practicum (Prastowo, 2011; Prabowo et al., 2016).

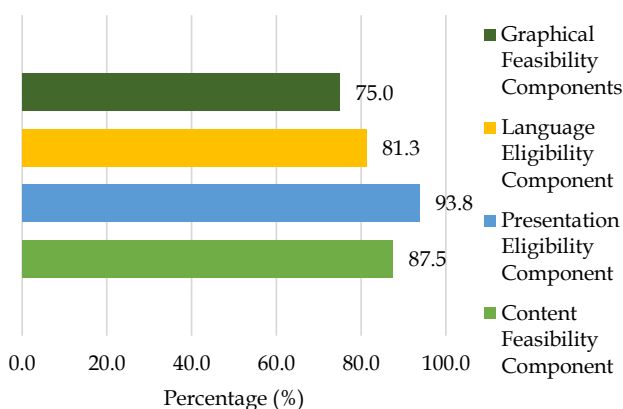


Figure 1. Product Practicality Test

**Conclusion**

Based on results study can concluded that validity test results done for know evaluation from design product or sheet Work practicum conducted by experts. Aspect assessment on validity test consists of the five components, viz component content with a score of 90.5% is categorized as very valid , component language with a score of 77.0% is categorized as valid, component presentation of 95.6% categorized as very valid, suitability with model learning project with a score of 87.4% is categorized as very valid and LKP of students' science process skills with a score of 90.6% is categorized as very valid whereas validity practicalization measurement in study covers component content with value 87.5 very valid category , component presentation with the value of 93.8 is very valid category, the Language component with value 81.3 valid category and components graphics with value 75.0 valid category, result in the practicalization test stated that sheet Work practice can be declared valid utilized in lectures ecology in practicum.

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**Author Contributions**

Ekariana S. Pandia: Designing Practicum Worksheets, Siska Rita Mahyuni: Creating Science Process Skills Instruments, Ayu Wahyuni: Creating Product Feasibility Test Instruments, Nursamsu: Processing Research Data, Nurhasnah Manurung: Product Validator.

