JPPIPA 9(12) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of Problem-Based Student Worksheet on Environmental Change Material

Nadya Welli Astuti[1*], Bernadetta Octavia[1]

[1] Department of Biology Education, Faculty of Mathematics and Natural Sciences, Yogyakarta State University, Yogyakarta, Indonesia.

Received: October 15, 2023
Revised: November 13, 2023
Accepted: December 20, 2023
Published: December 31, 2023

Corresponding Author:
Nadya Welli Astuti
nadyawelli.2021@student.uny.ac.id

DOI: 10.29303/jppipa.v9i12.5678

Abstract: This study aims to determine the feasibility and practicality of problem-based student worksheets on environmental change material. This research is a type of development research (research and development) with research procedures using the 4D Model which consists of the stages of define, design, develop, and disseminate. This research was conducted at SMA Negeri 1 Godean in Class XI semester II. This student worksheet contains environmental problems in Yogyakarta. Based on the results of the study, showed that problem-based student worksheet on environmental change material is suitable for use with a percentage of 71.25% by material experts and 82.1% by media experts. The assessment of the biology teacher as a practitioner expert obtained results with a percentage value of 82.91% with a very practical category to use and an assessment of students with a percentage of 76.82% with a category worth using. It can be concluded that problem-based student worksheets are feasible and practical to use in the implementation of learning biology of environmental change material.

Keywords: Environmental change; Problem based learning; Student worksheet

Introduction

Education is one of the tools that can affect the progress of a country, through education it can create an active learning so that the potential possessed by each individual can develop properly (Dewi et al., 2020). In the current era of globalisation, 21st century skills must be able to be possessed by every student graduate in Indonesia, including being able to think critically, and be creative in the fields of literacy, engineering, science, arts and mathematics (Azmarita et al., 2019). The 21st century skills known as 4C (Communication, Collaboration, Critical Thinking and Problem Solving, Creativity and Innovation) are the skills to be achieved with the 2013 Curriculum. In developing 21st century skills, the role of educators is needed to prepare appropriate learning in schools (Makhrus et al., 2019).

Based on the needs analysis that has been carried out, information is obtained that the availability of teaching materials used by teachers is still conventional, namely using package books from the education office so that it does not facilitate students in learning. This makes students less enthusiastic in participating in learning. So that innovative teaching materials are needed. According to Sulistyowati et al. (2023) teaching materials that can be used as innovative learning resources are in the form of student worksheet.

Student worksheet are teaching materials that contain learning materials, practice questions, and instructions on how to complete the task, student worksheet also refers to the basic competencies needed to achieve learning objectives (Fahrurozi et al., 2022). Student worksheet is very useful to help teachers and facilitate learning activities, so that it can increase students' learning activities and achievements and play an active role in solving problems (Astuti et al., 2018). Questions in the activity sheet should encourage students to conduct experiments, research, and discovery (Trianto, 2013). The use of student worksheet in the learning process can help students in finding concepts either through theory, investigation, or demonstration, student worksheet has also been equipped with instructions or work steps so that the

How to Cite:
Astuti, N. W., & Octavia, B. (2023). Development of Problem-Based Student Worksheet on Environmental Change Material. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 10916–10922. https://doi.org/10.29303/jppipa.v9i12.5678

indicators to be achieved can be completed properly (Firdaus et al., 2018).

In addition, it was found that in the learning process the teacher had never linked biology learning with environmental problems so that the attitude of students in protecting the environment was not developed. This is evident from the fact that students are still found littering, as well as school yards and classrooms that are less clean so that the learning process needs to be improved to consider environmental issues and make students more aware and responsible for their environment. One of the learning materials that can be used by linking environmental problems is environmental change material in class X SMA.

In addition to innovative teaching materials, learning models are also needed to make students active in learning. One of the learning models that can be used to support 21st century skills is an innovative learning model. The 21st century learning model that has the potential to be applied is the Problem Based Learning model (Setiawan, 2021).

Problem-based learning model is a learning model that focuses on providing a problem that is relevant to the real world of students, where the problem appears at the beginning of learning. So that students will be active, both independently and in groups, and can analyse and understand how to solve real problems (Setiawan, 2021). The ultimate goal of implementing problem-based learning is that students have the ability to find solutions to the problems they face. In addition, students will be more interested in approaching problems and discussing them critically and systematically, so that later they can draw conclusions based on their own understanding (Yolanda, 2018).

