

Training on Environmentally Friendly Science Media Creation for Elementary School Teachers

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ABSTRACT

This community service program was carried out as an effort to enhance the ability of elementary school teachers to design and develop creative, economical, and environmentally friendly science learning media. The program took place at SD Negeri Dadakitan 1, involving teachers and fifth-grade students as participants. The method employed was a qualitative descriptive approach consisting of three main stages: (1) initial observation and needs analysis of teachers regarding learning media, (2) implementation of training through material presentation, demonstration, and hands-on practice, and (3) reflection and evaluation of the program outcomes. The results indicated a significant improvement in teachers' pedagogical competence, creativity, and environmental awareness after participating in the training. Teachers were able to utilize recycled materials such as plastic bottles, straws, and balloons to create innovative learning media for the topic of the respiratory system. The produced media were not only attractive and easy to make but also effective in helping students understand abstract science concepts through concrete learning experiences. Moreover, students showed high enthusiasm and active engagement during the learning process. Overall, this training program successfully promoted the development of innovative and eco-friendly learning media while fostering ecological awareness and sustainable behavior among both teachers and students.

Keywords: Teacher Training, Environmentally Friendly Science Media, Science Learning Media, Elementary School Teachers, Environmental Education.



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INTRODUCTION

Primary education does not only emphasize mastery of cognitive aspects, but also plays a strategic role in developing students' creativity, literacy, and character. In science learning at the elementary school level, teachers are required to create learning experiences that are active, contextual, and meaningful. One effort is to use creative, environmentally friendly learning media so that abstract science concepts can be understood more concretely and be closer to students' daily lives. Learning

media function as a bridge between theory and real-life phenomena. However, learning practices in elementary schools are still dominated by conventional methods with limited supporting media, resulting in students' understanding of science concepts not yet being optimal. This condition indicates the need to improve teachers' capacity to design innovative, economical, and environmentally based learning media.

Various previous studies have shown that environmentally friendly learning media are effective in improving the quality of science learning. Putra et al. (2020) and Denico (2020) emphasized that the use of recycled materials as learning media can enhance classroom interactivity while fostering environmental awareness. Silviana and Prayogi (2023) also demonstrated that learning media made from recycled materials have high validity and receive positive responses from students. These findings reinforce the notion that media based on reused materials are not only pedagogically effective but also contribute to students' ecological awareness. In addition to learning media based on recycled materials, other studies have highlighted the effectiveness of digital media and simple teaching aids. Arbarista and Tyas (2025) and Rahmawati et al. (2025) showed that interactive media and simple teaching aids can improve learning outcomes and students' understanding of science concepts. In the context of project-based learning, Magfirah and Inganah (2025) emphasized that integrating Project-Based Learning with the creation of learning media from recycled materials can increase students' learning enthusiasm and social skills. Research conducted by Arbarista and Tyas (2025) demonstrated that the development of interactive digital media on Google Sites significantly improved science learning outcomes, with positive student responses exceeding 90%. These findings are consistent with the results of Rahmawati et al. (2025), who developed a respiratory teaching aid (ALPER) using simple materials such as plastic bottles, balloons, and hoses. This media proved effective in visualizing the processes of inspiration and expiration, making it easier for students to understand the human respiratory system. In addition to being pedagogically effective, this media is economical, environmentally friendly, and encourages students' creativity.

Nevertheless, most of these studies focus on the development and implementation of learning media for students, whether through classroom trials, expert validation, or specific learning models. There are still a few studies that specifically position teachers as the primary subjects of training, particularly in enhancing their capacity to design science learning media that are environmentally friendly, contextually relevant, applicable, and sustainable. In fact, teacher training is a key factor in the successful implementation of environmental education, as emphasized by Ivorra-Catal et al. (2024), who stated that limited training is one of the main challenges of environmental education in schools. To address this research gap, this Community Service Program (Pengabdian kepada Masyarakat/PKM) focuses on direct training for elementary school teachers in developing science learning media using recycled materials. The practical contribution of this activity is to improve teachers' pedagogical skills and creativity in producing learning media that are economical, environmentally friendly, and easy to apply in the classroom. Meanwhile, its scientific contribution lies in strengthening the role of teacher training as an effective strategy for integrating environmental education into elementary school science instruction, thereby supporting the development of sustainable learning models grounded in teachers' roles.