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**Conflicts of interest**

There are no problems in the research

**References**

- Afrizon, R., Ratnawulan, R., & Fauzi, A. (2012). Peningkatan Perilaku Berkarakter Dan Keterampilan Berpikir Kritis Siswa Kelas IX MTsN Model Padang Pada Mata Pelajaran IPA-Fisika Menggunakan Model Problem Based Instruction. *Jurnal Penelitian Pembelajaran Fisika*, 1, 1-16. <https://doi.org/10.24036/jppf.v1i1.598>.
- Abd.Rachman, F., Ahsanunnisa, R., & Nawawi, E. (2017). Pengembangan LKPD Berbasis Berpikir Kritis Materi Kelarutan Dan Hasil Kali Kelarutan Pada Mata Pelajaran Kimia Di SMA. *ALKIMIA*, 1(1), 16-25. Retrieved from <https://Jurnal.radenfatah.ac.id/index.php/alkimia/article/view/1326/1068>.
- Amirudin, A., Baidowil, A., & Sumarni. (2015). Pengaruh Model Pembelajaran Berbasis Proyek Terhadap Kemampuan Menulis Karya Ilmiah Geografi Siswa SMA. *Jurnal Pendidikan Geografi*, 20(1), 48-58. Retrieved from <https://journal2.um.ac.id/index.php/jpg/article/viewFile/285/201>.
- Bulent, A. (2015). The investigation of science process skills of science teachers in terms of some variables. *Educational Research and Reviews*, 10(5), 582-594. <https://doi.org/10.5897/ERR2015.2097>.
- Budiman, F. A., Soesanto, & Widjanarko, D. (2017). Journal of Vocational and Career Education Pengembangan Lembar Kerja Praktik Analitik bagi Calon Guru SMK Otomotif. *Journal of Vocational and Career Education*, 2(1), 50-56. <https://doi.org/10.15294/jvce.v2i1.11104>
- Barlenti, I., Hasan, M., & Mahidin. (2017). Pengembangan LKS Berbasis Project Based Learning untuk Meningkatkan Pemahaman Konsep. *Jurnal Pendidikan Sains Indonesia*, 5(1), 81-86. <https://jurnal.usk.ac.id/JPSI/article/view/8415>.
- Bayu, S., Gede, P., Gede, N. I., Wayan, S. I., Pendidikan, J., Elektro, T., & No, V. (2015). Meningkatkan Hasil Belajar Siswa Pada Pelajaran Penerapan Rangkaian Elektronika Kelas Xi Tav 1 Di SMK Negeri 3 Singaraja. *Jurnal PTE Universitas Pendidikan Ganesha*, 4(1), 1-10. <https://doi.org/10.23887/jjpte.v7i3.20862>.
- Chiang, C. L., & Lee, H. (2016). The Effect of Project-Based Learning on Learning Motivation and Problem-Solving Ability of Vocational High School Students. *International Journal of Information and Education Technology*, 6(9), 709-712. <https://doi.org/10.7763/IJiet.2016.V6.779>.
- Fajarudin, M. F., Siswanto, & Yusiran. (2016). Keterampilan Proses Sains Dan Kemandirian Belajar Siswa: Profil Dan Setting Pembelajaran Untuk Melatihkannya. *GRAVITY*, 2(2), 190-202. <http://jurnal.untirta.ac.id/index.php/Gravity/article/view/1136>.
- Fitri, L. A., Kurniawan, E. S., & Ngazizah, N. (2013). Pengembangan Modul Fisika pada Pokok Bahasan Listrik Dinamis Berbasis Domain Pengetahuan Sains untuk Mengoptimalkan Minds-On Siswa SMA Negeri 2 Purworejo Kelas X Tahun Pelajaran 2012/2013. *Radiasi: Jurnal Berkala Pendidikan Fisika*, 3(1), 19-23. Retrieved from <http://jurnal.umpwr.ac.id/index.php/radiasi/article/view/466>.
- Fathimah, Z., Halim, A., Hasan, M. (2017). Penerapan Praktikum Dengan Model Problem Based Learning (Pbl) Pada Materi Laju Reaksi Di SMA Negeri 1 Lembah Selawah. *Jurnal Pendidikan Sains Indonesia*, 5(2), 117-126. Retrieved from <https://jurnal.usk.ac.id/JPSI/article/view/9826>
- Fitriani, W., Bakri, F., & Sunaryo. (2017). Pengembangan Lembar Kerja Siswa (LKS) Fisika Untuk Melatih Kemampuan Berpikir Tingkat Tinggi (High Order Thinking Skill) Siswa SMA. *Jurnal Wahana Pendidikan Fisika*, 2(1), 36-42. <https://www.researchgate.net/publication/322011085>.
- Hadrianti, S., & Ramlawati. (2017). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berorientasi Keterampilan Generik Sains untuk Meningkatkan Hasil Belajar IPA Peserta Didik. *Simposium Nasional MIPA Universitas Negeri Makassar*, 113-118.
- Hamidiyah, N. (2017). Pengembangan Lembar Kerja Peserta Didik (LKPD) untuk Melatihkan Selfefficacy Siswa pada Materi Getaran Harmonik Sederhana di MAN 2 Kediri. *Jurnal Inovasi Pendidikan Fisika (JIPF)*, 6(3), 240-245. <https://doi.org/10.26740/ipf.v6n3.p%25p>
- Imanda, R., Khaldun, I., & Azhar. (2017). Pengembangan Modul Pembelajaran Kimia SMA Kelas XI pada Materi Konsep dan Reaksi-Reaksi. *Pendidikan Sains Indonesia*, 5(2), 42-49. <https://doi.org/10.24815/jpsi.v5i2.9816>
- Imran, B., Hunaepi, H., & Fitriani, H. (2021). Validitas Lembar Kerja Siswa Berbasis Saintifik Untuk Melatih Keterampilan Berpikir Kritis. *Jurnal Ilmiah Ikip Mataram*, 1(1), 1-14. Retrieved from <Http://E-Journal.Undikma.Ac.Id/Index.Php/Jiim/Article/View/4095>.
- Kosasih, E. (2021). *Pengembangan Bahan Ajar*. Jogjakarta: Yogyapress

