

# Development Of Liveworksheet Integrated E-Lkpd With Ethno-Vlog of Manengteung Hill Ecology and Ecosystem Material to Train Students' Science Literacy

**Azqia Noviatun Nisa<sup>1</sup>, Sudarmin<sup>2</sup>, Risa Dwita Hardianti<sup>3</sup>, Hendra Febriyanto<sup>4</sup>,  
Fredy Supriadi<sup>5</sup>**

Universitas Negeri Semarang<sup>12345</sup>  
E-mail: azqianisa91@students.unnes.ac.id

## Abstrak

Hasil PISA 2022 menunjukkan rendahnya literasi sains peserta didik di Indonesia, yang berdampak pada kesulitan memahami dan mengaitkan konsep sains dengan permasalahan nyata. Penelitian ini bertujuan untuk mengembangkan media pembelajaran Liveworksheet terintegrasi E-LKPD bermuatan etno-vlog Bukit Manengteung pada materi ekologi dan ekosistem guna melatih literasi sains peserta didik. Metode penelitian yang digunakan adalah research and development (R&D) dengan model pengembangan 4D. Subjek penelitian adalah peserta didik kelas VII SMP Negeri 2 Ciledug tahun ajaran 2024/2025. Hasil validasi menunjukkan bahwa media dinyatakan sangat layak dengan skor Aiken's V di atas 0,87. Penerapan media menunjukkan pengaruh signifikan terhadap peningkatan literasi sains peserta didik dengan nilai N-Gain sebesar 0,68. Aspek literasi sains yang ditingkatkan meliputi konten, konteks, kompetensi, dan sikap ilmiah. Media ini dinilai menarik, mudah digunakan, serta mampu mengaitkan konsep sains dengan nilai budaya lokal sehingga menjadikan pembelajaran lebih kontekstual dan bermakna.

Kata Kunci: E-LKPD; etno-vlog; literasi sains

## Abstract

PISA 2022 results show the low science literacy of students in Indonesia, which impacts the difficulty of understanding and linking science concepts with real problems. This study aims to develop Liveworksheet learning media integrated with E-LKPD with ethno-vlog Bukit Manengteung on ecology and ecosystem material to train students' science literacy. The research method used is research and development (R&D) with the 4D development model. The research subjects were seventh-grade SMP Negeri 2 Ciledug students in the 2024/2025 school year. The validation results showed that the media was declared feasible with an Aiken V score above 0.87. The media application significantly improved students' science literacy with an N-Gain value of 0.68. The aspects of science literacy that are improved include content, context, competence, and scientific attitudes. This media is considered interesting, easy to use, and able to link science concepts with local cultural values to make learning more contextual and meaningful.

Keywords: E-LKPD; ethno-vlog; science literacy

## INTRODUCTION

The rapid development of technology and information in the era of the industrial revolution 4.0 requires the world of education to transform in learning approaches and media. The era of education 4.0 requires students to adapt to the times, especially in the use of technology as a learning support instrument. (Setiyaningsih & Wiryanto, 2022). Science literacy is an important factor in supporting 21st-century life skills. Indonesia needs to develop a culture of literacy that includes literacy in reading and writing, numeracy, science, digital, financial, and cultural and citizenship (Nudiati, 2020).

Students' understanding of science literacy in science learning is still relatively low. The 2022 PISA results announced by OECD 2023 show that Indonesia's reading literacy score decreased in early 2022, The PISA reading literacy score reached 359 points, 12 points less than the 2018 PISA results (OECD, 2023). This data reflects that the science literacy of students in Indonesia still needs to be improved to be able to analyze and apply science concepts in solving everyday problems (Atmojo et al., 2024)

The learning model approach and the development of teaching media play an important role in improving students' science literacy (Yuanita & Ibrahim, 2015). Learner worksheets (LKPD) are one method that can be used to train students' skills during the learning process (ALDIYAH, 2021). Students should be able to master science literacy well, but in reality, conventional teaching methods cause students' science literacy to be low. Observations at SMP Negeri 2 Ciledug showed that teachers still rely on textbooks and printed worksheets as the main teaching materials. Science literacy indicators have not been optimally applied in teaching media, so students have limitations in understanding and applying scientific concepts in real life. (Haerani et al., 2020).

