Practice of the Science of Teaching Journal: Jurnal Praktisi Pendidikan
E-ISSN 2830-568X | https://jurnal.hafecs.id/index.php/hafecspost/index
Volume 3 Issue 2, August 2024, pp. 48-57
DOI: https://doi.org/10.58362/hafecspost.v3i2.81

Development of a popular scientific book on briquette processing from palm oil empty fruit bunch waste as an alternative energy source

Pengembangan buku ilmiah populer pengolahan briket dari limbah tandan kosong kelapa sawit sebagai sumber energi alternatif

Istiqamah [(1)] *, Zahratunnisa Rahmadina [(2)]

[(1)] Study Program of Biology Tadris, Faculty of Tarbiyah and Education, Universitas Islam Negeri Antasari, Banjarmasin, South Kalimantan, Indonesia, 70235
[(2)] Satuan Pendidikan Nonformal Sanggar Kegiatan Belajar Paser, Tanah Grogot, East Kalimantan, Indonesia, 76211

*Corresponding Author Email: istiqamah@uin-antasari.ac.id | Received date: 01/11/2024; Accepted date: 15/12/2024

Abstract
The development of oil palm plantations, especially in Kalimantan, is increasing, this also increases plantation waste such as oil palm empty fruit bunch waste. This empty bunch waste has not been processed and utilised so that it continues to accumulate. One of the products that can be utilised from this empty bunch waste is briquettes as alternative energy. Besides being easy to process, it can also improve the community's economy and reduce empty bunch waste. This research aims to develop a book in the form of a popular scientific book on the processing of briquettes from oil palm empty fruit bunch waste as alternative energy. This research uses the Educational Design Research (EDR) type consisting of three stages, namely preliminary research, prototyping phase, and assessment phase. However, this study only limits the use to the prototype development phase. This research approach is quantitative and qualitative. The data in this study were described and analysed and then made into a popular scientific book. After that, the popular scientific book was evaluated using Tessmer formative evaluation design including self-evaluation, expert review and limited to one-to-one evaluation. The results of this study showed that the average final result of expert test validation of popular scientific book was 90.84% (very valid) and could be used without revision. The average final result of readability validation with a one-to-one evaluation of 83.33% (very valid) can be used as a reference source for a wide audience.

Keywords: development; popular scientific book; briquettes; empty bunch waste; alternative energy

Abstrak *Perkembangan perkebunan sawit khususnya di Kalimantan begitu meningkat, hal ini juga meningkatkannya limbah perkebunan seperti limbah tandan kosong kelapa sawit. Limbah tandan kosong ini belum diolah dan dimanfaatkan sehingga terus menumpuk. Salah satu produk yang dapat dimanfaatkan dari limbah tandan kosong ini adalah briket sebagai energi alternatif. Selain mudah diolah, dapat pula meningkatkan perekonomian masyarakat dan mengurangi limbah tandan kosong. Penelitian ini bertujuan untuk mengembangkan buku berupa buku ilmiah populer mengenai pengolahan briket dari limbah tandan kosong kelapa sawit sebagai energi alternatif. Penelitian ini menggunakan jenis Educational Design Research (EDR) terdiri dari tiga tahapan, yaitu penelitian pendahuluan (preliminary research), tahap pengembangan prototipe (prototyping phase), dan tahap penilaian (assessment phase). Namun, penelitian ini hanya membatasi penggunaan hingga tahap pengembangan prototipe saja. Pendekatan penelitian ini yaitu pendekatan kuantitatif dan kualitatif. Data pada penelitian ini dijabarkan dan dianalisis kemudian dibuat menjadi sebuah buku ilmiah populer. Setelah itu, buku ilmiah populer dievaluasi dengan desain evaluasi formatif Tessmer meliputi evaluasi diri (self-evaluation), uji pakar (expert review) dan dibatasi sampai evaluasi perorangan (one to one evaluation). Hasil penelitian ini diketahui bahwa Rata-rata hasil akhir validasi uji pakar buku ilmiah populer diperoleh sebesar 90,84% (sangat valid) dan dapat digunakan tanpa revisi. Rata-rata hasil akhir validasi keterbacaan dengan evaluasi perorangan sebesar 83,33% (sangat valid) bisa digunakan sebagai sumber referensi khalayak luas. Kata kunci: pengembangan; buku ilmiah populer; briket; limbah tandan kosong; energi alternatif*