Based on the existing problems, problem-based LKPD is needed as teaching material that is adjusted to the syntax of problem-based learning and applied in learning activities. LKPD based on Problem Based Learning can help students to be active in learning activities, so that they are able to find and understand the concepts of the material they learn. This is in line with the opinion of Maulina (2019) which states that PBL-based student worksheet has the advantage of being able to help students think critically and learn independently. In this study, problem-based student worksheet on environmental change material was developed to see the feasibility and practicality in learning.

Method

This research uses the Research and Development (R&D) method. The R&D method is a research method and literature study to produce a certain product design and develop it by testing the validity of the design, so that it becomes a product that is tested and can be widely used (Sugiyono, 2020). Educational development research does not aim to test and determine theory, instead this type of research focuses on making and developing a product (Lutfi et al., 2017).

The learner worksheet product was developed to support grade X high school students in improving their environmental care attitude. The research procedure is using the 4D Model which consists of the stages of defining (define), designing (design), developing (develop), disseminating (disseminate). In this study, it is only limited to the development stage (develop).

Figure 1. Research framework

At the define stage, it is obtained through direct observation and interviews, teacher needs analysis, and student needs analysis. At this stage, material selection was carried out. In this study using environmental change material. At the design stage, media selection and media creation are carried out. Furthermore, the development stage is carried out by media expert validation lecturers and material experts to assess feasibility. Media experts are lecturers who have qualifications in the field of learning and multimedia programmes. Material experts are lecturers who are qualified experts in the field of environmental change material. Material validation is an assessment related to the quality of the material to be developed, whether the needs and components of learning devices have been met or not such as core competencies, objectives and so on (Wahyuningtyas et al., 2019). Meanwhile, teachers and grade XI students to assess practicality. Grade XI students show responses to problem-based student worksheets.

The material assessment questionnaire consists of two aspects, namely aspects of material quality, language, feasibility support. The media assessment questionnaire consists of two aspects including cover illustration, as well as content and design aspects. The teacher assessment questionnaire consists of four aspects, namely aspects of material feasibility of material accuracy, didactic aspects, construction aspects and technical aspects while the student assessment questionnaire consists of four aspects, namely technical aspects, visual display aspects, media aspects, aspects of learning material content.

The validation questionnaire data from expert lecturers, teachers, and students were analysed using Formula 1.

$$\mathbf{M} = \frac{\sum \boldsymbol{fX}}{\boldsymbol{N}} \quad (1)$$

Note:

M = Average per aspects

$\sum fX$ = Sum of scores per aspect

N = Number of components

After getting the average data per aspect, convert the average score to a value of 100 by (Formula 2).

$$\text{Value per aspects} = \frac{\text{Average score}}{\text{Max score}} \text{ x } 100 \quad (2)$$

Furthermore, the interpretation of each aspect is categorized according to the following categories:

Table 1. Interpretation of aspects

Score (%)	Category
81-100	Very Good
61-80	Good
41-60	Enough
21-40	Less
0-20	Not Good

Results and Discussion

Teaching materials in the form of problem-based student worksheet on environmental change material are obtained using the 4D model which includes the define, design, and develop stages. The three stages are described as follows.

Define

At this stage, an analysis of the needs of teaching materials is carried out, namely collecting information in the form of curriculum, learning characteristics, media utilization, and biology learning models. Based on the results of interviews and observations, it is known that biology learning still uses lecture and discussion methods and teaching materials in the form of printed books and PowerPoints. In addition, student worksheet is still rarely used as teaching material in the biology learning process and environmental problems have never been associated with material in biology learning. This has the potential to develop student worksheet products by linking environmental problems.

Design

At this stage, media selection and initial design of student worksheets that are relevant to the characteristics of the material so that learning objectives can be easily achieved. The preparation of the initial draft produces a student worksheet that contains the title, and learning objectives, and presents articles related to environmental problems and discussion materials according to problems with Problem-Based Learning syntax, and bibliography. Learners are asked to solve the problems faced in groups and individually.