Ethno-vlog is a combination of the words *ethnoscience* and *vlog*. The term *ethnoscience* comes from *ethnos* in Yunnan, which means "nation," and *science* in Latin, which means "knowledge." *Ethnoscience* refers to the knowledge a society possesses, obtained through certain methods that are by tradition and can be tested empirically (Sudarmin, 2014)

Ethno-vlogs as a learning media are declared effective in improving concept understanding and shaping the character of students. (Uriel et al., 2020). Applying culture and local wisdom in science learning allows students to interact directly with the process of forming new knowledge. Many unique cultures contain indigenous science that has not been fully revealed. Reconstructing culture into science allows learners to understand more deeply the process of forming their academic and cultural insights (Sudarmin, 2018).

The novelty of this research compared to previous studies lies in the use of interactive learning media. Previous studies have shown that the development of interactive learning media has the potential to improve science literacy (Andriyani et al., 2020). Liveworksheet integrated with E-LKPD is one of the innovative solutions in science learning. Ethno-vlog-based learning links the concepts of ecology and ecosystems with the surrounding environment, so that students can understand the material in a more contextual and applicable manner.

This research was conducted to develop Liveworksheet media integrated with E-LKPD with ethno-vlog Bukit Manengteung as an alternative learning on ecology and ecosystem material. The goal is to train students' science literacy thoroughly, based on local potential, and with a modern technology approach. This research is expected to be able to answer the problem of low science literacy while strengthening local cultural identity in science learning. Developing relevant, interesting, and interactive learning media, the learning process will be more fun and meaningful for students. This approach is in line with government policy in implementing the independent curriculum, which emphasizes project-based learning and local wisdom. This media deserves to be developed and widely implemented in science learning in junior high schools, so that students become a generation that is capable of science while loving and preserving the nation's culture..

## METHOD

Objectives of this study include (1) producing Liveworksheet integrated E-LKPD with Ethno-Vlog Bukit Manengteung to train students' science literacy; (2) identifying the effect of Liveworksheet integrated E-LKPD with Ethno-Vlog Bukit Manengteung ecology and ecosystem materials in training students' science literacy; (3) analyzing the advantages and limitations of Liveworksheet integrated E-LKPD with Ethno-Vlog Bukit Manengteung ecology and ecosystem materials. This research uses a development research approach (Research and Development / R&D) with the 4D development model.

The stages of the 4D development model consist of four stages, namely (1) define, which includes curriculum analysis, teaching media analysis, task and concept analysis, and specification

of learning objectives. (2) Design includes the preparation of research instruments, media selection, and initial product design format. (3) develop, which includes product development, validation, and product assessment by 1 lecturer and 2 junior high school teachers, respectively, as well as limited product readability trials by students of class VII A SMP Negeri 2 Ciledug. (4) disseminate, which includes the stages of product dissemination to schools and publication of journal articles.

Data collection techniques in this study were carried out through several instruments, namely observation sheets, interview guidelines, expert validation questionnaires, student readability questionnaires, and pretest and posttest science literacy questions. Validation was carried out by material experts and media experts to assess the feasibility of content, appearance, and media suitability with the curriculum. The readability questionnaire was given to students to assess the clarity of language, appearance, and ease of understanding of the media. Meanwhile, pretests and posttests were used to determine the extent of the influence of media use on improving students' science literacy skills.

The data obtained were analyzed using several methods, namely Aiken's V validity test to determine the validity of the instrument, as well as normality and homogeneity tests to see the distribution of data. To determine the effect of media, a paired sample t-test was used, and to measure the improvement of science literacy skills, the N-Gain calculation was used. All analyses were conducted to ensure that the media developed were valid, practical to use, and effective in improving students' science literacy (Merta et al., 2020)..