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

INTRODUCTION

According to the Plantation Office of East Kalimantan Province (2021), Indonesia has an extraordinary wealth of natural resources, such as oil palm which is a very potential plantation commodity. One example is in Olong Pinang Village, Paser Regency, with a plantation area of 897.39 hectares and oil palm production reaching 300 tonnes per day in 2020. Based on a report from Susanto et al. (2017), every processing of 1 tonne of oil palm fresh fruit bunches (FFB) produces 20-23% of oil palm empty fruit bunch waste, or around 200-230 kg. Thus, the production of 300 tonnes of FFB will produce around 60-69 tonnes of empty palm bunches. According to Plantation Key Technology (2022), a productive oil palm plant can be harvested 10-15 times in one year. This also depends on the age, type of oil palm and the plantation environment. If the waste of empty palm oil bunches is not reused, it is certain that in the next few years the environment around oil palm plantations will become increasingly worrying due to environmental pollution. The right solution to utilise this empty bunch waste is to process it into useful products for the community, such as briquettes as alternative energy.

According to Amalia et al. (2020), briquettes are a form of alternative energy that is solid and produced from the remains of organic materials through a compression process with a certain pressure. In this study, the researchers tried to reduce the accumulation of oil palm empty fruit bunch waste by processing it into briquettes, because briquettes can be a potential alternative fuel for household use in the long term. Briquettes are also a good option to replace firewood, which is in increasing demand and has a negative impact on forest ecology.

On 22 July 2023, researchers conducted observations and interviews with the community around the palm oil mill in Olongpinang Village, Paser Regency, East Kalimantan. The results of the observations and interviews showed that the accumulation of oil palm empty fruit bunch waste causes respiratory problems due to the pungent odour. In addition, the ditch water around residential areas has become pitch black and smells bad due to waste pollution. The community hopes that there will be efforts to process and utilise oil palm empty fruit bunch waste to overcome this problem.

From the interviews conducted, the researcher plans to follow up on the concerns of the people of Olongpinang Village, Paser District, East Kalimantan regarding the accumulation of oil palm empty fruit bunch waste. The waste will be utilised into environmentally friendly briquettes. The researcher will also process the results of this utilisation into a popular scientific book to facilitate students, students, the general public, and all groups in understanding how to process oil palm empty bunch waste into briquettes, in order to reduce empty bunch waste and make it an alternative energy source.

Relevant research on the manufacture of oil palm empty fruit bunch briquettes has been conducted by Artiningsih (2020), entitled "Processing Palm Oil Waste into Briquettes Supports and Reduces Environmental Burden". This research examines the quality of briquettes in terms of ash quality and moisture content with tapioca starch adhesive. However, in this study the results have not been processed into popular scientific books so that the results of making briquettes cannot be maximally distributed to the community. This is also in line with the research of Dhora and Sihotang (2022), with the title "Utilization of Empty Palm Bunches as Briquette Raw Material with Starch Flour Adhesive". Like the previous research, this research also focuses on making briquettes, the quality of briquettes seen from the moisture content and the adhesive tested, but the research results have not been processed into popular scientific books. Another relevant research is by Abdullah et al. (2016), with the research title "The Effect of the Addition of Empty Palm Bunches on the Quality of Briquettes Made from Cassava Peel Waste". This research focuses on the briquette size test, moisture content, heat produced, ash content, missing substances, and briquette density negatively correlated with calorific value. However, this research also did not turn it into popular scientific books. The above research only focuses on making briquettes but there is no follow-up processing to develop into popular scientific books. For the manufacture of popular scientific books itself regarding the processing of briquettes from oil palm empty fruit bunch waste itself is still minimal so this research needs to be done.