Through this PKM activity, teachers are expected not only to produce innovative learning media but also to develop greater ecological awareness. As a result, science learning becomes more meaningful, contextual, and oriented toward the formation of students' environmental care character. Thus, this activity has the potential to provide long-term impacts on the quality of science learning and the strengthening of character education in elementary schools.

THEORETICAL FRAMEWORK AND HYPOTHESES

Science learning in elementary schools requires teachers to present abstract concepts in a concrete, contextual, and meaningful manner through appropriate use of learning media, which serve as a bridge between theoretical concepts and students' real learning experiences. Creative,

environmentally friendly learning media not only support students' understanding of science concepts but also foster environmental awareness from an early age, particularly when using recycled materials readily available in the school environment. Various studies have shown that the use of recycled materials as science learning media effectively enhances classroom interactivity, creativity, and students' ecological awareness, while also being economical and applicable for elementary school teachers (Putra et al., 2020; Denico, 2020; Silviana & Prayogi, 2023). Learning media based on recycled materials, especially for the topic of the human respiratory system, have been proven to help visualize abstract processes, thereby enabling students to better understand learning concepts (Rahmawati et al., 2025; Magfirah & Inganah, 2025). However, most previous studies have focused on the development and implementation of learning media for students, while training programs specifically aimed at enhancing teachers' capacity to design environmentally friendly science learning media remain limited, even though teacher competence is a key factor in the successful implementation of environmental education in elementary schools (Ivorra-Catal et al., 2024). Therefore, this Community Service Program is grounded in an experiential learning approach, directly involving teachers in hands-on practice, developing science learning media from recycled materials. This approach is expected to enhance teachers' pedagogical competence, creativity, and ecological awareness, which in turn will contribute to the creation of more concrete, interactive, and meaningful science learning experiences for students. Accordingly, this activity hypothesizes that training on the development of environmentally friendly science learning media can improve elementary school teachers' ability to design creative, applicable, and environmentally oriented learning media.

METHODS

This community service activity employed a descriptive qualitative approach focusing on the process and outcomes of improving teachers' competencies in developing environmentally friendly science learning media. The activity was conducted at SD Negeri 1 Dadakitan and involved 15 participants: two Grade V teachers as the main subjects of the activity and 13 Grade V students as supporting participants and observers of the learning process. The teachers actively participated in all stages of the training, while the students observed the use of the media and provided responses to the developed learning media. A descriptive qualitative approach was used to obtain an in-depth understanding of the training process and participants' responses, while quantitative data from questionnaires served as supporting evidence in the evaluation of the activity.

Initial Observation and Needs Analysis

The initial stage of the activity began with direct classroom observations and informal interviews with Grade V teachers to identify the current condition of science learning and teachers' needs regarding learning media. The observation was conducted using a simple observation sheet containing indicators of media use, teaching methods, and student engagement during the learning process. Based on observations and discussions, it was found that teachers at SD Negeri 1 Dadakitan had not optimally utilized learning media, whether digital media such as PowerPoint or concrete learning media. The learning process was still dominated by lecture-based methods, leaving students with limited contextual and interactive learning experiences. These findings underscore the need to conduct training in the development of creative, applicable, and environmentally friendly science learning media.

Training Implementation

The implementation stage consisted of three main activities: material presentation, demonstration, and hands-on practice. The material was presented using media to introduce the concept of environmentally friendly learning media and the principles of using recycled materials. Furthermore, the community service team demonstrated the development of science learning media on the human respiratory system using simple materials such as plastic bottles, straws, balloons, hot glue, adhesive tape, scissors, and lighters. After the demonstration, teachers independently practiced making the learning media under the guidance of the community service team. During the practice session, data

were collected through process observations, activity documentation, and field notes to record teachers' engagement, creativity, and challenges encountered. In addition to teachers, Grade V students served as observers to understand the function and use of the media produced. Student involvement aimed to provide contextual learning experiences while fostering awareness of the importance of creatively and responsibly utilizing recycled materials.

Reflection and Evaluation

The final stage consisted of joint reflection and evaluation with teachers and students to assess the effectiveness of the developed media. The evaluation was conducted using a simple Likert-scale questionnaire (1 = very poor, 2 = poor, 3 = good, 4 = very good), administered to both teachers and students. The evaluation instrument included indicators of ease of media construction, practicality of use, suitability of the media to the respiratory system material, level of interest, and students' understanding. The scores presented in the graphs were obtained by summing the scores for each indicator, calculating the average, and then converting it to assessment categories. Instrument validity was established through content validity by soliciting feedback from classroom teachers and the community service team to ensure that the indicators aligned with the activity's objectives. The results of the reflection and evaluation indicated that the developed media were considered easy to make, practical to use, and effective in helping students understand the concept of the human respiratory system more concretely. Feedback from teachers and students served as the basis for developing further training activities to improve the quality of environmentally oriented science learning.

