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TRAINING ON ECO-FRIENDLY DISHWASHING LIQUID PRODUCTION FOR VOCATIONAL HIGH SCHOOL STUDENTS TO REDUCE PLASTIC WASTE

(Pelatihan Produksi Cairan Pencuci Piring Ramah Lingkungan bagi Siswa Sekolah Menengah Kejuruan untuk Mengurangi Sampah Plastik)

Arum Sanjayanti[1] ✉, Ferry Fauzi [2], Mashudi Alamsyah[3], Saring[4]

[1,2,3] Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Indraprasta PGRI University, Jakarta, Indonesia
[4]History Education Study Program, Faculty of Education and Social Sciences, Indraprasta PGRI University, Jakarta, Indonesia

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✉ **Corresponding author**: arumsanjaunindra08@gmail.com

Abstrak

Permasalahan limbah plastik, khususnya yang berasal dari kemasan sabun cuci piring, masih menjadi isu lingkungan yang signifikan di lingkungan sekolah. Tingginya penggunaan kemasan plastik sekali pakai serta minimnya edukasi mengenai produk ramah lingkungan menyebabkan meningkatnya volume sampah yang sulit terurai. Salah satu upaya strategis yang dapat dilakukan adalah melalui kegiatan Pengabdian kepada Masyarakat (PkM) berupa pelatihan pembuatan produk rumah tangga ramah lingkungan. Kegiatan ini bertujuan meningkatkan keterampilan siswa SMK dalam pembuatan biang sabun cuci piring ramah lingkungan sebagai langkah nyata pengurangan limbah plastik. Metode pelaksanaan menggunakan pendekatan partisipatif yang meliputi: (1) observasi lapangan, (2) wawancara siswa SMK, (3) sosialisasi kegiatan, (4) pelatihan pembuatan biang sabun cuci piring, serta (5) refleksi dan evaluasi. Hasil kegiatan menunjukkan adanya peningkatan pemahaman siswa mengenai konsep reduce–reuse–refill, peningkatan keterampilan dalam membuat produk secara mandiri dengan bahan aman dan ekonomis, tumbuhnya perilaku pro-lingkungan melalui penggunaan wadah isi ulang, serta munculnya potensi wirausaha hijau (green entrepreneurship) di lingkungan sekolah. Program ini berkontribusi terhadap penguatan literasi lingkungan sekaligus peningkatan kompetensi vokasional siswa secara aplikatif dan berkelanjutan.

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Abstract

The problem of plastic waste, particularly from dishwashing liquid packaging, remains a significant environmental issue in schools. The high use of single-use plastic packaging and the lack of education regarding eco-friendly products have contributed to the increasing volume of non-biodegradable waste. One strategic effort to address this issue is through Community Service (PkM) activities in the form of training on producing environmentally friendly household products. This program aims to improve vocational high school students' skills in producing eco-friendly dishwashing liquid base as a concrete step to reduce plastic waste. The implementation method employed a participatory approach consisting of: (1) field observation, (2) interviews with vocational high school students, (3)

program socialization, (4) training on producing eco-friendly dishwashing liquid base, and (5) reflection and evaluation. The results showed an increase in students' understanding of the reduce–reuse–refill concept, improved skills in independently producing safe and economical products, the growth of pro-environmental behavior through the use of refillable containers, and the emergence of green entrepreneurship potential within the school environment. This program contributes to strengthening environmental literacy while enhancing students' vocational competencies in an applicable and sustainable manner.

Keywords: *Eco-friendly soap, Green entrepreneurship*, *Plastic waste*, *Reduce–reuse–refill*, *Vocational high school*

1. INTRODUCTION

Plastic waste has become a global environmental issue that continues to increase each year. Single-use plastic products, particularly packaging, contribute significantly to waste volume and require a very long time to decompose naturally (Geyer et al., 2017; Hopewell et al., 2009; OECD, 2022; UNEP,2021) . In school environments, the use of dishwashing liquid packaged in single-use plastic also contributes to waste generation, although it often receives limited attention in school environmental management. Vocational High Schools (SMK) emphasize practice-oriented learning, making them highly potential institutions for integrating environmental education with the strengthening of students' vocational competencies. The application of the reduce–reuse–refill concept as part of circular economy principles is considered effective in minimizing waste from its source (Kirchherr et al., 2017). This approach not only focuses on waste reduction but also encourages more responsible consumption patterns. In this context, training on producing eco-friendly dishwashing liquid base serves as an applicable solution that can be implemented in schools. This activity not only reduces dependence on products with single-use packaging but also fosters environmental awareness and builds green entrepreneurship among students (Santika et al., 2022). Through this training, students are expected to develop sustainable production skills while creating environmentally friendly and economically valuable business opportunities.