According to Helmi (2017), one of the main advantages of digital and non-digital popular science books is that the writing style of popular science books is its power to attract many readers. Complex terms in the world of science are explained in simple words and examples that can be understood by everyone. By using a relaxed journalistic writing style, the author of this scientific book is able to bring readers into the realm of science without making them confused and bored. Therefore, researchers prefer popular scientific books as

a development product so that it can reach all groups, including children, students, students, parents, teachers and others. Digital popular scientific books can also make it easier for people to read even while traveling because digital popular scientific books is easily accessible. Based on observations of book and journal analysis regarding popular scientific books of oil palm empty fruit bunch briquettes, it was found that there were not many popular scientific books and journals found. This is what underlies the researcher to make a valid popular scientific book through research and development of popular scientific books on briquette processing from oil palm empty fruit bunch waste as alternative energy. It is hoped that this book will not only increase the literacy of all circles, but also reduce palm oil empty bunch waste by processing it into briquettes.

RESEARCH METHOD

This type of research is development research using the Educational Design Research (EDR) research method. EDR is an approach commonly used in education to design, develop, and evaluate various educational interventions as solutions to complex problems in educational practice. The research design applied in this study follows the Plomp model developed by Tjeed Plomp, consisting of three stages, namely preliminary research, prototyping phase, and assessment phase. The stages in EDR, according to Plomp & Nieveen (2013), are as follows:

A. *Preliminary Research*)

This stage carried out a context analysis and literature review to understand the needs and develop a theoretical basis for the research to be carried out.

1. Development or Prototyping Phase
   This stage is a microcycle in research that involves formative evaluation to refine and improve the intervention being developed with the aim of achieving the best solution to the problem being studied.
2. Assessment Phase
   This phase involves a summative evaluation to evaluate the solution that meets the pre-defined specifications, resulting in recommendations to improve the implemented solution, which is often repeated if revisions are needed.

According to Zaini (2018), in development research, there are two stages that are focused on, namely the preparation stage (preliminary) and the formative evaluation stage. Formative evaluation aims to assess the weaknesses and strengths of the instruction at the development stage, so that revisions can be made. After revisions are made, researchers ensure the success of revisions through validation, and continue to identify product weaknesses until the resulting product is suitable and suitable for use. In this development research up to the development stage using Tessmer (1993) formative evaluation which includes self-evaluation, expert review, and one to one evaluation.

The validity of Popular Scientific Books is obtained from expert tests and user readability tests. The expert test was carried out by asking for validation using a validation sheet questionnaire instrument that had been adapted from a study conducted by Sarpani et al. (2020) to 3 lecturers of UIN Antasari Banjarmasin who are material, language and media experts. Data on the validity of popular scientific books will be analyzed by calculating the validity score based on the evaluation results from material experts, language experts, and media experts. The formula for calculating the score of validation results by experts can be seen in Formula 1, and then determined the validity criteria of popular scientific books based on Akbar (2022) which can be seen in Table 1.

$$\text{Validation (V)} = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100\% \quad \text{.....Formula 1}$$

Table 1 Validity criteria of popular scientific books

No	Validity Criteria	Validity Level
1	85,01% - 100,00%	Very valid, can be used without revision.
2	70,01% - 85,00%	Fairly valid, can be used but needs minor revisions.
3	50,01% - 70,00%	Not valid, advised not to use, needs major revision
4	01,00% - 50,00%	Invalid, should not be used.

Source: Akbar (2022)

While the readability test was tested through a one-to-one evaluation in the form of a questionnaire questionnaire to six users, consisting of three students of the Tadris Biology Study Program at UIN Antasari Banjarmasin who have taken the Environmental Knowledge course, and three communities around oil palm mills in Olongpinang Village, Paser Regency, East Kalimantan, including factory workers and local residents. The purpose of this readability test is to evaluate the readability level of the contents of the Popular Scientific Book prepared by the researcher. The instrument used in this readability test is a questionnaire adapted from the research of Latifah et al. (2020), using a 1-4 Likert scale in a checklist format adapted from Akbar (2020). The readability of popular scientific books will be assessed through individual tests, with criteria adapted from Akbar (2022). The criteria can be seen in Table 2.