## RESEARCH RESULTS AND DISCUSSION

Research was conducted at SMP Negeri 2 Ciledug in the even semester of the 2024/2025 school year with the aim of developing Liveworksheet integrated E-LKPD media with ethno-vlog Bukit Manengteung content on ecology and ecosystem material. The results showed that the media developed had met the criteria of valid, practical, and effective in training students' science literacy. Validation by media and material experts obtained an Aiken's V value of 0.87 and above, which means it is very valid for use in learning.

Results of the readability questionnaire, students gave positive responses to the appearance, language, and ease of use of the media. In addition, this media is considered capable of linking science concepts with local culture found in Bukit Manengteung. This provides a more contextual and meaningful learning experience for students. The learning process is also more interactive and fun because it is enriched with elements of local wisdom-based video vlogs (Martareza, 2025).

Effectiveness of the media is seen from the pretest results, which show an average score of 45.69, while the posttest results increased to 81.72, so there is a significant difference. The Paired Sample t-Test test resulted in a significance of 0.00 ( $<0.05$ ), which indicates that the use of this media has a real effect on increasing students' science literacy.

The results of the N-Gain analysis are on average 0.68, which is included in the medium to high category, with most students showing an increase in scores above 70%. Thus, this E-LKPD media is declared effective for improving science literacy skills, especially in the aspects of content, context, competence, and scientific attitudes. In addition to improving learning outcomes, this media is also able to build students' awareness of environmental conservation and local cultural values. Another advantage is the flexibility of access because it is digital-based, which allows students to learn independently and collaboratively. Overall, the learning media developed succeeded in achieving the research objectives, namely producing products that are valid, practical, and effective in the context of science learning based on science literacy and ethnosience.

### **The Feasibility of E-LKPD Integrated Liveworksheet with Ethno-Vlog of Bukit Manengteung**

Validation of the liveworksheet integrated E-LKPD with ethno-vlog Bukit Manengteung was conducted to assess the feasibility and obtain input to improve the developed media. The validation results show that this media has met the academic standards needed to improve students' science literacy.

The developed E-LKPD has a well-organized structure, including several main components, such as (1) the initial display includes an introduction, table of contents, introduction (1) core activities, containing problem-based learning and science literacy aspects (3) the final display

includes reflection, science reconstruction, glossary, and table of contents. Each component is designed to provide a more interactive and contextual learning experience, so that learners can understand the material in depth and apply it in everyday life, as presented in Figure 1 below.

**Figure 1.** Cover view of E-LKPD integrated liveworksheet with Etno-Vlog Bukit Manengteung  
Link E-LKPD :

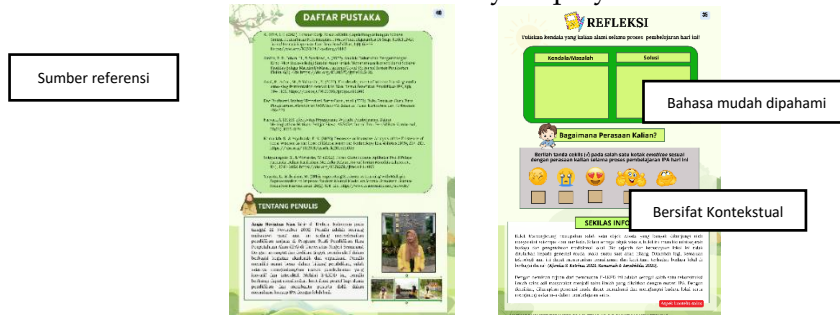
[https://drive.google.com/drive/folders/189Tsnnd5tNxk62sSgSGMTf9V\\_AYdKvw8?usp=sharing](https://drive.google.com/drive/folders/189Tsnnd5tNxk62sSgSGMTf9V_AYdKvw8?usp=sharing)



**Gambar 2.** Intiali of E-LKPD



**Gambar 3.** Core activity display of E-LKPD



**Gambar 4.** End view of E-LKPD

Media products developed also have characteristics in training science literacy. Science literacy indicators in the product contain four aspects of indicators, namely aspects of attitude, knowledge content, competence, and context, which allow students to develop critical thinking skills, understand scientific concepts systematically, and relate the material to the local wisdom of Bukit Manengteung, as presented in Figure 5.