2. METHODS

This Community Service Program (PkM) was implemented using a participatory approach, involving students as active participants throughout all stages of the program, from problem identification to final evaluation. This approach was selected because it is effective in increasing environmental awareness and encouraging sustainable behavioral change through direct involvement and experiential learning (Lestari & Trihadiningrum, 2019).The first stage was field observation conducted within the school environment to identify dishwashing liquid usage patterns, the frequency of single-use plastic packaging consumption, and the estimated amount of plastic waste generated. Observations focused on daily cleaning activities in school facilities such as canteens, laboratories, and washing areas. The findings from this stage served as the basis for designing training materials that were relevant to the actual environmental conditions and needs of the school. The second stage involved structured interviews with students and teachers to assess their initial understanding of the impacts of plastic waste, circular economy concepts, and the principles of reduce–reuse–refill. Interviews were also used to identify students' attitudes toward environmentally friendly products and their willingness to adopt more sustainable consumption habits. The collected data functioned as baseline information before the implementation of the training program. The third stage was material socialization through presentations and interactive discussions. The topics delivered included the environmental impacts of plastic waste, the importance of reducing single-use plastics, the principles of reduce–reuse–refill, and the concept of eco-friendly cleaning products. In addition, the refill system was introduced as a practical and realistic solution for minimizing plastic waste in

the school environment. Students were encouraged to share ideas and discuss how these concepts could be applied in their daily school activities. The fourth stage consisted of hands-on training in producing eco-friendly dishwashing liquid base through demonstrations and small-group practice sessions. Students learned to weigh raw materials accurately, mix ingredients according to correct procedures and formulations, conduct simple product quality testing such as texture and foam performance, and package the final product using reusable containers. This practice-based learning model supports the strengthening of vocational competencies, especially in production skills, teamwork, and problem-solving abilities (OECD, 2022). The final stage was reflection and evaluation through pre-tests and post-tests to measure improvements in students' understanding after participating in the program. Students also took part in reflective discussions to express their experiences, insights, and suggestions regarding the activity. The discussions revealed students' commitment to implementing the reduce–reuse–refill principles within the school environment, such as bringing refillable containers, reducing disposable packaging use, and promoting environmentally friendly practices among peers (Steg & Vlek, 2009;Ryan & Ryan, 2013).

3. RESULT

Improvement in Understanding of the Reduce–Reuse–Refill Concept

Based on the results of the pre-test and post-test evaluations, there was a significant increase in students' understanding of the reduce–reuse–refill concept as a strategy for reducing plastic waste. The average level of understanding increased from 45% before the training to 85% after the training. This improvement indicates that a practice-based educational approach effectively strengthens environmental literacy. The learning method, which actively involved students in the production process of the dishwashing liquid base, provided direct experience on how waste can be reduced from its source through a refill system. This approach aligns with circular economy principles that emphasize resource efficiency and waste reduction through changes in production and consumption patterns (Kirchherr et al., 2017) .Furthermore, participatory learning has been proven to enhance individual awareness and responsibility toward sustainable waste (Lestari & Trihadiningrum, 2019). Therefore, this training was not only informative but also transformative in building students' conceptual understanding.