Table 2 Readability test criteria for popular scientific books

Skor	Category
81,00 - 100,00	Very Good
61,00 - 80,00	Good
41,00 - 60,00	Good Enough
21,00 - 40,00	Not Good
00,00 - 20,00	Not Very Good

Source: Akbar (2022)

RESULTS AND DISCUSSION

The results of this development consist of the development stages of Educational Design Research (EDR) according to Plomp & Nieveen (2013) which consists of preliminary research, prototyping phase, and assessment phase in this study only focus on the preliminary and development stages.

A. Preliminary Research

In general, the stage passed in preliminary research is needs analysis. At this stage consists of several important steps, namely observation of problems, analysis of research urgency, and others. The results of observations of the research location in Olong Pinang Village, Paser Regency, East Kalimantan found that there were problems related to the accumulation of oil palm empty fruit bunch waste and there was no processing and follow-up such as processing into briquettes. The picture of the observation of the accumulation of oil palm empty bunch waste can be seen in Figure 1 (A).

Furthermore, the results of the analysis in the form of literature review and the need for popular scientific books through journals and books regarding the amount of empty bunch waste. The resulting review is in the form of data from oil palm plantations, it is found that according to the Dinas Perkebunan dan Perternakan Kabupaten Paser (2023), Indonesia has an extraordinary wealth of natural resources, such as oil palm which is a very potential plantation commodity. One example is in Olong Pinang Village, Paser Regency, there are a total of 80,703 hectares of independent oil palm plantations in Paser. The total with company plantations is 201,168 hectares. There are 18 palm oil processing factories, 16 of which are still operating and two are not operating. Total CPO production from all of them reached 519,458 tonnes per year. Based on a report from Susanto et al. (2017), every processing of 1 ton of oil palm fresh fruit bunches (FFB) produces 20-23% of oil palm empty fruit bunch waste, or around 200-230 kg. Thus, the production of 300 tons of FFB will produce waste of about 60-69 tons of empty palm bunches. This waste becomes a source of pollution if it is not recycled. this is in accordance with the statement of Ardila (2014) This palm oil industry solid waste has the potential to pollute the soil, environment and has not been optimally utilised. soil, the environment and has not been utilised optimally. Whereas this solid waste can still be used as a source of renewable energy. The analysis also found that journals and popular scientific books on the processing of briquettes from oil palm empty fruit bunch waste are still minimal, especially in the Kalimantan region.

The results of briquettes processed from oil palm empty fruit bunch waste found that the best adhesive used in terms of flame length, aroma and texture of briquettes is using starch adhesive. The results of briquette processing from palm empty fruit bunch waste can be seen in Figure 1 (B).



Figure 1 (A) Observation of palm oil empty fruit bunch waste accumulation; and (B) empty bunch waste briquettes

B. Prototyping Phase

Data on the results of briquette making were processed into a popular scientific book. Based on the results of self-evaluation (self-evaluation), a popular scientific book prototype 1 was obtained. The cover image of the popular scientific book prototype 1 can be seen in Figure 2.



Figure 2 Front cover of popular science book prototype 1

The prototype 1 popular science book was then validated by experts (expert review) which included material, language and media. The results of expert validation obtained data that can be seen in Table 4 and Table 5.

Table 4 Average percentage results of the popular scientific book validity test

No	Componen	Percentage	Validity Level
1	Coherence Aspect	96,83%	Very valid
2	Readability	83,33%	Valid
3	Vocabulary: expression, verb, choice, exaggeration	87,50%	Very Valid
4	Active and passive sentences	83,33%	Valid
5	Format	100%	Very valid
6	Writing Method	91,66%	Very valid
7	Applications and Implications	100%	Very valid
8	Definitions and Explanations	83,33%	valid
9	Other style devices: narrative, humour, and analogy	91,66%	Very valid
	Average	**90,84%**	**Very Valid**