RESULTS AND DISCUSSION

Implementation of the Community Service Activity

The community service activity in the form of training on the development of environmentally friendly science learning media was conducted at SD Negeri 1 Dadakitan, involving Grade V teachers and students as supporting participants. This activity was collaboratively designed and implemented by the community service team through systematic stages, including the introduction of concepts, demonstrations of media development, and guided practice in producing learning media. From the beginning of the implementation, the school demonstrated openness and strong support for the activity. Teachers actively participated in all stages of the program, while students served as observers and initial users of the developed media. The activity was carried out in a conducive, communicative, and participatory atmosphere, enabling the exchange of ideas between the community service team and the teachers.

Results of Learning Media Development

Through direct mentoring from the community service team, teachers successfully developed science learning media on the human respiratory system using simple, environmentally friendly materials, such as used plastic bottles, balloons, straws, and hoses. The developed media were designed to visually and functionally demonstrate the mechanisms of inspiration and expiration.

The learning media produced possess several key characteristics:

1. **Functional**, as they can be directly used to explain the concept of the human respiratory system;
2. **Contextual**, as they utilize materials that are easily found in the school environment;
3. **Economical and environmentally friendly**, as they make use of recycled materials without reducing their educational value.

These results indicate that, through structured mentoring, teachers can develop science learning media that are applicable and relevant to the learning needs of elementary school students.

Learning Responses and Initial Media Implementation

At the initial implementation stage, the developed learning media were used on a limited basis during classroom activities. Based on observations by the community service team, the use of the media helped create a more interactive learning atmosphere. Students showed interest in observing how the media functioned and actively asked questions about the respiratory processes being studied.

Teachers utilized the media as instructional aids to explain concepts, so that learning was not solely centered on verbal explanations but was also supported by concrete visualizations. The media functioned as a bridge between theoretical concepts and real learning experiences, particularly for abstract science content.

Evaluation Results Based on Structured Observation

The evaluation of the activity was conducted by the community service team through structured observations and reflective discussions during and after the program. The evaluation focused on:

1. The implementation of activities in accordance with the planned program,
2. Participant engagement during the training process, and
3. The feasibility of the developed learning media for use in elementary school science learning contexts.

The observation results indicated that the training was implemented in line with the activity's objectives, namely, providing teachers with direct experience in developing environmentally friendly science learning media. The produced media were considered feasible for use as instructional aids and showed potential for further development in other science topics. Overall, this training activity not only produced environmentally friendly science learning media but also fostered teachers' creativity, increased student participation, and strengthened ecological awareness within the educational context. Therefore, this training represents a strategic step toward the realization of innovative, contextually grounded, and environmentally oriented science learning in elementary schools.

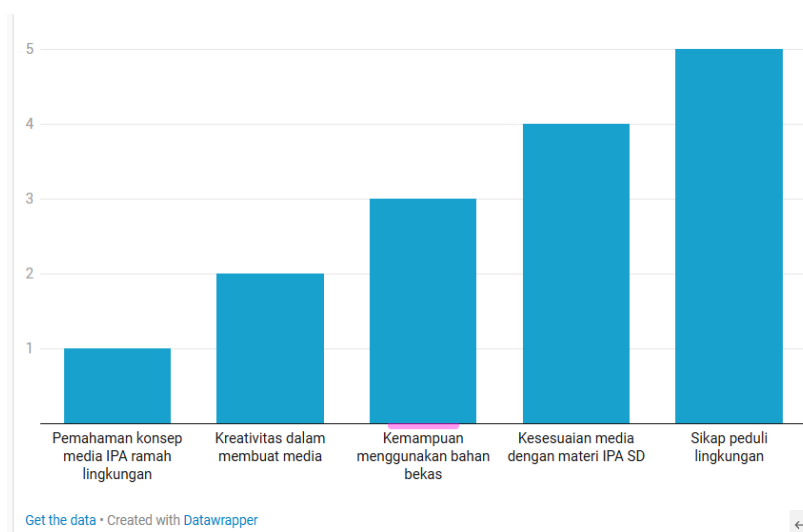


Figure 1. Effectiveness of Training on the Development of Environmentally Friendly Science Learning Media