The problem-based student worksheet consists ofthree activities. These activities are activity 1, containing with the topic of Environmental Change, raising issues of environmental changes that occur in Yogyakarta. Then activity 2, contains the topics of Environmental Pollution. Then activity 3, which contains Waste topics. This problem-based student worksheet is also equipped with learning video so that it will help students better understand the material of environmental change. In addition, each activity is equipped with practice questions based on the topic of the activity.

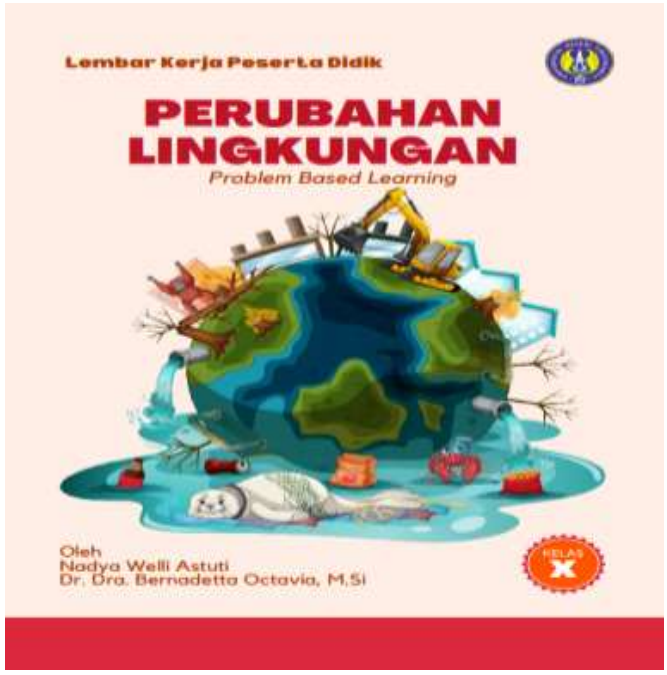

Figure 2. The first cover of the problem-based student worksheet

Develop

At this stage, validation of the product to be developed is carried out. This validation aims to get suggestions and comments from material and media expert lecturers. Products that have gone through this stage can be guaranteed quality and good for use. To ensure the feasibility of the product, the product to be developed needs to be validated by media experts and material experts (Amthari et al., 2021).

The material expert assessment includes two aspects, namely aspects of material quality, language, and feasibility support. The material expert assessment of the teaching materials developed is in Table 2.

Table 2. Material Expert Validity Results

Assessment Aspect	Score	Criteria
Material quality	75	Good
Language quality	70	Good
Supporting quality feasibility	68.75	Good
Average	71.25	Good

Based on Table 2, the results of the student worksheet value analysis from material experts obtained an average of 71.25. The quality aspect of the material obtained a score of 75, the language aspect obtained a score of 70, and the quality aspect of supporting feasibility obtained a score of 68.75. Based on the average obtained, it can be concluded that the product developed has met the criteria for feasibility for use in learning activities with several revisions and suggestions from material expert lecturers. This indicates that the material used in this student worksheet meets high-quality standards and can be relied upon to support learning. This is in line with the opinion of Susiani et al. (2017) who stated that it is very important to ensure that the material contained in the student worksheet is correct so that students are not confused or even get the wrong concept.

The language aspect is very important in a student worksheet, because if the sentences used are simple and clear then students will find it easy to understand. Choosing the right language will help students understand the concept and prevent errors in understanding the sentences conveyed (Sihafudin et al., 2020). Student worksheet will be easy to read and understand if it uses clear letters, numbers, and sentences (Amalini et al., 2021). Important language elements that should be avoided include the use of words that are unclear, ambiguous, difficult to understand, have double meanings, are not adjusted to the Pedoman Umum Ejaan Bahasa Indonesia (PUEBI), and do not use correct spelling (Syamsi et al., 2021). In addition to conducting validation in terms of material, the media is also validated by media experts to assess two aspects including cover illustrations, as well as content and design aspects. The media expert assessment of the teaching materials developed is in Table 3.

Table 3. Media Expert Validity Results

Assessment Aspect	Score	Criteria
Cover illustration	75	Good
Content and design	89.2	Very Good
Average	82.1	Very Good

Table 3 shows the results of the analysis of the value of student worksheets from media experts who obtained an average of 82.1 with a very good category. The cover illustration aspect obtained a score of 75 while the content and design aspects obtained a score of 89.2. Based on the average obtained, it can be concluded that the product developed has met the criteria of very feasible to be used in learning activities with some revisions and suggestions from media expert lecturers. The suggestions from media experts are in the form of changing the image on the student worksheet cover by showing before and after changes in the environment. The following are the results of the student worksheet cover revision.