Table 5 Recapitulation of suggestions and comments from expert validators

No	Suggestions and Comments	Follow Up
1	The cover is more focused and colorful.	The image on the cover has been replaced and the colors have been updated.
2	Many misspellings	The writing has been checked and corrected.
3	Added surah name, translation, and source of interpretation.	The source of the tafsir has been added, as well as the name of the surah and its translation.
4	Added a barcode that contains the source and further information.	*Barcode* has been added
5	Added information on alternative tools and materials.	Other alternative information has been added.
6	Use sentences with language that is easily understood by the general public, do not use terms.	Sentences or terms have been changed to language that is easy to understand.
7	Add own research in bibliography Popular scientific books	Bibliography has been added.

According to Plomp & Nieveen (2013), testing the validity of popular scientific books by experts is one of the steps in the Educational Design Research (EDR) stage, especially in the prototyping phase through expert review. The aim is to determine whether the popular scientific books design that has been developed by researchers can be considered valid or not. The opinion of Rahmi et al. (2020) support this by emphasizing that product validation is needed so that the author can identify deficiencies in the product being developed, so as to produce teaching materials that are of high quality and suitable for use. Hidayat et al. (2018) also stated that through the validity test, experts can provide input, suggestions, and comments that are useful for further improvement.

The recapitulation of the popular scientific books validity test results by expert experts conducted by researchers showed a score of 90.84%, with very valid criteria and can be used without the need for improvement. This assessment is consistent with Akbar (2022), which states that the percentage of 90.84% is included in the validity criteria of 85.01%-100.00%, with a very valid criteria level or can be used without making improvements. As a follow-up, researchers took suggestions and comments from experts to improve the quality of popular scientific books products. The aspects tested in the popular scientific books validity included coherence, readability, vocabulary, active and passive sentences, format, writing method, application and implication, definition and explanation, and other styles of the tool. The instrument used for the validity test, which includes 9 components of assessment aspects, was adopted from Sarpani et al. (2020).

In the coherence aspect, an average percentage of 96.83% was obtained, with a very valid category and can be used without revision. This assessment also received support from Akbar (2022), who placed the percentage of 96.83% in the validity criteria of 85.01%-100.00%, with a validity level of very valid or can be used without improvement. This shows that each paragraph in the popular scientific books has one clear main idea, accompanied by connective words that connect between sentences, and sequential presentation of ideas.

The readability assessment component scored 83.33%, with valid criteria and can be used with minor revisions. Although still within the valid criteria, there needs to be a simplification in the use of language to improve readability, in accordance with the suggestions of the experts. This is in line with the opinion of Sarpani et al. (2020), that materials that are organized in a language that is easy to understand, concise, and interesting will facilitate readers' access to the contents of the book. Other aspects such as vocabulary, active and passive sentences, format, writing methods, applications and implications, definitions and explanations, and other styles of the tool have also been assessed with satisfactory results, indicating that the popular scientific books has met the required validity standards.

The readability test (one to one evaluation) was conducted on 6 users of the popular scientific books consisting of 3 students of the Tadris Biology Study Program at UIN Antasari Banjarmasin who have taken the Environmental Knowledge course and 3 communities around oil palm mills in Olongpinang Village, Paser Regency, East Kalimantan consisting of oil palm mill workers and surrounding communities. The results of the readability test can be seen in Table 6.

Table 6 Average readability test results of popular scientific books

No	Assessment Aspect	Percentage (%)	Category
1	Each section is easy to understand.	87,50%	Very Good
2	The overall content of the popular science book is complete.	87,50%	Very Good
3	The sentences used are easy to understand.	87,50%	Very Good
4	The image quality is good and the meaning can be understood.	83,33%	Very Good
5	No typographical or grammatical errors found	75%	Good
6	The photo on the cover is clear and understandable.	79,16%	Good
	Average	**83,33%**	**Very Good**

The readability test was conducted through a one-to-one evaluation, as stated by Rusdi (2018), to evaluate the intrinsic aspects of the product that has been developed as well as the impact of using the product by users or respondents. These intrinsic aspects include clarity of content or content, ease of use, discussion structure, and completeness of elements in popular scientific books. This test involved 6 respondents, consisting of 3 students of the Tadris Biology Study Program at UIN Antasari Banjarmasin who have completed the Environmental Knowledge course, and 3 residents of Olongpinang Village, Paser Regency who live around an oil palm plantation.