Source: Explained

Figure 1 presents an overview of the achievements of the training implementation in developing environmentally friendly science learning media, based on direct observations and activity documentation conducted by the community service team throughout the program. The aspects shown in the figure reflect the main focus of the training: the alignment of the media with elementary school science content, the use of environmentally friendly materials, the potential of the media to support learning, and participant engagement during media development and initial implementation. The data represented in the figure were obtained through structured observations of the training process, including the demonstration stage, guided practice, and the initial use of the media in classroom learning activities. The assessment was conducted qualitatively by the community service team by considering the consistency of activity implementation, the characteristics of the developed

media, and participants' responses during the program. This figure is not intended to represent statistical measurement results or quantitative evaluations based on psychometric instruments; rather, it serves as a descriptive visual representation to help readers understand the overall trends in the community service activity. Therefore, the figure functions as a complement to the narrative of the activity results rather than as a basis for drawing inferential conclusions.

In science education studies, learning media are viewed as having a strategic role in helping teachers deliver abstract concepts so that students can more easily understand them. Learning media serve as intermediaries in conveying instructional messages from teachers to students and as tools for creating a more effective learning environment. In the educational context, learning media encompass all tools, materials, and facilities used to transmit information and facilitate students' learning. Sagitarini et al. (2020) emphasized that learning media function as instructional aids that can significantly influence students' learning conditions and environments. In line with this view, Fadillah (2020) stated that the use of learning media can enhance the effectiveness of content delivery and foster learning motivation, as the learning process becomes more engaging, interactive, and meaningful. From a sustainable education perspective, environmentally friendly learning media can be seen as an innovation that integrates sustainability principles into the teaching and learning process. Such media function not only as visual instructional aids but also as a means of instilling values of environmental awareness. Nurfurqon et al. (2023) explained that the reuse of waste materials such as plastic bottles, straws, and balloons as learning media encourages the reuse of educational materials relevant to students' daily lives. Conceptually, this approach demonstrates that science learning is oriented not only toward cognitive achievement but also toward the formation of environmentally responsible attitudes and character.

The use of environmentally friendly learning media in science instruction provides dual benefits: it helps students understand science concepts more concretely through direct learning experiences while simultaneously fostering ecological awareness through students' involvement in reusing discarded materials. This is consistent with the objectives of the Adiwiyata school program, which emphasizes the development of environmentally conscious and environmentally cultured schools (Sulaiha et al., 2024). In the long term, integrating environment-based learning media can contribute to sustainable development by fostering character and ecological responsibility in students from an early age. The findings of this community service activity align with previous studies demonstrating the effectiveness of environmentally friendly learning media. Syafi et al. (2022) showed that using household waste as a learning medium in project-based learning can enhance elementary school students' ecoliteracy and creativity by fostering their direct involvement in the media development process. Ivanka and Nurani (2025) also emphasized that integrating environmental values into learning media, including digital media, positively impacts students' ecological awareness development. Furthermore, Wahyudi et al. (2024) reported that science media made from recycled materials can increase students' motivation and interest in learning through authentic and enjoyable learning experiences, while Sahabuddin and Dirawan (2022) demonstrated that green school-based animated video media are effective in fostering environmental awareness and strengthening environmentally caring character among elementary school students. Overall, these findings confirm that the successful implementation of environment-based learning media is strongly influenced by teachers' creativity and institutional support from schools.

From the perspective of teacher competency development, the training on environmentally friendly learning media conducted during this community service activity can be understood through the framework of experiential learning, which emphasizes that knowledge and skills are more effectively acquired through direct experience than through solely theoretical approaches. Through direct involvement in the media development process, teachers not only gained a conceptual understanding of learning media but also experienced a creative process that strengthened their pedagogical skills. This process simultaneously encouraged pedagogical reflection on teachers' roles in integrating environmental issues into science learning. Changes in teachers' perceptions of the use of recycled materials as learning media indicate an important shift in instructional perspectives.

Denico (2020) stated that although teachers generally understand the importance of environmental education, its implementation is often constrained by limited resources and insufficient school policy support. In this context, the training activities served as a catalyst for awareness that waste management can be carried out simply and integrated into classroom learning activities without requiring complex facilities or substantial costs.