**Figure 5.** Aspects of science literacy indicators in E-LKPDs

Liveworksheet is also equipped with an ethno-vlog video integrated in the scientific reconstruction section. The video acts as a means of exploration for learners to understand how the concepts of ecology and ecosystems are applied in everyday life, especially in the cultural and environmental context of Bukit Manengteung. The scientific reconstruction and ethno-vlog content in the E-LKPD are presented in Figure 6 .



**Figure 6.** Ethno-Vlog and Scientific Reconstruction of Bukit Manengteung

The local wisdom listed in the E-LKPD integrated liveworksheet media is Bukit Manengteung. Bukit Manengteung, as an ethnosience object, has high cultural and historical value. The following is presented as Figure 7 of the scientific reconstruction at Bukit Manengteung.



**Figure 7.** Reconstruction of the National Monument

*Image source: Personal document*

Indigenous science: Many marine fossils, such as shells and mollusks, are found, which are believed to be a manifestation that Bukit Manengteung is a large ocean.

Scientific science: fossilized shells and mollusks are part of an ancient marine ecosystem that shows that Bukit Manengteung was once the bottom of the sea



**Figure 8.** Reconstruction of manoa plants and trees around Bukit Manengteung

*Image source : Personal document*

Native science: Many plants thrive around Bukit Manengteung because this hill is a reservoir that was buried by Tangkuban Perahu in the story of Sangkuriang. One plant that is believed to be rare and has a symbol of goodness and benefits for local residents is the Manoa tree. Locals believe manoa fruit can be used as traditional medicine because the tree grows in fertile soil due to the prayers of ancestors.

Science: Plants can thrive due to several scientific factors, such as the weathering of rocks over thousands of years, which can enrich the soil with essential minerals, such as phosphorus, potassium, and magnesium, so that plants can thrive. The river below Bukit Manengteung is also one of the factors that cause the soil to be rich in minerals and avoid drought. The manoa tree, or *Annona cherimola*, that grows in Bukit Manengteung is a species of edible fruit-producing plant in the genus *Annona*, of the *Annonaceae* family. The tree is closely related to srikaya (*Annona squamosa*) and soursop (*Annona muricata*) and is known as a traditional medicine due to its high vitamin C and antioxidant content. Manoa fruit is commonly used to treat various diseases such as fever, cough, worms, headache, and inflammation.



**Figure 9.** Reconstruction of the hill ecosystem

*Image source: Personal document*

Indigenous science: Belief of the surrounding community believes that the hill is one of the relics of the Sangkuriang story, namely tangkuban perahu, because the shape of the hill resembles a Tangkuban Perahu (inverted boat) so that this hill becomes sacred and is believed to be a place to put offerings (sesajen).

Scientific Reconstruction: Beliefs about sacred places and used as ritual places and put offerings, which involve organic materials such as flowers, leaves, fruit, and food. These organic materials will decompose to enrich humus and increase soil fertility.

This approach not only strengthens learners' understanding of ecology and ecosystem concepts, but also fosters a sense of love for local cultural heritage. This process is aligned with the project-based learning approach and real-life contexts. Cultural reconstruction leads learners to think critically and compare local science with scientific knowledge. This forms a complete and meaningful understanding of science.

The feasibility of the media was validated by 1 lecturer and 2 teachers, consisting of 2 aspects, namely the feasibility of graphics and science literacy. In addition to the material and media feasibility aspects, this liveworksheet has been tested through the validity test of pretest and posttest questions. This test ensures that each question is able to measure science literacy indicators and learning media developed in accordance with academic standards, and is able to effectively improve students' understanding. The results of media validity that have been assessed by three validators can be seen in Table 1.