Based on the results in table 4.5, the average percentage is 83.33% with a very good category and can be used without revision. Akbar (2022) also stated that the percentage is included in the criteria of 81.00%-100.00% with very good criteria and can be used without improvement. Nevertheless, based on suggestions and comments from respondents, popular science books need to undergo minor improvements. According to Sugiyono (2015), product modification or improvement has great significance in improving the quality and ability of products that are superior and in accordance with learning objectives.

The first aspect assessed is the clarity of content or content that is easy to understand, which gets a percentage of 87.50% with a very good category and can be used without revision. According to Akbar (2022), the percentage is included in the score of 81.00%-100.00% with very good criteria. This shows that popular scientific books already include parts that are easy to understand, in line with the opinion of Helmi et al. (2017) about the advantages of popular scientific books in attracting readers with reviews that are easier to understand and language that facilitates understanding of the general public. This is also a session with the statement of Setiana, et al (2022) that popular scientific books have a simpler and more interesting approach. This aims to make even non-expert readers able to easily understand content that is usually considered complicated.

The recapitulation of the readability test results shows that the overall content of the popular scientific book is complete, with a percentage of 87.50% and very good criteria. This result is in accordance with the predetermined standards. Likewise, the aspect of words that are easy to understand, which gets a percentage of 87.50% with a very good category. The quality of images in popular scientific books is also considered good, with a percentage of 83.33% and a very good category. Nevertheless, respondents gave suggestions to clarify some of the images to make them more interesting and facilitate understanding. Although overall

popular science books received good ratings, there were still grammatical errors that needed to be corrected, with a percentage of 75% and a good category. Fajeriadi et al. (2019) also support the use of simple language, interesting styles, and conciseness in teaching materials to facilitate understanding and increase reading interest. This is in line with Suparman (2012) and Fahmi et al. (2021) view on the use of color images that can increase the attractiveness and understanding of readers. According to Helmi et al. (2017), it is important for popular science books to meet editing standards, including scientific and grammatical error checking.

The revised popular science book based on expert validation (expert review) and user validation (one to one evaluation) obtained a valid final prototype popular science book. the final prototype popular science book can be seen in Figure 3.



Figure 3 Front and Back Cover of Final Prototype and Barcode of Popular Scientific Book

The advantage of this final prototype popular science book is that it has gone through a systematic and thorough validation process to ensure that the final prototype popular science book meets the desired validity standards. The validation steps have included reviewing important aspects such as coherence, readability, vocabulary, active and passive sentences, applications, implications, definitions, explanations, writing methods, and other related styles. Through the stages of expert review and revision in accordance with the suggestions given, the final prototype popular science book became a valid book. This process aims to ensure that the popular science book developed is able to provide valid and accurate data for readers, and can be useful in increasing knowledge and understanding of the material discussed.

The advantage of this popular scientific book is that the content in the book comes from experiments or research so that the content is close to the community and is valid content because it comes from research. this is in accordance with Dalman (2014) and Fajeriadi et al. (2024) that popular scientific book writing should be written based on research results or material derived from the environment, so that it will create an essay that is in accordance with real conditions which will make it easier for readers to understand the content because people who read occasionally relate to their environment.

This final prototype popular science book has a brighter and more attractive cover and has drawn the topic to be discussed. In addition, the book has also explained the steps of making briquettes and the results of briquette testing so that the briquettes obtained are expected to be of high quality and useful for the community. This popular scientific book also has interesting pictures and a “did you know” column to attract readers. The content of popular scientific books that are interesting can not only be read by adults and students; popular scientific books are also interesting for children to read so that it is expected to increase community literacy. This is in accordance with Helmi (2017), one of the main advantages of digital and non-digital popular scientific books, the writing style of popular scientific books is its strength that attracts many

readers. this is in accordance with the opinion Pammai (2014) explains that BIP can be used by everyone, for example, students of various levels and the community.