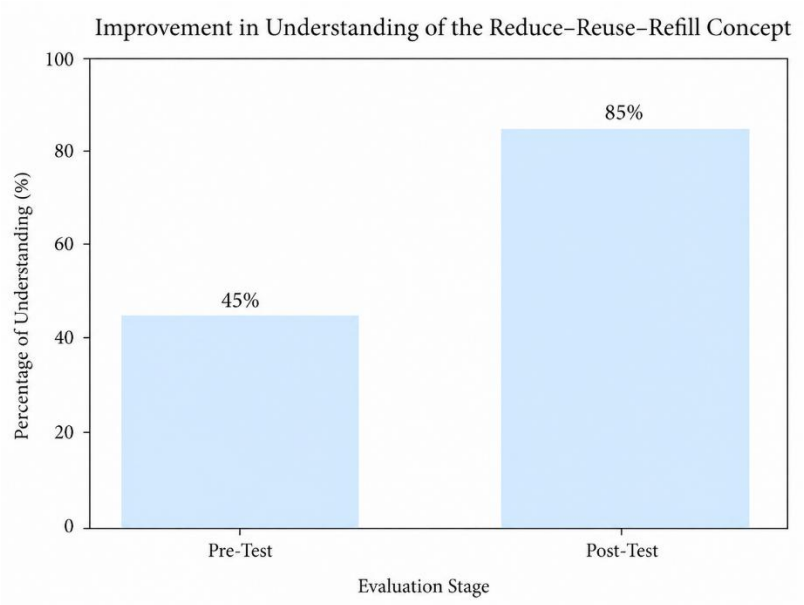

Figure 1. Improvement in Understanding of the Reduce–Reuse–Refill Concept

Improvement in Vocational Skills

The training on producing eco-friendly dishwashing liquid base also contributed to enhancing students' vocational competencies. Students were able to: (a) identify safe, economical, and environmentally friendly materials; (b) mix ingredients according to proper procedures and accurate measurements;(c) package products using a refill system to minimize the use of single-use plastics (Putri et al., 2025). This project-based learning model is effective in vocational education because it integrates theoretical knowledge and practical skills simultaneously. Students not only understood production concepts but also mastered applicable technical skills that have the potential to be developed on a small business scale. This approach also supports the development of essential life skills such as attention to detail, teamwork, problem-solving, and basic production management, all of which are highly relevant to the characteristics of vocational education.

Pro-Environmental Behavioral Change

The impact of the training was not only reflected in improved knowledge and skills but also in changes in students' behavior. After the program, several observable changes included: (a) reusing old soap bottles as refill containers; (b) initiatives to establish soap refill stations within the school environment;(c) continued discussions on strategies to reduce plastic use in schools. These changes indicate that practice-based educational interventions can effectively encourage behavioral transformation toward a more sustainable school culture. According to recent studies, contextual and action-based learning experiences significantly influence the development of pro-environmental behavior among adolescents (Ardoin et al., 2020; UNEP, 2021)

Green Entrepreneurship Potential

One important outcome of the program was the emergence of students' interest in producing and marketing eco-friendly soap on a small scale. This demonstrates the potential for developing green entrepreneurship among vocational high school students. Green entrepreneurship integrates economic orientation with environmental responsibility. Sustainability-based entrepreneurship education has been proven to increase entrepreneurial intention while also strengthening concern for ecological issues (Munoz & Cohen, 2018; Santika et al., 2022). Through this activity, students not only learned how to produce goods but also understood the added market value of environmentally friendly products. This potential can be further developed through simple business planning, cost analysis, and sustainability-based marketing strategies (Yu et al., 2024).

Program Impact and Sustainability

Overall, the training program had positive impacts in several areas: (a) reducing the potential for plastic packaging waste through refill systems; (b) improving students' environmental literacy; (c) strengthening practical competencies and production skills; (d) creating opportunities for environmentally based business ventures. To ensure program sustainability, several recommendations can be implemented: (1) integrating the activity into entrepreneurship subjects or the Pancasila Student Profile Strengthening Project (P5); (2) establishing a student production unit as a green entrepreneurship laboratory; (3) collaborating with the school cooperative for product distribution and marketing; (4) conducting regular monitoring and evaluation to ensure consistent implementation of the reduce–reuse–refill system. The sustainability of the program will be further optimized if supported by school policies that systematically promote the reduction of single-use plastics.

4. CONCLUSION

The training on producing eco-friendly dishwashing liquid base has proven effective in improving students' understanding of the reduce–reuse–refill concept, strengthening their vocational skills, encouraging pro-environmental behavioral changes, and fostering the potential for green entrepreneurship.The program not only provided educational benefits but also contributed to efforts to reduce plastic waste within the school environment. By integrating environmental education with practical vocational training, the activity successfully demonstrated that sustainability initiatives can be both educational and economically empowering. Therefore, this program is suitable to be developed as a community service model based on vocational education that is practical, contextual, and sustainable.

5. RECOMMENDATIONS

To enhance the impact and sustainability of the program, several recommendations are proposed:

1. The program should be integrated into entrepreneurship subjects or sustainability-based school projects to ensure continuity.
2. Schools are encouraged to establish a student production unit as a laboratory for green entrepreneurship development.
3. Collaboration with school cooperatives or local partners should be strengthened to support product distribution and marketing.
4. Regular monitoring and evaluation should be conducted to ensure consistent implementation of the reduce–reuse–refill system.
5. School policies should systematically support the reduction of single-use plastics to reinforce long-term environmental commitment.

With sustained support and institutional integration, this initiative has strong potential to become a replicable model for vocational schools in promoting environmental sustainability and student entrepreneurship simultaneously.

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