- Lucas, G. (2015). *Instructional Module Project Based Learning*. Educational Foundation.
- Larasati, Z. U., Serevina, V., & Astra, I. M. (2017). Pengembangan Lembar Kerja Siswa (Lks) Fisika Dengan Menggunakan Strategi Relating, Experiencing, Applying, Cooperating, Transferring (React) Berbasis Karakter Pada Pokok Bahasan Hukum Newton. *Jurnal Wahana Pendidikan Fisika*, 2(1), 63-68. <https://doi.org/10.17509/wapfi.v2i1.4906>
- Movahedzadeh, F., Patwell, R., Rieker, J.E., & Gonzalez, T. (2012). Project based learning to promote effective learning in biotechnology courses. *Education Research International*, 2012, 1-8. <https://doi.org/10.1155/2012/536024>.
- Mustami, M. K. (2017). Validitas Pengembangan Penuntun Praktikum Ilustratif Mikroteknik Hewan Berbasis Guided Inquiry. *Jurnal Ilmiah Pena*, 11(1), 75-83. <https://doi.org/10.51336/jip.v9i1.87>.
- Mayasari, H., Syamsurizal, & Maison. (2015). Pengembangan Lembar Kerja Siswa (LKS) Berbasis Karakter melalui Pendekatan Saintifik pada Materi Fluida Statik untuk Sekolah Menengah Atas. *Edu-Sains: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam*, 4(2), 30-36. <https://doi.org/10.22437/jmpmipa.v4i2.2533>
- Nyamupangedengu, E., & Lelliott, A. (2012). An Exploration of Learners' Use of Worksheets During a Science Museum Visit. *African Journal of Research in Mathematics, Science and Technology Education*, 16(1), 82-99. <https://doi.org/10.1080/10288457.2012.10740731>.
- Ozgelen, S. (2012). Students' science process skills within a cognitive domain framework. *Eurasia Journal of Mathematics, Science & Technology Education*, 8(4), 283-292. <https://doi.org/10.12973/eurasia.2012.846a>.
- Prastowo, A. (2011). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press
- Prabowo, C. A., Ibrohim, & Saptasari, M. (2016). Pengembangan Modul Pembelajaran Inkuiri Berbasis Laboratorium Virtual. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, 1(6): 1090-1097. Retrieved from <http://journal.um.ac.id/index.php/jptpp/article/view/6422>.
- Putra, H. D. (2016). Pengaruh Project Based Learning Terhadap Kemampuan Belajar Mahasiswa. In *Prosiding Seminar Pendidikan Nusantara 2016*, 106-115. <https://www.researchgate.net/publication/317399886>.
- Puspasari, R. (2017). Implementasi Project Based Learning Untuk Meningkatkan Kemandirian Dan Prestasi Belajar Mahasiswa Dalam Pembuatan Alat Peraga Matematika Inovatif. *Math Didactic: Jurnal Pendidikan Matematika*, 3(1), 10-22. <https://doi.org/10.33654/math.v3i1.51>
- Putri, R., Raharjo, R. (2021). Practicing Creative Thinking Skills: Inquiry Base Activity Sheets Development In Protists Learning Material. *Jpbio*, 4(1), 1-14. Retrieved from <http://Jurnal.Stkippersada.Ac.Id/Jurnal/Index.Php/Jbio/Article/View/847>.
- Rifai, M. H., Dasna, I. W., & Kusairi, S. (2016). Persepsi Guru dan Siswa Sekolah Swasta di Kecamatan Waru Kabupaten Sidoarjo terhadap Pelaksanaan Praktikum dalam Pembelajaran IPA. *Pros. Semnas Pend IPA Pascasarjana UM*, 1, 1033-1040.
- Rahmi, D., & Sumarmin, R. (2021). Pengujian Validitas Booklet Bernuansa Spiritual Pada Materi Virus Untuk Peserta Didik Kelas X Sma/Ma. *Jurnal Penelitian Dan Pengembangan* 3(1), 1-8. Retrieved from <https://Ejournal.Undiksha.Ac.Id/Index.Php/Jjl/Article/View/35641>.
- Susanti. (2013). Pengaruh pembelajaran berbasis proyek terhadap kemampuan berpikir kreatif dan sikap ilmiah siswa pada materi nutrisi. *Jurnal Pengajaran MIPA*, 18(1), 36-42. <https://doi.org/10.18269/jpmipa.v18i1.36115>.
- Siwa, B., Muderawan, I.W., & Tika, I.N. (2013). Pengaruh Pembelajaran Berbasis Proyek Dalam Pembelajaran Kimia Terhadap Keterampilan Proses Sains Ditinjau Dari Gaya Kognitif Siswa. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, 3(2), 1-13. Retrieved from [https://ejournal-pasca.undiksha.ac.id/index.php/jurnal\\_ipa/article/view/794](https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/794).
- Sababha, B., Alqudah, Y., Albasal, A., & Qaralleh A. (2016). Project based learning to enhance teaching embedded systems. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(9), 2575-2585. Retrieved from <https://www.ejmste.com/article/project-based-learning-to-enhance-teaching-embedded-systems-4619>.
- Sadjati, I. M., & Pertiwi, P. R. (2013). Persepsi Mahasiswa tentang Penyelenggaraan Praktikum pada Pendidikan Tinggi Terbuka Jarak Jauh. *Jurnal Pendidikan Terbuka Dan Jarak Jauh*, 14(1), 45- 56. Retrieved from <http://jurnal.ut.ac.id/index.php/jptj/article/view/395>
- Sitaresmi, K. S., Saputro, S., & Utomo, S. B. (2017). Penerapan Pembelajaran Project Based Learning (PjBL) untuk Meningkatkan Aktivitas dan Prestasi Belajar Siswa pada Materi Sistem Periodik Unsur (SPU) Kelas X MIA 1 SMA Negeri 1 Teras Boyolali Tahun Pelajaran 2015/2016. *Jurnal Pendidikan Kimia*, 6923