This final prototype popular science book is ready to be distributed and printed. This popular science book is one of the solutions to reduce oil palm empty fruit bunch waste, especially in Olong Pinang village, Paser district, East Kalimantan. Briquettes processed from empty palm bunch waste can be an alternative energy source by utilizing waste for the community. The briquettes can also be sold to generate new economic value. This popular scientific book is also expected to increase community literacy.

CONCLUSION

The validity test of popular scientific books by experts, consisting of 3 lecturers of the Tadris Biology Study Program at UIN Antasari Banjarmasin, showed a final percentage of 90.84%, with very valid criteria. The readability test of popular scientific books by 6 respondents, including 3 students of the Tadris Biology Study Program at UIN Antasari Banjarmasin and 3 residents of Olong Pinang Village, Paser Regency, showed a final percentage of 83.33%, with very good criteria. This indicates that the popular science book on briquette processing of oil palm empty fruit bunch waste can be used without requiring further improvement. Researchers suggest that further research can develop similar popular science books in the form of briquette processing from other wastes such as unused wood shavings waste and others. In addition, the researcher also suggested that this development research could be carried out until the third EDR stage, namely the summative evaluation stage or the Assessment Phase.

REFERENCES

Abdullah, K., Zulfa, Z., & Jyoti, M. D. (2016). Pengaruh penambahan tandan kosong kelapa sawit terhadap kualitas briket berbahan utama limbah kulit singkong. *Jurnal Dinamika Penelitian Industri*, *27*(1), 49–58. DOI: https://doi.org/10.28959/jdpi.v27i1.1264

Akbar, S. (2022). *Instrumen perangkat pembelajaran*. Bandung: Remaja Rosadkarya.

Amalia, N., Kurniawan, E., & Jalaluddin, J. (2020, December). Pemanfaatan arang tandan kosong sawit sebagai bahan bakar alternatif dalam bentuk briket. Dalam *Prosiding Seminar Nasional Penelitian LPPM UMJ* (Vol. 2020). Institut Pertanian Bogor. Retrieved from https://jurnal.umj.ac.id/index.php/semnaslit/article/view/7812

Ardila. (2014). Pemanfaatan limbah kelapa sawit (*Elaeis guineensis Jack*). *2*, 21.

Artiningsih, A. N. K. A. (2022). Lingkungan zero waste melalui pengolahan limbah kelapa sawit menjadi briket. *Jurnal Agrifoodtech*, *1*(2), 10–16. DOI: https://doi.org/10.56444/agrifoodtech.v1i2.199

Dalman. (2014). *Menulis karya ilmiah*. Bandar Lampung: UM Lampung Press.

Dhora, A., & Sihotang, A. J. (2022). Pemanfaatan tandan kosong kelapa sawit sebagai bahan baku briket dengan perekat tepung kanji. *Jurnal Sains dan Ilmu Terapan*, *5*(1), 14–17. DOI: https://doi.org/10.59061/jsit.v5i1.63

Dinas Perkebunan dan Perternakan Kabupaten Paser. (2023). 77.484 hektare lahan sawit di Paser belum terdaftar. Indonesia: DPDP Kabupaten Paser. Retrieved from https://disbunak.paserkab.go.id/detailpost/77-484-hektare-lahan-sawit-di-paser-belum-terdaftar

Fahmi, F., Fajeriadi, H., & Irhasyuarna, Y. (2021). Feasibility of the Prototype of Teaching Materials on the Topic of Classification of Living Things based on the Advantage of Local Wetland. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, *3*(2), 113-118. DOI: http://dx.doi.org/10.20527/bino.v3i2.10322

Fajeriadi, H., Zaini, M., & Dharmono. (2019). The validity of the gastropods popular scientific book in the Pulau Sembilan Kotabaru coastal area. *Journal of Biology Education*, *8*(2), 142–149. DOI: https://doi.org/10.15294/jbe.v8i2.29519