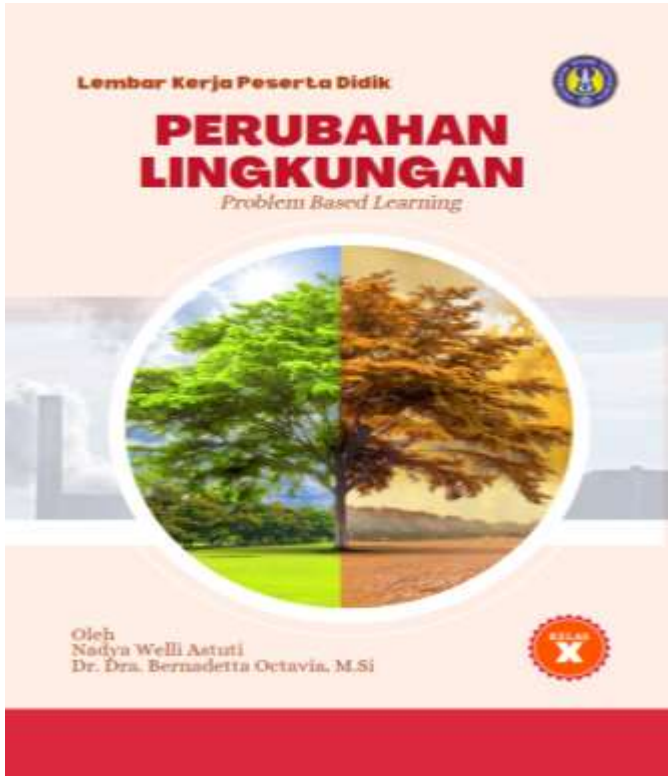

Figure 3. Final cover of problem-based student worksheet

Learners will be more interested in using student worksheets if the appearance is attractive and the material is. An attractive cover design and the material will also increase the desire of students to use it. This is in line with the opinion of Rohmani et al. (2023) which states that students can gain an initial understanding of the lesson topics they will learn through the right title, have high-quality images available to support the material presented, and ensure that the material is provided in an organized manner so that students can learn well. Student worksheets with an organized presentation can make it easier for students to use and interesting student worksheets with the right learning time can increase students' learning attention (Wulandari et al., 2018).

Image placement is one of the assessment items contained in the content and design aspects of the student worksheet. According to Faradiba &

Rachmadiarti (Faradiba et al., 2020), states that clear images can increase students' interest in learning and make the material easier to understand. Images and videos contained in student worksheets are very useful because they can help convey the material being studied and clarify material that is still abstract. This can allow students to complete the tasks they have as well as possible (Fitriasari et al., 2021).

Teaching material products in the form of student worksheets developed are assessed by practitioners, namely biology teachers at the State Senior High School 1 Godean. Practicality can be said to be fulfilled if the results of data analysis from the practicality questionnaire are in the range of 60 ≤ Value ≤ 80 percent with practical criteria and in the range of 80 ≤ Value ≤ 100 percent with very practical criteria (Lestari et al., 2018). The assessment is based on aspects of material feasibility of material accuracy, didactic aspects, construction aspects, and technical aspects. The following assessment results from biology teachers can be seen in Table 4.

Table 4. Teacher Practicality Results

Assessment Aspect	Score	Criteria
Aspects of Material Appropriateness	83,3	Very good
Material accuracy aspect	75	Good
Didactic aspect	80	Good
Construction aspect	82.5	Very good
Technical aspects	93.75	Very good
Average	82.91	Very good

Table 4 shows the results of the problem-based student worksheet product assessment from practitioners obtained an average score of 82.91. The highest assessment was obtained in the technical aspect while the aspect that received the lowest score was the accuracy of the material. Based on the acquisition of these values, it can be concluded that problem-based student worksheet is very practical to use in learning activities after revision by the suggestions and input that has been given by practitioners. The advice from educators is to minimize the letters contained in the student worksheet. According to Khafida et al. (2021), it is stated that the systematics of presentation in student worksheets must be presented consistently, in concepts and successive paragraphs, as well as the need for precise material meaning. In addition, attractive images, colors, layouts, and designs of student worksheets and writing are used so that they can encourage students to easily use them.