**Table 1.** Media Validity Results

Butir	Penilai			S1	S2	S3	ΣS	n(c-1)	V	Ket.
	I	II	III							
Butir 1	4	4	4	3	3	3	9	9	1,00	SEDANG
Butir 2	4	4	4	3	3	3	9	9	1,00	SEDANG
Butir 3	4	4	3	3	3	2	8	9	0,89	SEDANG
Butir 4	4	4	4	3	3	3	9	9	1,00	SEDANG
Butir 5	3	4	4	2	3	3	8	9	0,89	TINGGI
Butir 6	3	4	4	2	3	3	8	9	0,89	TINGGI
Butir 7	4	4	4	3	3	3	9	9	1,00	TINGGI
Butir 8	4	4	4	3	3	3	9	9	1,00	TINGGI
Butir 9	3	4	4	2	3	3	8	9	0,89	SEDANG
Butir 10	4	4	4	3	3	3	9	9	1,00	SEDANG
Butir 11	4	4	4	3	3	3	9	9	1,00	SEDANG
Butir 12	3	4	4	2	3	3	8	9	0,89	SEDANG
Butir 13	4	4	4	3	3	3	9	9	1,00	SEDANG
Butir 14	3	4	4	2	3	3	8	9	0,89	SEDANG
Butir 15	3	4	4	2	3	3	8	9	0,89	SEDANG
Butir 16	3	4	4	2	3	3	8	9	0,89	SEDANG
Butir 17	4	4	4	3	3	3	9	9	1,00	SEDANG

Butir	Penilai			S1	S2	S3	ΣS	n(c-1)	V	Ket.
	I	II	III							
Butir 1-17	61	68	67	44	51	50	145	153	0,95	TINGGI

Results of the assessment from the validators showed that the liveworksheet integrated E-LKPD media with ethno-vlog Bukit Manengteung aspects of graphics and science literacy had a high level of validity. Aiken's V value obtained ranges from 0.89 to 1.00, which shows that all aspects assessed fall into the valid category and the media developed meets high validity standards.

### **Effect of Application of Liveworksheet Integrated E-LKPD with Ethno-Vlog of Bukit Manengteung**

Application of Liveworksheet integrated E-LKPD media in the learning process showed a significant effect on improving students' science literacy. This is shown from the results of the pretest and posttest, which were statistically analyzed using the Paired Sample t-Test in Table 2.

**Table 2.** Paired Sample t-Test Test Results Pretest Posttest data



Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Sebelum diberikan - Setelah diberikan	-36.03448	6.32163	1.17390	-38.43910	-33.62986	-30.696	28	.000

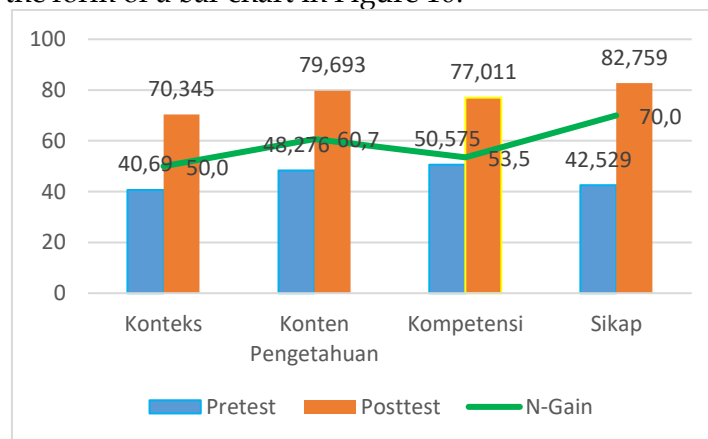
Based on Table 1, the results of the paired sample t-test on the pretest-posttest data show that there is a significant effect on the science literacy skills of students after the application of liveworksheet media integrated with E-LKPD with Ethno-Vlog Bukit Manengteung content. This is indicated by the value of  $t_{count} = 0.00 < t_{table} = 0.05$ , so  $H_0$  is not accepted and  $H_a$  is accepted. This improvement not only occurs quantitatively, but also can be seen from the higher enthusiasm of students during the learning process.