- 6(1), 54-61. Retrieved from <http://jurnal.fkip.uns.ac.id/index.php/kimia/article/view/9405>.
- Sari, T. (2018). Pengembangan Buku Penuntun Praktikum Energi Dalam Sistem Kehidupan Dengan Model Argumen Driven Inquiry (ADI). *Jurnal Bioterdidik*: 6(1), 1-12. Retrieved from <http://jurnal.fkip.unila.ac.id/index.php/JBT/article/view/14787/10774>.
- Sabri, M., Muhali, M., & Hulyadi, H. (2022). Validitas Bahan Ajar Hidrokarbon Model Inkuiri Dengan Strategi Konflik Kognitif Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *Journal Of Authentic*, 2(1), 1-18. <https://doi.org/10.36312/jar.v1i1.635>
- Sonjaya, T., Hidayat, E., & Natalliasari, I. (2022). Validitas, Praktikalitas, Dan Reliabilitas Penilaian Bahan Ajar Cetak Materi Segitiga Pada Model Discovery Learning Berbasis High Order Thinking Skills. *Kongruen*, 2(3), 27-38. Retrieved from <https://Publikasi.Unsil.Ac.Id/Index.Php/Kongruen/Article/View/203>.
- Wena. (2014). *Strategi Pembelajaran Inovatif Kontemporer*. Jakarta: Bumi Aksara. 2014.
- Wati, P. A., & Santosa, A. B. (2017). Pengembangan LKS Berbasis Proyek Pada Mata Pelajaran Kerja Bengkel Dan Menggambar Teknik Kelas X SMK Kal-1 Surabaya. *Jurnal Pendidikan Teknik Elektro*, 6(3), 401-407. Retrieved from <https://ejournal.unesa.ac.id/index.php/jurnal-pendidikan-teknik-elektro/article/view/21534/19740>