Fajeriadi, H., Zaini, M., Dharmono, D., Nugroho, B. A., Fahmi, F., & Fitriani, A. (2024). The popular scientific book-based coastal gastropod's diversity as local potential: Practicality and effectiveness on student's critical thinking ability. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *10*(2), 580-590. DOI: https://doi.org/10.22219/jpbi.v10i2.32255

Helmi, R. L., Safitri, M., Fazi, R., Mahelingga, D. E. I. R., Suhendra, M. F., Hartiningsih, R. W., Indrasari, N. P., Kusuma, S. H., Taslima, R. H., Sasiwi, P., Dewi, S. P., Helmiawan, M., & Puspita, A. D. (2017). *Panduan penelaahan & penilaian naskah buku ilmiah*. Jakarta: LIPI Press.

Hidayat, S., Saputri, Wu., & Satriani, M. (2018). *Metodologi penelitian biologi*. Palembang: Universitas Muhammadiyah Palembang Press.

Latifah, N., Dharmono, D., & Zaini, M. (2020). Validasi buku ilmiah populer keanekaragaman spesies famili Anacardiaceae untuk meningkatkan keterampilan berpikir kritis mahasiswa. *Quantum: Jurnal Inovasi Pendidikan Sains*, *11*(2), 196–210. DOI: https://doi.org/10.20527/quantum.v11i2.8806

Pammai, K. (2014). Studi keanekaragaman anggrek di Kabupaten Merauke untuk pengembangan buku ilmiah populer sebagai upaya pelestarian sumber daya lokal bagi masyarakat di Kabupaten Merauke (Doctoral dissertation, Universitas Negeri Malang).

Plantation Key Technology. (2022). Cara singkat meningkatkan produksi sawit dengan teknologi PKT. Retrieved from https://pkt-group.com

Plomp, T., & Nieveen, N. (2013). *An introduction. Educational design research*. Retrieved from https://digilibadmin.unismuh.ac.id/upload/26518-Full_Text.pdf#page=12

Rahmi, B., Riefani, M. K., & Utami, N. H. (2022). Validitas buku ilmiah digital keanekaragaman tumbuhan semak di areal reklamasi pertambangan batubara. *Edukatif: Jurnal Ilmu Pendidikan*, *4*(4), 5818–5826. DOI: https://doi.org/10.31004/edukatif.v4i4.2997

Sarpani, M. A., Dharmono, D., & Mahrudin, M. (2020). Validitas buku ilmiah populer etnobotani tumbuhan *Fagraea racemosa* Jack ex Wall. di kawasan hutan Bukit Tamiang Kabupaten Tanah Laut. *Wahana-Bio: Jurnal Biologi dan Pembelajarannya*, *12*(2), 96–105. DOI: https://doi.org/10.20527/wb.v12i2.8491

Setiana, E. P., Hakim, N., Yudiyanto, Y., & Suhendi, S. (2022). Pengembangan buku ilmiah populer keanekaragaman mangrove di Pasir Sakti sebagai sumber belajar pada materi keanekaragaman hayati. *Jurnal Bioeducation*, *9*(1), 16–25. DOI: https://doi.org/10.29406/bioed.v9i1.3178

Sugiyono. (2015). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Bandung: PT Alfabet.

Suparman, M. A. (2012). *Desain instruksional modern*. Jakarta: Erlangga.

Susanto, J. P., Santoso, A. D., & Suwedi, N. (2017). Perhitungan potensi limbah padat kelapa sawit untuk sumber energi terbarukan dengan metode LCA. *Jurnal Teknologi Lingkungan*, *18*(2), 165–172. DOI: https://doi.org/10.29122/jtl.v18i2.2046

Tessmer, M. (1993). *Planning and conducting formative evaluation*. Cogan Page.

Zaini, M. (2018). *Penelitian desain pendidikan: Aplikasi teori ke dalam praktik*. Yogyakarta: Penebar Media Pustaka.