Effect of media use was also analyzed using the N-Gain calculation to determine the magnitude of the increase. The results of the N-Gain test calculation can be seen in Table 3.

**Table 3. N-Gain Test of Science Literacy Skills**

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
NGain	29	.42	1.00	.6833	.15527
Valid N (listwise)	29				

N-Gain test results from the pretest and posttest questions show that there is an increase in students' science literacy after using the media. Of the 29 samples tested, the N-Gain value has a range between 0.42 - 1.00, with an average of 0.68 and a standard deviation of 0.156. This indicates that the use of the E-LKPD-integrated live worksheet with Bukit Manengteung ethno-vlog can improve learners' understanding and skills in science literacy, enabling them to better analyze and understand scientific concepts. Learners also show a high interest in the content of the material presented in the form of ethno-vlog videos. The following presents the results of the N-Gain test for each sub-indicator in the form of a bar chart in Figure 10.



**Figure 10. Achievement of each sub-indicator**

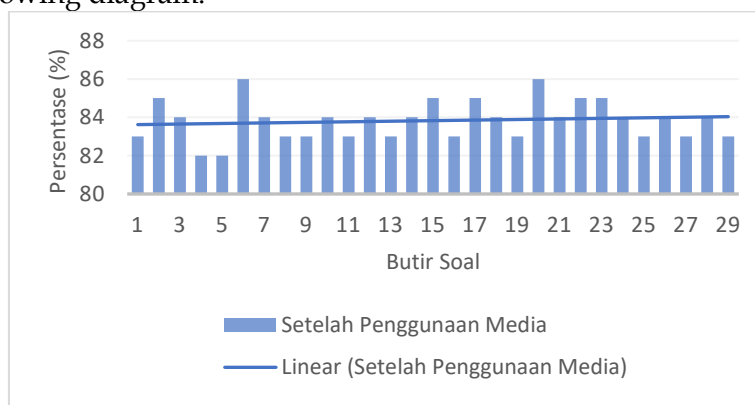
N-Gain test analysis showed that there was a significant increase in each sub-indicator of students' science literacy skills. The highest N-gain results are in the aspect of attitude indicators, with a value of 0.82, which is included in the moderate category. The moderate category in this indicator is due to the ability of VII A class students to find and explain the various opinions needed to understand ecology and ecosystem material. This is in line with Yusuf & Hamami, (2022) who state that students' understanding is not only measured by their ability to remember facts or concepts they know, but also need to have the ability to understand and analyze various concepts in depth.

Learning activities with this media also have an impact on the scientific attitude of students. They become more active in asking questions, discussing, and expressing opinions during the

learning process. The application of local culture-based media makes learners more confident because they feel close to the context being studied. In addition, they showed interest in the surrounding environment, especially in observing the interaction between living things around Bukit Manengteung. With fun and meaningful learning, students not only understand the material but are also encouraged to apply scientific concepts in real life. This is an indicator of the success of the media in building 21st-century skills, especially in critical thinking and problem solving. Therefore, this media deserves to be used as an example to be further developed in other subjects.

### Advantages of Using Bukit Manengteung Ethno-Vlog Media

The use of E-LKPD integrated liveworksheet with Bukit Manengteung Ethno-Vlog has been proven to have a positive impact on students in the learning process. The students' readability questionnaire given aims to evaluate the feasibility of the E-LKPD integrated liveworksheet with Bukit Manengteung Ethno-Vlog based on students' responses to the media provided. The diagram of the results of the questionnaire test of students' responses to the developed media is presented in Figure 11 of the following diagram.