The suitability of the material to support the achievement of Basic Competencies is one of the assessments contained in the material feasibility aspect. According to Fatmawati (2016) states that to achieve optimal learning objectives, the development of student worksheet must involve curriculum analysis. This is done so that the development of student worksheet is by the basic competencies (KD), learning indicators, and the subject matter that has been determined.

Furthermore, student worksheet products are tested on class XI students to determine the readability of problem-based LKPD products on environmental change material based on student response questionnaires. The number of students who took part in this trial was 30 students. There are four aspects contained in the product readability questionnaire, namely technical aspects, visual appearance aspects, media aspects, and learning material content aspects. The results of students' responses can be seen in Table 5 below.

Table 5. Learner Response Results

Assessment Aspect	Score	Criteria
Technical aspects	77.5	Good
Visual appearance aspect	76.37	Good
Media aspects	78	Good
Content aspect of learning material	75.41	Good
Average	76.82	Good

Based on Table 5, shows the results of students' responses to the student worksheet obtained an average of 76.82 with a good category. The highest assessment was obtained in the media aspect while the aspect that received the lowest score was the content aspect of the learning material. Based on the average obtained, it can be concluded that the product developed in the form of a problem-based student worksheet received a positive response from students as users of teaching materials so it is feasible to use in learning biology of environmental change material.

Students like the activities contained in the student worksheet, this is indicated by the many positive responses from students. Students also considered that the student worksheet was easy to use, interesting and helped to be active in learning and made it easier to understand the material. This is in line with the statement of Maimufi et al. (2021) which states that student worksheets can make students more interested and motivated to learn, make them more active, and create a more enjoyable learning environment.

Student worksheets that use real problems can increase students' motivation because they allow them to understand firsthand what the material they are learning means and how the concept can be applied in the real world (Zahroh et al., 2021). Learners will more easily understand the learning material with the PBL model which is connected to real-world situations (Isma et al., 2022). Student worksheet that is easy to use allows students to control their time and not rush so that

students can complete the task on time (Rochman J K et al., 2021).

Conclusion

Based on the data obtained related to the results of problem-based student worksheet development research on environmental change material at SMAN 1 Godean, that problem-based student worksheet on environmental change material are feasible to use with a percentage of 71.25% by material experts and 82.1% by media experts. The assessment of the biology teacher as a practitioner expert obtained results with a percentage value of 82.91% with a very practical category of use and an assessment of students with a percentage of 76.82% with a category worth using.

Acknowledgments
Thank you to all the parties who participated in this research, especially to the principal, teachers, and students of State Senior High School 1 Godean, who have helped so that this research can run well.

Author Contributions
The authors would like to thank Atirah Surayya for contributing to this research article with her responsibilities of editing and translation.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest regarding the publication of this journal.

References

Amalini, H., & Winarsih, W. (2021). Pengembangan Perangkat Pembelajaran Biologi Berbasis Sains Teknologi Masyarakat dan Lingkungan Kelas X SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *11*(1), 206–217. https://doi.org/10.26740/bioedu.v11n1.p206-217

Amthari, W., Muhammad, D., & Anggereini, E. (2021). Pengembangan E-LKPD Berbasis Saintifik Materi Sistem Pernapasan pada Manusia Kelas XI SMA. *BIODIK*, *7*(3), 28–35. https://doi.org/10.22437/bio.v7i3.13239

Astuti, S., Danial, M., & Anwar, M. (2018). Pengembangan LKPD Berbasis PBL (Problem Based Learning) untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik pada Materi Kesetimbangan Kimia. *Chemistry Education Review (CER)*, *1*(1), 90. https://doi.org/10.26858/cer.v0i1.5614

Azmarita, T., Helmi, H., & Azis, A. (2019). Pengembangan Lembar Kerja Peserta Didik (LKPD) Luar Kelas Berbasis Kontekstual Untuk Meningkatkan Literasi Sains XI MIPA SMAN 8 Maros. *Jurnal Sains Dan Pendidikan Fisika*, *15*(1), 37–42. https://doi.org/10.35580/jspf.v15i1.9410