Although the training on environmentally friendly learning media demonstrated positive impacts, this discussion also highlights challenges related to its sustainability. The inconsistent availability of recyclable materials, limited teacher preparation time, and the need for institutional and educational policy support are factors that influence the sustainability of the use of environment-based learning media. This is consistent with various findings in the literature, which emphasize that the effectiveness of environmental education is determined not only by instructional innovation but also by the existing support systems within schools. Thus, this discussion confirms that practice-based training approaches are highly relevant for improving the pedagogical competencies of elementary school science teachers while simultaneously fostering environmental awareness. The use of environmentally friendly learning media not only supports concrete understanding of science concepts but also contributes to the development of attitudes, responsibility, and motivation toward environmental conservation among teachers and students. To ensure the sustainability of these positive impacts, systemic support from schools and policymakers is required through the provision of resources, continuous training, and the integration of environmental care values into school culture and curricula.



Figure 2. Documentation of the Training on the Development of Respiratory System Learning Media Conducted by the Community Service Team in Collaboration with Teachers.

Source: Primary Documentation

The image above depicts a training activity on the development of environmentally friendly science learning media conducted at SDN 1 Dadakitan. Several university students or members of the community service team, wearing yellow jackets, can be seen providing explanations and demonstrations at the front of the classroom. They demonstrate the steps for creating simple learning media to Grade V teachers and students, who are seated and observing. The activity takes place in a well-organized classroom equipped with pink desks and chairs, and the walls are decorated with colorful geometric paintings that create a cheerful learning atmosphere. In the background, the Indonesian national flag and school information boards are visible, indicating that the activity took place in a formal elementary school setting.

Overall, the image illustrates an interactive, collaborative training atmosphere in which participants actively listen to and observe the demonstration process. This activity is part of a Community Service Program (PKM) aimed at improving teachers' skills in creating learning media that are creative, economical, and environmentally friendly.

CONCLUSION

The training activity on the development of environmentally friendly science learning media at SD Negeri 1 Dadakitan produced its main outputs in the form of science learning media made from recycled materials, as well as improved teachers' skills in designing creative, economical, and applicable learning media. The outcomes of the activity were reflected in increased students' understanding of and interest in science subjects, as well as in growing awareness among teachers and students of the importance of responsibly using recycled materials in the learning process. Nevertheless, this activity had several limitations, including the relatively short training duration and the limited number of participants, which prevented in-depth exploration of the material and the development of a broader range of learning media.

REFERENCES

- Arbarista, R. D., & Tyas, D. N. (2025). Pengembangan media pembelajaran interaktif proses sistem pencernaan (prosipen) berbasis google sites untuk meningkatkan hasil belajar deserta Didik kelas V SDN Tambangan 02 Kota Semarang. *Jurnal Pendidikan Matematika Dan IPA*, 5(2), 324–337. <https://doi.org/https://doi.org/10.53299/jagomipa.v5i2.1376>
- Denico, A. (2020). Media pembelajaran ramah lingkungan sekolah dasar Negeri inklusi di Pekanbaru di era revolusi industri 4.0. *J-Al-Mutharahah*, 17(1), 62–74.
- Erlina, N., Warpala, I. W. S., & Juniartina, P. P. (2023). Kesipan calon guru IPA dalam pengembangan alat peraga 3D berbasis eco-friendly melalui project based blended learning. *JURNAL PENDIDIKAN DAN PEMBELAJARAN SAINS INDONESIA (JPPSI)*, 6(2), 152–161.
- Fadillah, M. (2020). Upaya meningkatkan kemampuan membaca siswa dengan pemanfaatan media audio-visual Di kelas rendah. *Jurnal Penelitian, Pendidikan Dan Pengajaran: JPPP*, 1(1), 16. <https://doi.org/10.30596/jppp.v1i1.4453>
- Husamah, Rahardjanto, A., Pemana, T. I., & Lestari, N. (2025). Earning Media for Environmental Education: What Can the Scopus Database Tell Us? A Review. *Journal of Biology Education Research*, 6(1), 93–114. <http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz%0ALearning>
- Ivanka, W., & Nurani, D. C. (2025). The effect of digital media on elementary school students' ecoliteracy development. *Jurnal Pendidikan Dasar Volume*, 9(1), 105–112.
- Ivorra-catal, E. S., Catret-mascarell, M., & Moreno-g, E. (2024). Are our schools carrying out effective environmental education? In-service and pre-service teachers' perceptions. *Social Sciences Article*, 13(425), 1–16. <https://doi.org/https://doi.org/10.3390/socsci13080425>
- Kharisma, A. N., Magdalena, I., Firmansyah, R., & Indriani, F. D. (2025). Penyuluhan pengelolaan sampah daur ulang untuk guru sekolah dasar mendorong bendidikan Berbasis green education. *Jurnal Ilmiah Multidisiplin*, 1(2), 260–269.
- Kumala, D., Genisa, M. U., Sumah, A. S. W., & Ismail, G. (2023). Pelatihan pembuatan bioplastik pandan (pandanus amarylifollius) sebagai media ramah lingkungan dalam memahani konsep biologi bagi siswa SMA Negeri 1 Indralaya Selatan Ogan Ilir Sumatera Selatan. *Jurnal Pengabdian Masyarakat I-Com: Indonesian Community Journal*, 3(2), 488–495. <https://doi.org/10.33379/icom.v3i2.2450>
- Magfirah, & Inganah, S. (2025). Pembelajaran berbasis proyek melalui pembuatan alat peraga sistem pernapasan untuk meningkatkan antusiasme belajar siswa SD. *Didaktika Dwija Indria*, 13(3), 412–416.
- Nurfurqon, F. F., Kelana, J. B., & Pratama, D. F. (2023). Improving elementary school students' environmental care skills in utilizing plastic bottles as social science learning media. *Jurnal Cakrawala Pendas*, 9(1), 190–196. <https://doi.org/http://dx.doi.org/10.31949/jcp.v9i1.3909>