**Figure 11. Questionnaire for Students' Responses to the Use of E-LKPD**

Based on the questionnaire of students' responses to the use of E-LKPD in Figure 8, it can be seen that most students gave positive responses to the learning media used. From the data obtained, it can be seen that the percentage of correct answers is above 80%, indicating the effectiveness of the learning media used. This live worksheet has interactive and accessible characteristics, so that students can access the material anytime and anywhere. This media is equipped with a barcode that is connected to the Ethno-Vlog, supporting images, and Google Forms-based practice questions to facilitate the evaluation of students' understanding.

The main advantage of this media is its ability to integrate local cultural values into science learning. The ethno-vlog media makes the concepts of ecology and ecosystems easier to understand because they are associated with real phenomena in the surrounding environment. The use of vlog videos from Bukit Manengteung shows the direct interaction between humans, animals, plants, and abiotic elements in an ecosystem. This allows students to directly witness concepts that were previously only read in books. This visualization fosters high interest and curiosity in learners. They become more sensitive to environmental problems and more easily understand the importance of ecosystem conservation.

These advantages make this media very promising to be developed further. In the context of 21st-century education, this media can bridge the curriculum demands, student needs, and technological and cultural developments. Thus, this media is not only cognitively effective, but also forms an attitude of environmental care.

Media developed not only has many advantages, but this media is still being tested in a limited scope, so the research results cannot be generalized. Limited access to technology and the internet is an obstacle for students who do not have personal devices. Thus, the implementation of this media needs to be adjusted to the conditions and infrastructure available in each school.

Another limitation lies in the ability of teachers to manage digital media. Not all teachers have sufficient digital literacy to develop media based on online platforms such as Liveworksheet. Continuous training and mentoring are needed so that teachers can utilize the media optimally. This



media still needs more varied content development to keep it interesting and not boring if used in the long run. Some teachers also said that although the media is interesting, the time needed to prepare and compile E-LKPD is quite long. Therefore, a collaborative team is needed so that media development can be more efficient. Despite these limitations, this media remains an important breakthrough in fun and contextualized science learning.

## CONCLUSIONS

Based on the results of the research and data analysis that have been carried out, it can be concluded that the Liveworksheet integrated E-LKPD media with ethno-vlog content of Bukit Manengteung is declared feasible to use in learning science ecology and ecosystem material. The results of material and media expert validation show that this media is very valid, both in terms of content, appearance, and conformity with the curriculum.

The effectiveness of this media is proven to be able to significantly improve students' science literacy. This is evidenced by the increase in posttest results compared to pretest and N-Gain value of 0.68, which is in the medium to high category. Aspects of science literacy, including content, context, competence, and attitude, all increased after the application of the media.

The use of ethno-vlogs from Bukit Manengteung as part of the media makes learning more real, meaningful, and in accordance with the students' environment. The interactive features of the Liveworksheet add practical value and ease of use by both teachers and learners. The systematic design and interesting content in the media encourage active involvement of learners during the learning process. Overall, the developed media have met the aspects of validity, practicality, and effectiveness