Dewi, M. D., & Izzati, N. (2020). Pengembangan Media Pembelajaran PowerPoint Interaktif Berbasis RME Materi Aljabar Kelas VII SMP. *Delta: Jurnal Ilmiah Pendidikan Matematika*, *8*(2), 217. https://doi.org/10.31941/delta.v8i2.1039

Faradiba, D. F., & Rachmadiarti, F. (2020). Kelayakan Teoritis E-Book Interaktif Materi Ekosistem untuk Melatihkan Keterampilan Berpikir Kritis Siswa Kelas X SMA. *Jurnal Bioedu*, *9*(2), 179–185. https://doi.org/10.26740/bioedu.v9n2

Fatmawati, A. (2016). Pengembangan Perangkat Pembelajaran Konsep Pencemaran Lingkungan Menggunakan Model Pembelajaran Berdasarkan Masalah Untuk SMA Kelas X. *Edusains*, *4*(2), 94–103. https://doi.org/10.23971/eds.v4i2.512

Firdaus, M., & Wilujeng, I. (2018). Pengembangan LKPD inkuiri terbimbing untuk meningkatkan keterampilan berpikir kritis dan hasil belajar peserta didik. *Jurnal Inovasi Pendidikan IPA*, *4*(1), 26–40. https://doi.org/10.21831/jipi.v4i1.5574

Fitriasari, D. N. M., & Yuliani, Y. (2021). Pengembangan Lembar Kegiatan Peserta Didik-Elektronik (E-LKPD) Berbasis Guided Discovery untuk Melatihkan Keterampilan Proses Sains Terintegrasi pada Materi Fotosintesis Kelas XII SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(3), 510–522. https://doi.org/10.26740/bioedu.v10n3.p510-522

Isma, T. W., Putra, R., Wicaksana, T. I., Tasrif, E., & Huda, A. (2022). Peningkatan Hasil Belajar Siswa melalui Problem Based Learning (PBL). *Jurnal Imiah Pendidikan Dan Pembelajaran*, *6*(1), 155. https://doi.org/10.23887/jipp.v6i1.31523

Khafida, I. L., & Ismono, I. (2021). Pengembangan Lkpd Inkuiri Berbasis Hands-On & Minds-on Activity untuk Meningkatkan HOTS pada Materi Laju Reaksi. *UNESA Journal of Chemical Education*, *10*(1), 38–47. https://doi.org/10.26740/ujced.v10n1.p38-47

Lestari, L., Alberida, H., & Rahmi, Y. L. (2018). Validitas dan Praktikalitas Lembar Kerja Peserta Didik (LKPD) Materi Kingdom Plantae Berbasis Pendekatan Saintifik untuk Peserta Didik Kelas X SMA/MA. *Jurnal Eksakta Pendidikan (JEP)*, *2*(2), 170. https://doi.org/10.24036/jep/vol2-iss2/245

Lutfi, & Ardi. (2017). *Metodologi Penelitian*. Jakarta: Rajawali Ekspress.

Maimufi, R., Haviz, M., Delfita, R., & Fajar, N. (2021). Validitas Lembar Kerja Peserta Didik (LKPD)

Berbasis Model Problem Based Learning (PBL) Pada Materi Sistem Peredaran Darah Kelas XI SMA. *Edusainstika: Jurnal Pembelajaran MIPA*, *2*(1), 49. https://doi.org/10.31958/je.v2i1.3144

Makhrus, M., Harjono, A., Syukur, A., Bahri, S., & Muntari, M. (2019). Identifikasi Kesiapan LKPD Guru Terhadap Keterampilan Abad 21 Pada Pembelajaran IPA SMP. *Jurnal Ilmiah Profesi Pendidikan*, *3*(2), 124–128. https://doi.org/10.29303/jipp.v3i2.20

Maulina, R., Nazar, M., & Hanum, L. (2019). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Masalah pada Materi Koloid di Kelas XI SMAN 5 Banda Aceh. *Jurnal Ilmiah Mahasiswa Pendidikan Kimia*, *4*(4), 35–41. Retrieved from http://www.jim.unsyiah.ac.id/pendidikan-kimia/article/view/16150