- Putra, I. A., Prihatiningtyas, S., & Ma'arif, I. B. (2020). Pendampingan dan penerapan media belajar sains berbasis ramah lingkungan di kelas bagi guru MI di Jombang. *JURNAL ABDIMAS BSI Jurnal Pengabdian Kepada Masyarakat*, 3(1), 76–82.
- Rahmawati, F., Asriani, Ahkam, A. A. H., & Nasharuddin. (2025). Pengembangan media ajar alat peraga pernapasan (Alper) pada sistem pernapasan manusia. *Jurnal Inovasi Penelitian Ilmu Pendidikan Indonesia*, 2(2), 139–145.
- Sagitarini, N. M. D., Ardana, I. K., & Asri, I. G. A. A. S. (2020). Model experiential learning berbantuan media konkret berpengaruh terhadap kompetensi pengetahuan IPA. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, 4(2), 315–327.
- Sahabuddin, E. S., & Dirawan, G. D. (2022). Green School-Based Animation Video Media in Increasing Students' s Awareness of the Environment. *International Journal of Elementary Education*, 6(3), 386–392. <https://doi.org/https://doi.org/10.23887/ijee.v6i3.54084>
- Silviana, F., & Prayogi, S. (2023). Pemanfaatan bahan bekas sebagai alat peraga IPA ramah lingkungan. *BERDIKARI JURNAL INOVASI DAN PENERAPAN IPTEKS VOL.11, 11(2)*, 217–226. <https://doi.org/DOI:https://doi.org/10.18196/berdikari.v11i2.17845> ABSTRACT
- Sulaiha, Mertika, & Mariana, D. (2024). Pembentukan karakter peduli lingkungan siswa melalui program adiwiyata di SDN 12 Singkawang. *Jurnal Ilmiah Pendidikan Dasar*, 09(02), 208–215.
- Sulistiyono, Effendi, M. S., & Charli, L. (2025). Pendampingan pembuatan media pembelajaran sederhana menggunakan barang bekas untuk guru SD Negeri 2 Marga baru. *JURNAL CEMERLANG: Pengabdian Pada Masyarakat*, 7(2), 558–567.
- Syafi, A., Saptono, S., & Made, Ngurah Putra, D. (2022). Utilization of Household Waste Media in Project-Based Learning to Improve Students' Eco-literacy and Creativity. *Journal of Primary Education*, 11(1), 64–77. <https://journal.unnes.ac.id/sju/index.php/jpe%0AUtilization>
- Wahyudi, B. A., Jumadi, & Eryanti. (2024). Media Pembelajaran Fisika Menggunakan Bahan Recycle untuk Meningkatkan Kreatifitas dan Motivasi Belajar. *Journal of Teaching and Learning Physics*, 9(1), 47–56. <https://doi.org/http://dx.doi.org/10.15575/jotalp.v9i1.31508> <http://dx.doi.org/10.15575/jotalp.v9i1.31508>.