## REFERENCES

- ALDIYAH, E. (2021). Lembar Kerja Peserta Didik (Lkpd) Pengembangan Sebagai Sarana Peningkatan Keterampilan Proses Pembelajaran Ipa Di Smp. *TEACHING : Jurnal Inovasi Keguruan Dan Ilmu Pendidikan*, 1(1), 67–76. <https://doi.org/10.51878/teaching.v1i1.85>
- Andriyani, N., Hanafi, Y., Safitri, I. Y. B., & Hartini, S. (2020). Penerapan Model Problem Based Learning Berbantuan Lkpd Live Worksheet Untuk Meningkatkan Keaktifan Mental Siswa Pada Pembelajaran Tematik Kelas VA SD Negeri Nogopuro. *Prosiding Pendidikan Profesi Guru*, September, 122–130. <http://eprints.uad.ac.id/21216/1/12>. Novi Andriyani-PGSD %28122-130%29.pdf
- Atmojo, S. E., Wardana, A. K., & Muhtarom, T. (2024). The Effectiveness of An Internet of Things (IoT)-based Virtual Science Laboratory on Nervous System Material in Science Course. *Jurnal Paedagogy*, 11(1), 71. <https://doi.org/10.33394/jp.v11i1.7938>
- Haerani, S. A. S., Setiadi, D., & Rasmi, D. A. C. (2020). Pengaruh Model Inkuiri Bebas Terhadap Kemampuan Literasi Sains. *Jurnal Pijar Mipa*, 15(2), 140–144. <https://doi.org/10.29303/jpm.v15i2.1682>
- Martareza. (2025). Analisis Kebutuhan Pengembangan Media Ajar Etno-Vlog Batik Gentongan Tanjung Bumi Madura pada Siswa SMP. *JURNAL KONSTRUKTIVISME*, 17(1), 134–142. <https://doi.org/10.35457/konstruk.v17i1.3972>
- Merta, I. W., Artayasa, I. P., Kusmiyati, K., Lestari, N., & Setiadi, D. (2020). Profil Literasi Sains dan Model Pembelajaran dapat Meningkatkan Kemampuan Literasi Sains. *Jurnal Pijar Mipa*, 15(3), 223–228. <https://doi.org/10.29303/jpm.v15i3.1889>
- Nudiati, D. (2020). Literasi Sebagai Kecakapan Hidup Abad 21 Pada Mahasiswa. *Indonesian Journal of Learning Education and Counseling*, 3(1), 34–40. <https://doi.org/10.31960/ijolec.v3i1.561>
- OECD. (2023). Pisa 2022 Results. In *Factsheets: Vol. I*. [https://www.oecd-ilibrary.org/education/pisa-2022-results-volume-i\\_53f23881-en%0Ahttps://www.oecd.org/publication/pisa-2022-results/country-notes/germany-1a2cf137/](https://www.oecd-ilibrary.org/education/pisa-2022-results-volume-i_53f23881-en%0Ahttps://www.oecd.org/publication/pisa-2022-results/country-notes/germany-1a2cf137/)

- Setiyaningsih, S., & Wiryanto, W. (2022). Peran Guru Sebagai Aplikator Profil Pelajar Pancasila Dalam Kurikulum Merdeka Belajar. *Jurnal Ilmiah Mandala Education*, 8(4), 3041–3052. <https://doi.org/10.58258/jime.v8i4.4095>
- Sudarmin. (2014). Pendidikan karakter, etnosains dan kearifan lokal. *Fakultas Matematika Dan Ilmu Pengetahuan Alam, UNNES*, 1–139. [http://lib.unnes.ac.id/27040/1/cover\\_PENDIDIKAN\\_KARAKTER\\_SUDARMIN.pdf](http://lib.unnes.ac.id/27040/1/cover_PENDIDIKAN_KARAKTER_SUDARMIN.pdf)
- Sudarmin, & Sumarni, W. (2018). Increasing character value and conservation behavior through integrated ethnoscience chemistry in chemistry learning: A Case Study in the Department of Science Universitas Negeri Semarang. *IOP Conference Series: Materials Science and Engineering*, 349(1). <https://doi.org/10.1088/1757-899X/349/1/012061>
- Uriel, C., Sergio, S., Carolina, G., Mariano, G., Paola, D., & Martín, A. (2020). Improving the understanding of Basic Sciences concepts by using Virtual and Augmented Reality. *Procedia Computer Science*, 172, 389–392. <https://doi.org/10.1016/j.procs.2020.05.165>
- Yuanita, L., & Ibrahim, M. (2015). Supporting Students in Learning with Multiple Representation to Improve Student Mental Model on Atomic Structure. *Science Education International*, 26(2), 104–125. <http://www.icasonline.net/seiweb/>
- Yusuf, M., & Hamami, T. (2022). Peran Guru Pendidikan Agama Islam Menyiapkan Peserta Didik dalam Menghadapi Tes Asesmen Kompetensi Minimum. *Jurnal Basicedu*, 6(2), 3012–3024. <https://doi.org/10.31004/basicedu.v6i2.2571>