Rochman J K, A. K. R., & Yuliani, Y. (2021). Pengembangan Lembar Kerja Peserta Didik Elektronik (E-LKPD) Berbasis Inkuiri pada Submateri Fotosintesis untuk Meningkatkan Kemampuan Argumentasi Peserta Didik. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(3), 663–673. https://doi.org/10.26740/bioedu.v10n3.p663-673

Rohmani, A., & Kuntjoro, S. (2023). Pengembangan E-Lkpd Berbasis Roblem Solving Pada Submateri Pencemaran Lingkungan Kelas X Untuk Melatih Keterampilan Berpikir Kritis. *Jurnal Bioedu*, *12*(1), 260–271. https://doi.org/10.26740/bioedu.v12n1

Setiawan, A. (2021). Problem Based Learning (PBL) Model for the 21st Century Generation. *Jurnal Social Humanities, and Education Studies (SHES)*, *4*(6), 290–296. https://doi.org/10.20961/shes.v4i6.68457

Sihafudin, A., & Trimulyono, G. (2020). Validitas dan Keefektifan LKPD Pembuatan Virgin Coconut Oil Secara Enzimatis Berbasis PBL Untuk Melatihkan Keterampilan Proses Sains Pada Materi Bioteknologi. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *9*(1), 73–79. Retrieved from https://ejournal.unesa.ac.id/index.php/bioedu/article/view/32313%0Ahttps://ejournal.unesa.ac.id/index.php/bioedu/article/download/32313/29234

Sugiyono. (2020). *Cara Mudah Menyusun: Skripsi, Tesis, dan Disertasi*. Bandung: Alfabeta.

Sulistyowati, P., & Triwahyuningtyas, D. (2023). Pelatihan Pengembangan Lembar Kerja Peserta Didik Inovatif Untuk Siswa Sekolah Dasar. *Jurnal Pengabdian Kepada Masyarakat*, *3*(1), 48–53. Retrieved from https://journal.actual-insight.com/index.php/jpkm/article/view/1574

Susiani, Indana, S., & Indah, N. K. (2017). Validitas dan Efektivitas LKS Berbasis Literasi Sains pada Materi Tumbuhan untuk Siswa Kelas X. *BioEdu: Berkala Ilmiah Pendidikan Biologi*, *6*(1), 60–67. Retrieved from https://ejournal.unesa.ac.id/index.php/bioedu/article/view/20841

Syamsi, A. N., & Fitrihidajati, H. (2021). Validitas Lembar Kegiatan Peserta Didik (LKPD) Berbasis Problem Based Learning pada Materi Perubahan Lingkungan untuk Melatihkan Keterampilan Berpikir Kritis Siswa Kelas X SMA. *Jurnal Bioedu*, *10*(2), 397–402. https://doi.org/10.26740/bioedu.v10n2

Trianto. (2013). *Mendesain Model Pembelajaran Inovatif, Progresif, Konsep, Landasan, dan Implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: Kencana Prenada Media Group.

Wahyuningtyas, N., & Rosita, F. A. D. (2019). Pengembangan Multimedia Interaktif Berbasis Android Pada Materi Kehidupan Sosial Masyarakat Indonesia. *Sejarah Dan Budaya: Jurnal Sejarah, Budaya, Dan Pengajarannya*, *13*(1), 34–41. https://doi.org/10.17977/um020v13i12019p34

Wulandari, R., & Novita, D. (2018). Pengembangan Lembar Kerja Siswa (LKPD) Berbasis Project Based Learning Pada Materi Asam Basa Untuk Melatihkan Keterampilan Berpikir Kritis. *Journal Chamecal Education*, *7*(2), 129–135. https://doi.org/10.2740/ujced.v7n2.p

Yolanda, Y. (2018). Pembelajaran Tematik Terpadu Menggunakan Model Problem Based Learniing (PBL) di Sekolah Dasar. *Pakar Pendidikan*, *16*(2), 29–39. https://doi.org/10.24036/pakar.v16i2.43

Zahroh, D. A., & Yuliani, Y. (2021). Pengembangan e-LKPD Berbasis Literasi Sains untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik pada Materi Pertumbuhan dan Perkembangan. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(3), 605–616. https://doi.org/10.26740/bioedu.v10n3.p605-616